ENCLOSURE 1

EXAMINATION REPORT - 50-321/OL-85-01

Facility License: Georgia Power Company
P. O. Box 4545
Atlanta, GA 30302

Facility Name: E. I. Hatch

Facility Docket Nos.: 50-321 and 50-366

Replacement and Requalification examinations were administered at Edwin I. Hatch Nuclear Plant near Baxley, Georgia.

Chief Examiner: _____ 4/2/85
Ken E. Brockman. Date Signed

Approved by: _____ 4/2/85
Bruce A. Wilson, Section Chief Date Signed

SUMMARY

Replacement examinations on March 11-14, 1985

Requalification examinations on March 11-14, 1985

Written, oral, and simulator replacement examinations were administered, as required, to three SROs and one RO; all candidates passed these examinations.

Written and operating requalification examinations were administered to seven SROs (six written exams/six simulator exams/seven oral exams) and five ROs (four written exams/three simulator exams/five oral exams); four of the SROs and all five of the ROs passed these exams. (Two of the SRO failures were one-section written failures only.)

The performance on the requalification examinations (75% pass rate) has resulted in a determination that Plant Hatch's accelerated requalification training program is proceeding satisfactorily, as of March 1985. Final determination as to its success will be made after the July 1985 results are evaluated.

REPORT DETAILS

1. Facility Employees Contacted:

J. Badgett, Manager-Nuclear Training Corporate (E)
P. Bennett, General Physics Instructor (E)
K. Elliott, General Electric Instructor (R)
D. Giddens, Simulator Instructor (R)
L. Gooden, Simulator Instructor (R/E)
R. S. Grantham, Supervisor-Operations Training (R/E)
T. Greene, Deputy General Manager, Hatch (E)
J. Lewis, Operation Department, Hatch (E)
M. Marlow, General Electric Instructor (R/E)
D. Matherly, General Physics Instructor (R)
B. Moll, General Electric Certification Engineer (R)
C. T. Moore, Training Manager, Hatch (E)
G. Neeley, Simulator Instructor
H. Nix, General Manager, Hatch (E)
R. Rutan, General Physics Instructor (R)
B. Smith, Simulator Instructor (R)
L. Sumner, Operations Manager, Hatch (E)

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

2. NRC Personnel

a. Examiners

K. E. Brockman, NRC
S. Guenther, NRC
W. Hehl, NRC
J. Munro, NRC
G. Sly, PNL
L. Wiens, NRC

b. Resident Inspector

P. Holmes-Ray, Senior Resident Inspector, Hatch

3. Examination Review Meeting

At the conclusion of the written examinations, the examiners met with facility representatives to review the written examination and answer key. The following comments were made by the facility reviewers:

a. SRO Exam (Replacement)

(1) Question 5.08

Facility Comments:

Response "b" (supposed correct answer) shows a Xenon free condition from 100% power in 35 hours. L-RQ-606 (A.1.g.) indicates Xenon free conditions require 72 hours. Question should be deleted.

NRC Resolution:

Response "d" shows the Xenon decay over a 72-hour period. This will be accepted as an alternative response to the question.

(2) Question 5.10

Facility Comments:

(a) It is difficult to determine which part of the curve is being referenced. Recirculation Pump Runback should be accepted as an alternative response.

(b) Answer key indicates that the pressure increase is due to MSIV closure; integration of ATTS now has MSIV closure at -121" with HPCI initiation at -55" (38" UI). Alternative response should be "CV closure" or "CV closure w/BPV F.S."

(c) Answer key indicates pressure fluctuation due to SRV cycling. With LLS in effect at Hatch, the cause of this should be HPCI (RCIC) cooldown effects.

NRC Resolution:

(a) Graph is specific as to point in question. No changes to answer key made.

(b) ATTS integration allows for new cause of pressure increase. Review of graphs shows pressure increase to greatly exceed 920# Pressure Set for EHC, however; thus, only the alternative response of "CV closure w/BPV F.S." is accepted.

(c) Answer key changed to reflect correct response.

(3) Question 5.13

Facility Comments:

Attached graphs do not allow the calculation of any of the responses provided. Delete question since there is no correct answer.

NRC Resolution:

Question deleted. Discrepancies between current and previous MCPR graphs caused for inaccurate reference material being provided to examinees.

(4) Question 5.17

Facility Comments:

If the circ water flow increase required to increase vacuum significantly increases condensate depression, efficiency goes down. Delete since answer could be TRUE or FALSE.

NRC Resolution:

Answer unchanged. The conditions did not tell the candidate to assume a significant condensate depression increase. Also, the change in condensate depression would need to be very excessive to establish an efficiency decrease.

(5) Question 6.03

Facility Comments:

This question requires an in-depth knowledge of the diesel generator synch acceptor circuit. This circuit is not addressed in the GPC training manual, nor could an operator determine how it operated from looking at the elementaries (it is black-boxed). No where in the training curriculum is an instructor required to cover the operation of the synch acceptor circuit, and often times it was not covered because the elementaries have never been received which cover its operation; therefore, its operation has never been fully verified. There have been numerous problems on the simulator concerning D/G logics and D/G output breaker logics during the requal training period which has, understandably, raised questions as to the simulators response to various posed scenarios. Therefore, the requal and initial license personnel could not use it (the simulator) as a sole source for answering D/G logic questions.

In light of the above stated facts, any NRC question as to how the synch acceptor circuit functions should be removed from the exam.

NRC Resolution:

It is agreed that an understanding of the impact that the synch acceptor circuit has on D/G operations is required. However, detailed electrical knowledge (inside the black boxes) is not being queried. This has been a previously identified shortcoming in candidate performance on simulator exams and resulted in a

design change to the simulator in late 1984. Since there are two procedures to manually tie the D/G to a bus, it is essential that the operator know the operational restrictions that the different modes of D/G operation impose. Initial review by the facility verifies the technical accuracy of the question. No change to the answer key will be made.

(6) Question 6.13

Facility Comments:

Response "d" is also correct as per GPNT, Vol. V, Chapter 2.3-14.

NRC Resolution:

Response "d" included as an alternate answer.

(7) Question 6.21

Facility Comments:

This question is unfair to the operator because there is no way an operator could withdraw rods into this configuration without violating both procedures and TSs.

(a) RSCS would have to have been bypassed - TS and HNP-2(1)-9207 specifically disallow this.

(b) HNP-2(1)-9207 rod withdrawal pull sequence would have to be violated to achieve this rod pattern (i.e., rod 34-27 can not be withdrawn past position 04 in Group 4).

Therefore, this is a very unrealistic and hard to understand question which requires the operator to regurgitate the RWM program and apply it to a situation any safe operator could never be in without violating several procedures and deliberately bypassing a system (RSCS) specifically required to be operable for continued plant operation. The question should be deleted.

NRC Resolution:

While it may be difficult for an operator to get into the operational configuration posed by the question, it is a straight forward and unconfusing scenario. Not addressing the potential for violating rod movement procedures, the question asks the operator for the control room indications he would expect for given rod patterns. It requires application of the RWM logic, not regurgitation, and is directly oriented to the operating environment. No changes to the question or answer key will be made.

(8) Question 8.09

Facility Comments:

Response "d" is a FALSE statement, per HNP-504 B.6.

NRC Resolution:

Comment not allowed. The purpose of HNP-504 is to, "... provide a method to control all temporary jumpers and lifted wires... where an approved plant procedure is not available..." Response "d" addresses the use of temporary jumpers during surveillance procedures and is, therefore, covered by HNP-9.M.a.(1), which supports a TRUE response.

(9) Question 8.15

Facility Comments:

The Unit 2 Tech Specs state that Operational Condition 5 is when the RPV head volts are unbolted or the head removed. Detensioned does not mean unbolted. Operational Condition 4, Cold Shutdown should be accepted as an alternative response.

NRC Resolution:

Comment not accepted. Detensioning of the head bolts establishes the initiating of unbolting and effects the establishment of Operational Condition 5. This was confirmed with the Senior Resident Inspector for the site.

b. SRO Exam (Requalification)

No new items were identified by the utility. Subsequent review by the NRC identified response "c" as an alternative response to Question 8.07.

c. RO Exam (Requalification)

No new items were identified by the utility. Subsequent review by the NRC identified unconsistencies in the construction of Question 3.01; the distractors were not focused to the point of being unconfusing. The question was deleted.

4. Exit Meeting

At the conclusion of the site visit, the examiners met with representatives of the plant staff to discuss the results of the examination. Those individuals who clearly passed the operational examination were identified. There were no generic weaknesses (greater than 75 percent of candidates giving incorrect answers to one examination topic) noted during the oral examination.

Two items of interest were shared with the plant management for their review:

a. Procedure HNP-3801 had a Pen and Ink Change (#35) issued on December 18, 1984. Instructions on the procedure indicated that a typed copy was to follow. As of 3/14/85, the pen and ink change was still in use; this provided an opportunity for misinterpretation and misapplication by the operating staff. (SRI will follow up.)

b. The need for an instrument cross-reference between instrument numbers, surveillance procedures, and Tech Spec requirements was noted. (This comment was given as a suggestion for improvement and does not require followup tracking.)

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

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Enclosure 3

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

FACILITY: HATCH 1&2

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 85/03/11

EXAMINER: K E BROCKMAN

APPLICANT: _____

INSTRUCTIONS TO APPLICANT:

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

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
~~30.00~~ 29.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
30.00	25.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
30.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
30.00	25.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
~~120.00~~ 119.00	100.00			TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

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

QUESTION 5.01 (1.00)

Which of the following is NOT a characteristic of Subcritical Multiplication?

a. The subcritical neutron level is directly proportional to the neutron source strength

b. Doubling the indicated count rate by reactivity additions will reduce the margin to criticality by approximately one-half.

c. For equal reactivity additions, it takes longer for the new equilibrium count rate to be reached, as K-eff approaches unity.

d. If ten (10) notches of rod withdrawal increases the SRM count rate by 10 cps, then twenty (20) notches of rod withdrawal will increase the SRM count rate by 20 cps. ASSUME CONSTANT ROD WORTH.

QUESTION 5.02 (1.00)

The change in reactivity associated with a change in K-eff from 0.920 to 1.004 is approximately ... (CHOOSE ONE)

a. 0.091
b. 0.084
c. 0.087
d. 0.080

QUESTION 5.03 (1.00)

A "Periodic NSSS Core Performance Log" (P-1) is attached for reference. Which statement is most accurately reflected by this printout?

a. Maximum LHGR(s) in the core is 12.00 Kw/ft.
b. Maximum LHGR(s) in the core is 7.69 Kw/ft.
c. Maximum LHGR(s) in the core is 13.40 Kw/ft.
d. Maximum LHGR(s) in the core is 9.19 Kw/ft.

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

QUESTION 5.04 (1.00)

The condensate subcooling in a condenser operating at 1 PSIA, with a condensate temperature of 95 deg F is ... (CHOOSE ONE)

a. 6.7 deg F
b. 196.7 deg F
c. 10.7 deg F
d. 120.3 deg F

QUESTION 5.05 (2.00)

The attached figure shows a basic closed loop fluid system with its head vs. flow plot (BOLD LINES). The two pumps are identical, variable speed, radial, centrifugal pumps. Pump 1 is initially operating at one-half speed to supply flow to component 1, as shown.

a. Component 2 is placed into service, thereby increasing the system heat load. Would total power consumption be less by ...(CHOOSE ONE)
   (1) Doubling the speed of Pump 1
   (2) Starting Pump 2 at one-half speed (0.5)

b. Which Pump Curve - A, B, C, or D - most accurately shows BOTH PUMPS operating to supply the system flow? (0.5)

c. With only Pump 1 operating at one-half speed - If component 2 were throttled open from its initial position, would the system flow INCREASE, DECREASE, or REMAIN THE SAME? (COMPONENTS 1 & 2 ARE IDENTICAL!) (0.5)

d. Given one operating pump, that is changed to a POSITIVE DISPLACEMENT pump. Is the correct Pump Curve to reflect this Curve A, B, C, or D? (0.5)

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

QUESTION 5.06 (1.50)

MATCH the appropriate Thermal Limit (a-c)...

a. Linear Heat Generation Rate (LHGR)
b. Average Planar Linear Heat Generation Rate (APLHGR)
c. Minimum Critical Power Ratio (MCPR)

to each FAILURE MECHANISM AND to each LIMITING CONDITION given below:

FAILURE MECHANISM	LIMITING CONDITION
F1. Clad melting caused by decay heat & stored heat following a LOCA	L1. Coolant transition boiling
F2. Clad cracking from the surface becoming vapor "blanketed"	L2. Clad plastic strain < 1%
F3. Clad cracking caused by high stress from pellet expansion	L3. Maximum clad temperature of 2200 deg F

QUESTION 5.07 (1.00)

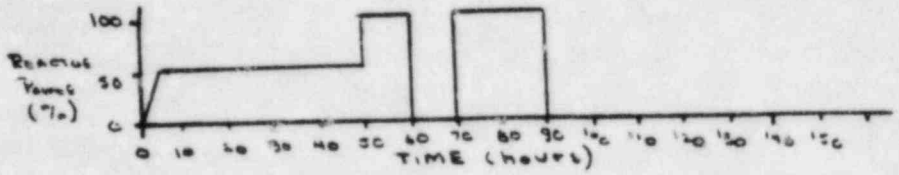
Which of the following describes the changes to the steam that occurs between the inlet and the outlet of a REAL turbine?

a. Enthalpy DECREASES, Entropy DECREASES, Quality DECREASES
b. Enthalpy INCREASES, Entropy INCREASES, Quality INCREASES
c. Enthalpy CONSTANT, Entropy DECREASES, Quality DECREASES
d. Enthalpy DECREASES, Entropy INCREASES, Quality DECREASES

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

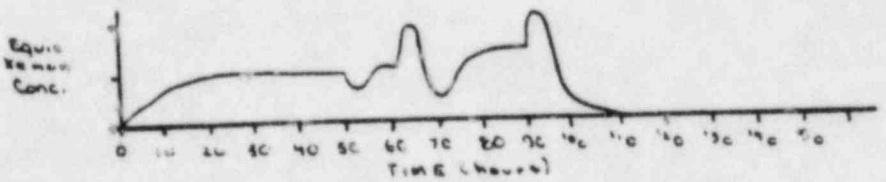
QUESTION 5.08 (1.00)

Given the following Power History:

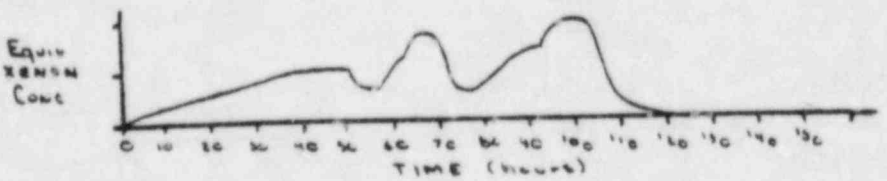


Select the most accurate curve displaying the expected XENON transient.

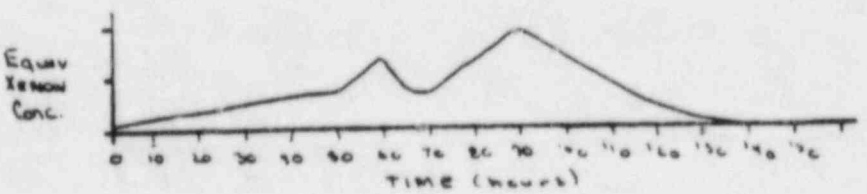
a.



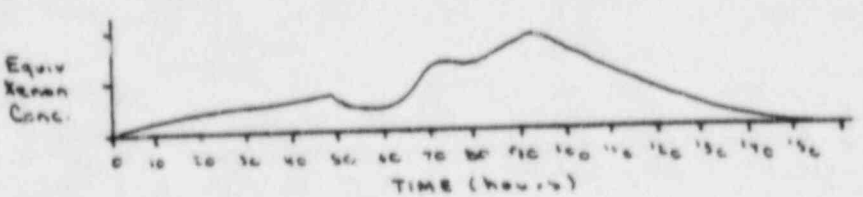
b.



c.



d.



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

QUESTION 5.09 (1.00)

Which of the following accurately describes a benefit of the Control Cell Core (CCC)?

a. The Capacity Factor is increased due to the elimination of rod pattern exchanges.

b. Operations are simplified since flux shaping is no longer required.

c. Thermal Limit margins are increased due to the elimination of all high power fuel bundles.

d. Fuel reliability has been improved due to the increased PCIOMR ramping rates which have been incorporated.

QUESTION 5.10 (2.50)

The attached figure represents a transient that could occur at a BWR.

Given: (1) All FW Pumps trip at time T=1.2 min
(2) No operator actions occur
(3) Recorder Speed = 1 division = 1 minute

EXPLAIN the cause(s) of the following recorder indications:

a. Core Flow DECREASE (Point A)
b. Reactor Pressure INCREASE (Point B)
c. Level INCREASE (Point C)
d. Pressure FLUCTUATION (Point D @ Time 3 - 7 minutes)
e. Reactor Power DECREASE (Point E)

QUESTION 5.11 (2.50)

The attached figure represents a transient that could occur at a BWR.

Given: (1) Both Recirculation Pumps trip at time T = 1 min
(2) No operator actions occur
(3) Recorder Speed = 1 division = 1 minute

EXPLAIN the cause(s) of the following recorder indications:

a. Core Flow DECREASE (Point A)
b. Level INCREASE (Point B)
c. FW Flow DECREASE (Point C)
d. Power INCREASE (2.2 - 3.2 minutes - Point D)
e. Why did Turbine Steam Flow stabilize at approximately 50%?

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

QUESTION 5.12 (1.00)

A reactor heat balance was performed (by hand) during the 00-08 shift due to the Process Computer being OOC. The GAF's were computed, but the APRM GAIN ADJUSTMENTS HAVE NOT BEEN MADE. Which of the following statements is TRUE concerning reactor power?

a. If the feedwater temperature used in the heat balance calculation was LOWER than the actual feedwater temperature, then the actual power is HIGHER than the currently calculated power.

b. If the reactor recirculation pump heat input used in the heat balance calculation was OMITTED, then the actual power is LOWER than the currently calculated power.

c. If the steam flow used in the heat balance calculation was LOWER than the actual steam flow, then the actual power is LOWER than the currently calculated power.

d. If the RWCU return temperature used in the heat balance calculation was HIGHER than the actual RWCU return temperature, then the actual power is LOWER than the currently calculated power.

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

QUESTION 5.13 ~~(2.00)~~ 1.00

Given:

Reactor Power	60%
Core Flow	30%
T (Tau)	.6
Fuel Type	P8x8R
Max Flow Rate	107%

Figures 5.4, 5.5, 5.6 Enclosed

~~a. OLMCPR is ...(CHOOSE ONE)~~

~~(1) 1.231~~
~~(2) 1.632~~
~~(3) 1.539~~
~~(4) 1.469~~

Deleted

(1.0)

b. If the MCPR Printout from the Process Computer for Rod 29-17 read 1.273, which of the following would be required per Unit 2 Tech Specs?

(1) No Action Required

(2) Initiate corrective action within 15 minutes and continue the corrective action so that MCPR is within the applicable limit within 2 hours, or reduce thermal power to < 25% within the next 4 hours.

(3) Initiate corrective action within 15 minutes and continue the corrective action so that MCPR is within the applicable limit within 4 hours, or reduce thermal power to < 25% within the next 8 hours.

(4) Place the reactor in HOT SHUTDOWN within 2 hours and reduce steam dome pressure to < 785 psig and core flow to < 10% within the next 4 hours.

QUESTION 5.14 (1.00)

The fission process in a commercial reactor requires the neutrons that are "born" by fission to be "thermalized." The interaction in the reactor core which is most efficient in thermalizing neutrons for fission occurs with the ...(CHOOSE ONE)

a. OXYGEN atoms in the water molecules
b. BORON atoms in the control rods
c. ZIRCONIUM atoms in the fuel cladding
d. HYDROGEN atoms in the water molecules

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

QUESTION 5.15 (.50)

Answer the following TRUE or FALSE:

With a reactor that is critical, low in the intermediate range, an EQUAL amount of POSITIVE or NEGATIVE reactivity insertion (e.g. 10E-4 k/k) will produce stable periods of EQUAL MAGNITUDE.

QUESTION 5.16 (2.00)

STATE how fuel pin centerline temperature will change (INCREASE, DECREASE, or REMAIN THE SAME) with each of the following conditions.

a. A 0.001 inch thick layer of corrosion product deposits on the clad surface. (0.5)

b. The Pressure Set on EHC is lowered by 10 psig. (0.5)

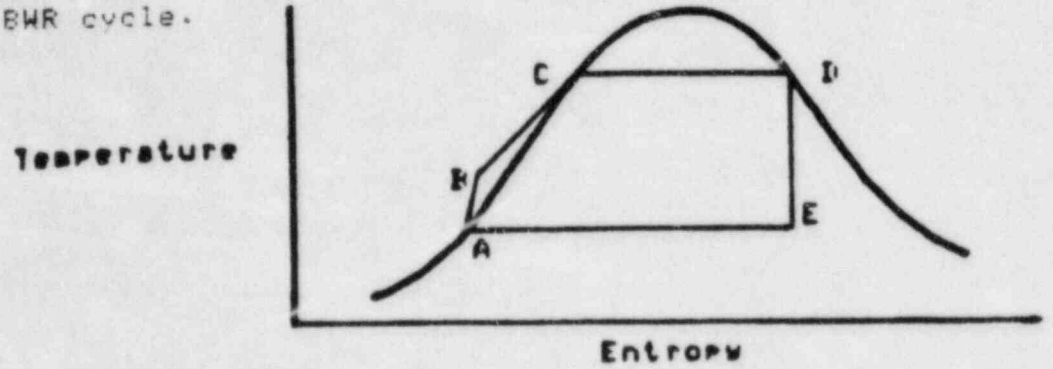
c. A fuel bundle reaches DNB. (0.5)

d. A HPCI full flow surveillance is conducted. (0.5)

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

QUESTION 5.17 (1.00)

The BWR is designed to operate like the RANKINE VAPOR CYCLE, shown below. Select the statement which is NOT TRUE, as applies to the REAL BWR cycle.



a. Increasing condenser vacuum (25" changed to 29") INCREASES cycle efficiency.

b. Condensate Depression, which is required for proper plant equipment performance, INCREASES overall thermodynamic efficiency.

c. Feedwater Heating INCREASES overall thermodynamic efficiency.

d. Feedwater pump pressure increase causes the feedwater to be FURTHER from saturation conditions.

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

QUESTION 5.18 (2.00)

Concerning General Electric's Preconditioning Interim Operating Management Recommendations (PCIOMR):

a. Starting with the fuel at a threshold of 11.0 kw/ft, a maximum ramp increase is begun at time 0000 and the final desired power of 13.0 kw/ft is achieved at 2000. At this time, the required soak is performed FOR 10 MINUTES, at which time the load dispatcher directs a power reduction that takes nodal power down to 12.0 kw/ft. SELECT the valid preconditioned value for this node.

ASSUME THE MAXIMUM RAMP RATE IS .10 Kw/ft/hr

1) 11.0 kw/ft
2) 11.8 kw/ft
3) 12.5 kw/ft
4) 13.0 kw/ft

b. SELECT the minimum time which would be required to raise power back to 13.0 kw/ft, given the above maximum ramp rate.

1) Immediate (Raise to 13.0 kw/ft, w/o restrictions)
2) 5 hours
3) 12 hours
4) 20 hours

QUESTION 5.19 (2.00)

As part of the scram procedure, the operator is directed to insert the SRM's and IRM's.

a. Following a severe LOCA, EXPLAIN how these systems could be used to detect gross core damage. (1.0)

b. EXPLAIN how these systems could be used to provide a crude indication of water level if level could not be confirmed by normal instrumentation. (1.0)

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

QUESTION 5.20 (1.00)

Which of the following statements best describes the operating characteristics of an LPRM detector?

a. Depletion of the detector's uranium coating causes both the neutron and the gamma sensitivity to DECREASE with detector age; the resulting neutron to gamma signal ratio remains relatively CONSTANT.

b. Since the detector functions as an ionization chamber and the Argon gas pressure remains relatively CONSTANT, BOTH the neutron and the gamma sensitivity, as well as the neutron to gamma signal ratio, remain relatively CONSTANT as the detector ages.

c. Depletion of the detector's uranium coating causes neutron sensitivity and the neutron to gamma signal ratio to DECREASE significantly as the detector ages; this may impair the detector's ability to respond to changes in power.

d. Depletion of the detector's uranium coating causes a DECREASE in the neutron to gamma signal ratio as the detector ages, but this does not impair the detector's response since gamma discrimination is not required in the power range.

QUESTION 5.21 (2.00)

a. After a reactor Scram from power, the shortest STABLE period possible is - 80 seconds. EXPLAIN why. (1.0)

b. Is the INITIAL period IMMEDIATELY following the above described Scram SHORTER or LONGER than the - 80 seconds. EXPLAIN. (1.0)

QUESTION 6.01 (1.00)

The Drywell Pneumatics System is operating in its normal line-up (Mode B). Pressure DECREASES (to approximately 100 psig). The system will automatically align such that ...(CHOOSE ONE)

a. ...the back-up Nitrogen supply line isolation valve (F001A) will OPEN and the bypass valve (F001B) will CLOSE.

b. ...the back-up Nitrogen supply line isolation valve (F001A) will OPEN and the bypass valve (F001B) will OPEN.

c. ...the Essential/Uninterruptable Instrument Air supply line isolation valves (F029 & F053) will OPEN.

d. ...the Non-essential/Interruptable Instrument Air supply line isolation valves (F036 & F038) will OPEN and the Drywell Pneumatics Compressors will TRIP and ISOLATE.

QUESTION 6.02 (1.00)

Given a Low CST Level on Unit 1 AND a High Torus Level on Unit 2, which one of the following accurately describes the responses of the HPCI and RCIC Systems?

a. BOTH units' HPCI AND RCIC will auto-swap to Torus Suction.
b. Unit 2 HPCI AND RCIC will auto-swap to Torus Suction; Unit 1 will auto-swap for HPCI ONLY.
c. Unit 1 HPCI AND RCIC will auto-swap to Torus Suction; Unit 2 will auto-swap for HPCI ONLY.
d. BOTH units' HPCI will auto-swap to Torus Suction; RCIC does not swap.

QUESTION 6.03 (1.00)

Given: Unit 2 in control of D/G "B"
D/G "B" Mode Switch in TEST (Surveillance being performed)
Electrical distribution NORMAL (Full Power Lineup)

D/G "B" is at rated speed and voltage, but not synchronized, when power is lost to 4160 volt Bus 2F. Which of the following accurately describes the system operation?

a. Bus 2F can be powered by D/G "B" when the operator takes the Output Breaker Switch to CLOSE and has the SYNC SCOPE activated.

b. Bus 2F will be powered by D/G "B" automatically, after 12 seconds; appropriate loads will be picked up sequentially.

c. Bus 2F can not be powered by D/G "B" while it is in the TEST mode, given these conditions.

d. Bus 2F can be powered by D/G "B" when the operator resets the Lockout Relay, activates the SYNC SCOPE, and takes the Output Breaker to CLOSE.

QUESTION 6.04 (1.00)

The Main Turbine first stage pressure switches provide permissives and/or control signals for several plant functions. Which of the following is NOT one of these control functions?

a. Recirculation Pump FPT breaker trip permissive
b. RCIS bypass
c. RWM LPAP
d. TSV, 10% Closure Scram bypass

QUESTION 6.05 (1.00)

The Recirculation Flow Control System contains a 44% Speed Limiter to control Recirculation pump speed under certain plant conditions. This 44% Limiter ...(CHOOSE ONE)

a. ...is first activated when total feedwater flow decreases below 20% and a reactor vessel low water level alarm is received.

b. ...is designed to prevent Recirculation pump cavitation by ensuring adequate Net Positive Suction Head.

c. ...enables the FWCS to recover reactor vessel water level upon loss of one Reactor Feedwater pump.

d. ...automatically resets when the initiating signal clears to enable the operator to restore normal recirculation flow.

QUESTION 6.06 (1.00)

The Reactor Water Cleanup System (RWCU) is being operated in the "Hot Blowdown" mode to control reactor water level. Which one of the following limitations is NOT a valid concern to the operator while controlling blowdown flow rate to the main condenser?

a. Exceeding the maximum allowable RBCCW System temperature exiting the Non-Regenerative Heat Exchanger (NRHX).

b. Exceeding the maximum allowable RWCU system temperature exiting the NRHX.

c. Exceeding the Pressure setpoint for downstream of the Blowdown FCV.

D. Exceeding the design cooling capacity of the Regenerative Heat Exchanger (RHX).

QUESTION 6.07 (1.00)

Which one of the following accurately describes Low-Low Set (LLS) logic, as applied at Plant Hatch?

a. Lowers BOTH the opening and closing setpoints of the LLS valves.
b. Controls the operation of all relief valves, excepting E and H.
c. Is activated by a position switch which confirms any SRV opening.
d. Is applicable to Unit 2 ONLY.

QUESTION 6.08 (2.00)

Regarding the Residual Heat Removal (RHR) System while operating in the Shutdown Cooling (SDC) Mode:

a. STATE why it is necessary to prevent the RHR pump's discharge from decreasing below 400 gpm. (1.0)

b. LIST 2 ways in which the system will be effected if reactor pressure increases to above 135 psig. (1.0)

QUESTION 6.09 (2.00)

With regard to the Unit 2 HPCI System:

a. LIST the two (2) conditions (includir setpoints) which will automatically initiate HPCI. (1.0)

b. For each of the situations listed below, STATE whether HPCI WILL or WILL NOT Automatically Inject into the reactor vessel. (1.0)

NOTE: ASSUME NO OPERATOR ACTIONS; ASSUME ANY FAILED COMPONENTS WERE IN THE FAILED CONDITION AT THE TIME OF THE AUTO INITIATION SIGNAL.

(1) The GLAND SEAL EXHAUSTER VACUUM PUMP fails to operate.

(2) The MINIMUM FLOW VALVE fails to auto open (stays shut) when system conditions require it to be open.

(3) After decreasing to 50 psig, HPCI Steam Line Pressure increases to 150 psig.

(4) After increasing to +60 inches, Reactor Vessel Water Level decreases to -60 inches.

QUESTION 6.10 (1.00)

The Unit 2 Vital AC Power 120/240 v Distribution Cabinet 2A is normally supplied from 600 v Bus 2D through a Battery Charger and a Static Inverter. If the Static Inverter fails ...(CHOOSE ONE)

a. ... the 125 vdc battery will maintain power to the Vital AC Cabinet for up to 6 hours.

b. ...the power supply can be manually transfered to the alternate 600 v Bus 2C / Vital AC Transformer 2A by depressing a transfer PB.

c. ...the power supply will automatically transfer to the alternate 600 v Bus 2C / Vital AC Transformer 2A.

d. ...the power supply can be manually transfered to the alternate 600 v Bus 2C / alternate Static Inverter by depressing a transfer PB.

QUESTION 6.11 (1.00)

The Unit 1 Primary Containment Atmospheric Control System can be used to vent the primary containment under normal operating conditions. To do this, the operator must manipulate the key-locked bypass switches. The direct effect of doing this, and the method by which this is done, is to ...(CHOOSE ONE)

a. ...override the HI MSL PRESSURE (> 850 psig) isolation signal by HOLDING the bypass switches in the BYPASS position.

b. ...override the HI MSL PRESSURE (> 850 psig) and the LOCA isolation signals by HOLDING the bypass switches in the BYPASS position.

c. ...override the HI MSL PRESSURE (> 850 psig) isolation signals by PLACING the bypass switches in the BYPASS position.

d. ...override the HI MSL PRESSURE (> 850 psig) and the LOCA isolation signals by PLACING the bypass switches in the BYPASS position.

QUESTION 6.12 (1.00)

Unit 1 is operating at 48% RTP using Reactor Feedwater Pumps 1A and 1B. Feedwater Line A is isolated (MOV F006A Shut). With this condition, a flowpath for RWCU ... (CHOOSE ONE)

a. ...CAN BE MAINTAINED. The RWCU connection to FW Line A is isolated by removing the spool piece between RWCU and the HPCI discharge; RWCU is operated via RCIC and FW Line B.

b. ...CAN BE MAINTAINED. The RWCU connection to FW Line A is isolated by manually valving shut the connection between RWCU and the HPCI discharge. RWCU is operated via RCIC and FW Line B.

c. ...CANNOT BE MAINTAINED. The RWCU flow to FW Line A is not isolable since the RWCU to HPCI discharge connection is not valved.

d. ...CANNOT BE MAINTAINED. RWCU only has a discharge isolation valve on its common discharge header; no FW line can be isolated without securing RWCU.

QUESTION 6.13 (1.00)

Which of the following statements correctly describes the protective trip function(s) associated with the Reactor Recirculation pumps/motor generator sets?

a. The "EOC-RPT" trip protects the plant from overpressurization transients (e.g. MSIV Closure) by tripping the recirculation pumps, when reactor pressure exceeds 1120 psig.

b. The motor generator field breaker stays closed in most instances when the MG Set drive motor breaker trips, in order to maximize coastdown flow.

c. The two "EOC-RPT" breakers for each recirculation pump are redundant to the MG Set drive motor breakers, and interrupt power to the MG Set during overpressurization transients.

d. The reactor recirculation pumps trip on low low reactor vessel water level, to ensure Net Positive Suction Head (NPSH) requirements are met.

QUESTION 6.14 (1.00)

A reactor startup/power ascent is in progress with the "B" IRM failed upscale and in BYPASS. The mode switch has just been taken to "Run". WHICH one of the following situations/ events will cause a reactor HALF-SCRAM?

a. APRM Flow Converter (Unit) "A" goes INOP
b. APRM "B" fails DOWNSCALE
c. One of the 11 valid LPRM inputs to APRM "B" fails DOWNSCALE
d. APRM "B" Mode Switch is taken to STANDBY

QUESTION 6.15 (1.00)

Which of the displays of the indicator lights for ATTS indicate that the system is in its normal operating mode with NO ALARM CONDITIONS present? (CHOOSE ONE)

NOTE: FIGURES 9.9(3) AND 9.9(6) PROVIDED FOR REFERENCE

	DISPLAY/COLOR			
LITE/PANEL	(a)	(b)	(c)	(d)
TRIP STATUS/MTU	ON/Green	OUT	ON/Amber	OUT
STATUS/MTU	ON/Green	ON/Green	OUT	On/Red
GROSS FAIL/MTU	ON/Green	OUT	ON/Green	OUT
POWER/P925	ON/Green	ON/Clear	ON/Red	ON/Green

QUESTION 6.16 (2.00)

EXPLAIN how reactor vessel level is controlled in the dP mode during a reactor startup. Include the parameters which are sensed and the plant systems/components controlled.

QUESTION 6.17 (1.00)

STATE how (INCREASE, DECREASE, REMAIN THE SAME) Drywell Pressure would be expected to respond to an SRV discharge line vacuum breaker STICKING OPEN during actuation of the SRV. EXPLAIN YOUR CHOICE.

QUESTION 6.18 (1.00)

Which of the following is NOT TRUE regarding the operation of the Main Steam Isolation Valves (MSIV's)?

a. Air pressure is normally used to open and close the MSIV's.

b. Accumulators supply normal pneumatic pressure for valve operation, with the plant air system providing a backup source.

c. AC and DC solenoid valves control the admission of pneumatic pressure to each MSIV, but only ONE solenoid need be energized to reposition the MSIV OPEN.

d. During test operation, the MSIV will go 90% CLOSED under spring pressure as the under-piston pressure is released through a needle valve.

QUESTION 6.19 (2.00)

The plant is operating normally at full power with the FWCS in THREE-ELEMENT CONTROL. A single SRV fails open and remains open with NO operator actions taken.

After the initial transient, the plant attains a new steady-state condition (the one SRV is still open). STATE whether the reactor water level will be HIGHER, LOWER, or the SAME as it was before the transient. EXPLAIN your answer. (Include control signal variances and the component responses)

QUESTION 6.20 (1.00)

Reactor Feed Pump (RFP) turbine speed is controlled by either a Motor Speed Changer (MSC) or an Electric Automatic Positioner (EAP). The EAP ...(CHOOSE ONE)

a. ... will control the RFP turbine's speed only if its speed signal is greater than that from the MSC.

b. ...is normally used to control feed flow rate at a turbine speed of 0 - 5500 rpm.

c. ... unlike the MSC, does NOT afford the capability of manual speed control by use of a local handwheel.

d. ...will lock in place to prevent a ramp response to a false signal, if it loses its signal from the flow controller.

QUESTION 6.21 (3.00)

Assume the following initial rod position distribution:

All rods in Groups 1 - 3 are FULLY WITHDRAWN, except for one rod in each Group --- 22-51 in Group 1, 46-55 in Group 2, and 18-03 in Group 3 (These 3 rods are FULLY INSERTED). All rods in Groups 4 - 10 are FULLY INSERTED to position 00 except for rod 34-27 (Group 4) which is FULLY WITHDRAWN.

Fill in the following table with the Rod/Rod Group number you would expect to see displayed in each RWM window for EACH of the situations (a - c). If nothing will appear, write 'Blank.'

RWM WINDOW	SITUATIONS (a) Initial Conditions (IC)	(b) IC with Rod 34-27 INSERTED to 00	(c) IC with Rod 22-51 withdrawn to 48
ROD GROUP	--------	--------	--------
INSERT ERROR	--------	--------	--------
INSERT ERROR	--------	--------	--------
WITHDRAW ERROR	--------	--------	--------

QUESTION 6.22 (2.00)

Regarding the SRV's and the associated Low Low Set (LLS) logic:

There are three lights associated with each SRV - RED, GREEN, and AMBER. EXPLAIN what each of the different colored lights indicates, and STATE whether each would be energized or de-energized during the time its SRV was open as a result of reactor pressure reaching the SRV's relief setpoint.

QUESTION 6.23 (1.00)

Which of the following lists of responses (a - d) CORRECTLY describes the main turbine's response to an OVERSPEED condition?

RESPONSES

SPEEDS	(a)	(b)	(c)	(d)
102%	'Master' ICV's begin to throttle	All ICV's begin to throttle	All ICV's begin to throttle	'Master' ICV's begin to throttle
	'Slave' ICV's begin to throttle			'Slave' ICV's begin to throttle
	All ICV's Full Closed	All ICV's Full Closed	All ICV's Full Closed	All ICV's Full Closed
110%	Mechanical O'Spd Trip	Electrical O'Spd Trip	Mechanical O'Spd Trip	Electrical O'Spd Trip
111.5%	Electrical O'Spd Trip	Mechanical O'Spd Trip	Electrical O'Spd Trip	Mechanical O'Spd Trip

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

QUESTION 7.01 (2.00)

Procedure HNP-2-1909, "Inability to Shutdown With Control Rods", states that:

> "... if at any time, either condition b(1) or b(2) exists, and either _____(a.1)____ or ____(a.2)____, and if it is obvious that the reactor cannot be shutdown and, in the judgment of the Shift Supervisor, or in his absence, a licensed operator, a hazard exists to the environs, personnel, or the plant, utilize the standby liquid control system per HNP-2-1400 ..."

a. LIST conditions (a.1) and (a.2). (1.0)

b. LIST conditions b(1) and b(2). (1.0)

QUESTION 7.02 (1.50)

Procedure HNP-8008, "Radiation Work Permit", describes three (3) different types of RWP's which can be issued - REGULAR, ROUTINE, and BLANKET. For the following situations, STATE the most appropriate RWP to be issued.

a. Unit 1 is in an outage and the main turbine is being repaired. A controlled work area, with constant HP coverage, has been established for the round-the-clock repairs. This should last for several weeks. (0.5)

b. Unit 1 is in an outage and the main turbine requires inspection. Constant HP coverage will be maintained; the job should take approximately 18 hours. (0.5)

c. Unit 1 is in an outage. Special outage procedures will require routine (once per shift) entries into a Hi Radiation Area for component inspection. This will be required for the next three (3) months. (0.5)

QUESTION 7.03 (1.00)

You are supervising refueling activities on the Refueling Floor and hear the ARM HI RADIATION ALARM. No control rods are currently withdrawn. Per HNP-1903, "Refueling Floor High Radiation", you would contact the Control Room after ...(CHOOSE ONE)

a. ...immediately evacuating all personnel involved in fuel handling activities to the 130' Health Physics area.

b. ...reading the ARM level locally and immediately evacuating ALL personnel to the 130' Health Physics area, if the level is > 50 mR/hr.

c. ...immediately evacuating ALL personnel on the refueling floor to the 185' Change area.

d. ...immediately evacuating those personnel in the vicinity of the alarming ARM (not the entire R/F Floor) to the 185' Change Area.

QUESTION 7.04 (1.00)

You enter HNP-2-1910, "Loss of All Plant Service Water", and are unable to restore PSW operation. Subsequent operator actions require you to place Fuel Pool Cooling in operation at maximum flow. This is done to ...(CHOOSE ONE)

a. ... provide a long-term heat sink for RHRSW via the Fuel Pool Cooling Assist connection.

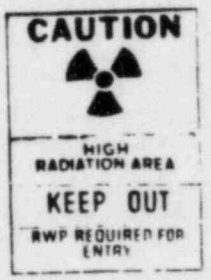
b. ... prepare for the high heat load from the impending reactor shutdown and required fuel unload.

c. ... provide a long term heat sink for TBCCW.

d. ... provide a short term heat sink for RBCCW.

QUESTION 7.05 (.50)

You enter an area posted with the following sign:



As a minimum, how often should you read your pocket dosimeter?

QUESTION 7.06 (1.00)

Unit 2 is operating at 70% RTP; you notice power start to increase with NO CHANGE in recirculation flow or rod position. You suspect a Loss of Feedwater Heating.

Which of the following actions are required/appropriate, per HNP-2-1946?

a. A 20% reduction in Recirc Flow, monitored by Recirc Flow Controller ma signal variance.

b. A 20% Power Reduction, using Recirc Flow, monitored by APRM's.

c. Insertion of Shallow Rods, to maintain proper flux shape, prior to reducing Recirc Flow.

d. Insertion of Power Rods, to maintain proper flux shape, prior to reducing Recirc Flow.

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

QUESTION 7.07 (1.00)

A CAUTION in HNP-2-1902, "Pipe Break Inside Primary Containment", states that:

> "A Pipe Break in the Drywell could result in Reactor Level Reading inaccuracies due to increased temperature. Refer to Section "E" ... for erratic correction method before proceeding. Erratic level indication could be due to water in the sensing line flashing to steam."

Using Section "E", enclosed, and given the following readings:

2T47-R620	192 deg F
2T47-R621	228 deg F
2B21-604A	+26 inches
2B21-604B	+23 inches

What is the best estimate of Actual Water Level?

a. +9-1/2 inches
b. +15 inches
c. +34 inches
d. +37-1/2 inches

QUESTION 7.08 (1.00)

Which of the following conditions establishes the reactor in HOT STANDBY, as defined by HNP-2-1015, "Maintaining Hot Standby Condition"?

PARAMETER	CONDITION (a)	(b)	(c)	(d)
Mode Switch	S & HS	S & HS	S & HS	S & HS
Coolant Temp	> 212 deg F	> 212 deg F	> 200 deg F	> 200 deg F
Rx Pressure	< 1040 psig	< 1010 psig	< 1010 psig	< 1040 psig
K-eff	1.000	< 1.000	1.000	< 1.000

QUESTION 7.09 (1.00)

Both Recirculation Pumps trip. You place the Mode Switch to SHUTDOWN but are, subsequently, UNSUCCESSFUL in restarting either Recirc Pump.

COMPLETE THE FOLLOWING: (HNP-2-1932)

> "Subsequent to Reactor Shutdown, and without both recirculation pumps operating, maintain vessel level from (greater than) ____(a)____, to ensure ____(b)____."

QUESTION 7.10 (1.00)

You receive the following annunciator alarm:

POWDEX SYSTEM TROUBLE

You determine that you have a Condenser tube leak, per HNP-2-1928, "Condenser Tube Leaks". Which one of the following accurately describes your Operator Actions?

a. Confirm demin effluent < 0.1 umho/cm; increase power to maintain conductivity < 2.0 umho/cm; commence a reactor shutdown if conductivity > 0.5 umho/cm.

b. Confirm demin effluent < 1.0 umho/cm; decrease power to maintain conductivity < 2.0 umho/cm; initiate fast shutdown if conductivity becomes > 2.0 umho/cm.

c. Confirm demin effluent < 1.0 umho/cm; increase power to maintain conductivity < 2.0 umho/cm; commence normal reactor shutdown if conductivity becomes > 5.0 umho/cm.

d. Confirm demin effluent < 0.1 umho/cm; decrease power to maintain conductivity < 0.2 umho/cm; initiate fast shutdown if conductivity becomes > 0.2 umho/cm.

QUESTION 7.11 (1.00)

Procedure HNP-2-1934, "Torus Water Temperature Above 95 deg F", directs:

"If any point indicates a torus temperature greater than or equal to 95 deg F, initiate torus cooling..."

Additionally,

"Operator should not initiate torus cooling unless water level is ___(1)___ and at a level greater than ___(2)___."

Which of the following are the MINIMUM requirements for (1) and (2)?

a. (1) Stable
(2) that required for Natural Circulation

b. (1) Increasing
(2) Top of Active Fuel

c. (1) Stable
(2) 2/3 Core Height

d. (1) Increasing
(2) Reactor Vessel Zero

QUESTION 7.12 (2.00)

Place the following procedural steps from HNP-2-1001 into the proper sequence, as they would be performed during an actual reactor plant startup and pressurization according to the procedure:

a. Stabilize reactor power with 1-1/2 BPV's open
b. Start a Mechanical Vacuum Pump
c. Open the Steam Seal Feed and Bypass Valves
d. Establish vessel water reject thru the RWCU System
e. Place a SJAE into service
f. Start a Steam Packing Exhauster
g. Place RCIC in Standby, per HNP-2-1125
h. Start Reactor Feedwater Pump 2A (or 2B)

QUESTION 7.13 (1.00)

Procedure HNP-2-4207, "Transformer Fire", lists three (3) Operator Action Steps for a Startup Auxiliary Transformer fire. Which of the following is NOT a required Operator Action?

a. Confirm CARDOX system actuated.
b. Manually start the required D/G's and synchronize to the E-bus.
c. Deenergize the Transformer.
d. Evaluate the plant conditions for possible shutdown.

QUESTION 7.14 (2.00)

Procedure HNP-2-1001, "Normal Startup", instructs the operator to:

READ water level select switch (select level B; level A to be used only when performing maintenance or surveillance on level B).

NOTE: FIGURE 2.3(2) IS PROVIDED AS REFERENCE

EXPLAIN why level B is specified.

QUESTION 7.15 (1.00)

Procedure HNP-2-1437, "Reactor Recirculation Pump Speed Changes", cautions the operator not to start an idle pump unless the other pump is operating at < 50% loop speed.

EXPLAIN the reason for this procedural CAUTION.

QUESTION 7.16 (1.00)

Procedure HNP-2-1005, "Power Changes", states that Unit 2's licensed maximum thermal power for steady state operations is 2436 MwT.

EXPLAIN in what instance(s) this maximum power may be exceeded and how this is verified.

QUESTION 7.17 (1.00)

HNP-2-9400, "Jet Pump Integrity", identifies conditions under which jet pump integrity checks/calculations must be performed. Which of the following IS NOT one of these conditions?

a. DAILY, with the Mode Switch in HOT STANDBY or RUN, and BOTH Recirculation Pumps running.

b. Following ALL Recirculation Pump restarts.

c. Prior to exceeding 25% RTP.

d. Following any normal increase in Recirculation flow greater than 20%.

QUESTION 7.18 (1.50)

HNP-2-19●6, "Post Accident Venting", directs that Hydrogen and Oxygen concentrations must be strictly controlled. STATE the volumetric concentration limits for Hydrogen and Oxygen.

QUESTION 7.19 (1.50)

Per HNP-2-1020, "Normal Shutdown", LIST three (3) steps that the reactor operator should take to DECREASE a cooldown rate that is too fast.

ASSUME THAT THE SHUTDOWN IS FROM HIGH POWER CONDITIONS AND THAT THE BPV's ARE FULLY CLOSED.

QUESTION 7.20 (1.00)

After station startup and synchronization to the 230 KV line and partial loading of the generator, WHAT transfer(s) should be made to assure station house load supply?

NOTE: BE SPECIFIC WITH REGARD TO BUS/TRANSFORMER/ETC IDENTIFICATION

QUESTION 7.21 (1.00)

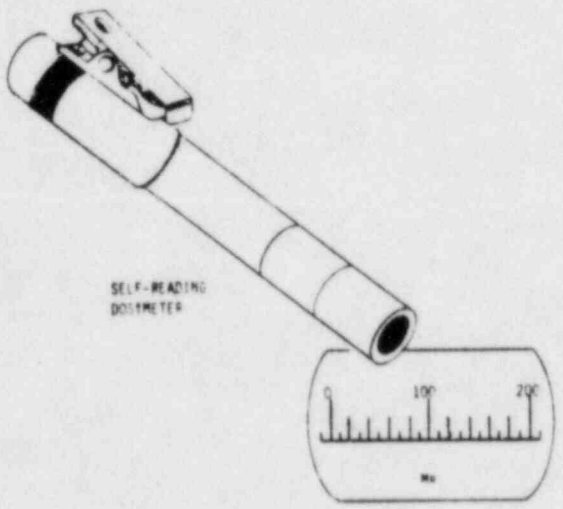
Regarding the "Loss of 125/250 volt DC Switchgear 2B (2R22-S017)", Procedure HNP-2-1913:

EXPLAIN why the "B" Recirculation MG Drive Motor is TRIPPED.

QUESTION 7.22 (1.00)

You are given the dosimetry shown below. SELECT the maximum radiation level where it is adequate dosimetry (excluding a TLD) BY ITSELF.

a. Whole Body dose rate of 2.0 mR/hr.
b. Whole Body dose rate of 20.0 mR/hr.
c. Whole Body dose rate of 200.0 mR/hr.
d. Whole Body dose rate of 5.0 R/hr.



QUESTION 7.23 (1.00)

Which of the following is NOT required to be immediately verified or executed by the operator in response to a "Suspected Fuel Element Failure", per HNP-2-1930?

a. Verify the Off-gas adsorber bypass valve (F043) CLOSES on an Off-gas Pre-treatment high alarm.

b. Verify the Off-gas stack inlet valve (F057) CLOSES on an Off-gas Post-treatment high-high-high alarm.

c. Lock out all the Drywell and Reactor Building Sump pumps until analysis can be performed, or the SS's approval.

d. DO NOT reject any reactor water to the Main Condenser or Radwaste without the SS's approval.

QUESTION 7.24 (1.00)

Procedure HNP-2-1902, "Pipe Break Inside Primary Containment", lists numerous conditions indicative of a break. Which of the following supports the suspicion of a SMALL break inside containment.

a. Decrease in reactor water level; pressure and/or temperature increase in Drywell; airborne activity increase in Drywell; increased DWFDS operating frequency.

b. Decrease in reactor pressure; pressure and/or temperature increase in Drywell; generator load decrease; DWFDS high level.

c. Reactor Scram from low water level; pressure and/or temperature increase in Drywell; generator load decrease; increased DWFDS operating frequency.

d. Reactor Scram from high Drywell pressure; generator load decrease; airborne activity increase in Drywell; DWFDS high level.

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

QUESTION 7.25 (1.00)

The reactor is at power and the CRD System is lost. Per HNP-2-1940, "Loss of CRD Systems", if the operator CANNOT restore CRD flow, he should ...(CHOOSE ONE)

a. ..., with reactor pressure less than 800 psig, and more than five (5) accumulator trouble lights, commence a fast reactor shutdown.

b. ..., with reactor pressure greater than 800 psig, and five (5) adjacent accumulator trouble lights or thirty (30) total trouble lights, manually Scram the reactor.

c. ..., with reactor pressure less than 800 psig, and more than three (3) accumulator trouble lights, manually Scram the reactor.

d. ..., with reactor pressure greater than 800 psig, and three (3) adjacent accumulator trouble lights or thirty (30) total trouble lights, commence a fast reactor shutdown.

QUESTION 7.26 (1.00)

Regarding Hatch procedures, in general, EXPLAIN when you would expect to see a CAUTION statement AND when you would expect to see a WARNING statement. (Include the difference between the two)

QUESTION 7.27 (1.00)

Procedure HNP-501, "Equipment Clearance and Tagging", states:

"Under no circumstances is anyone ever authorized to attach or remove a red HOLD tag without first having a proper clearance. The only exception to this is ..." (CHOOSE ONE)

a. ...to isolate DC systems of less than 24 vdc.

b. ...to rack in/rack out a station service feeder breaker

c. ...to isolate multi-divisional power transmission circuits.

d. ...to rack in/rack out bus ties of 480 vac, or less.

QUESTION 8.01 (1.00)

Which of the following scenarios requires application of the Power Transient fuel cladding integrity Safety Limit of the Unit 1 Technical Specifications?

a. Reactor power is at 42% RTP; the main turbine trips due to an EHC malfunction; the reactor SCRAMS on HIGH PRESSURE; the BPV's control pressure thereafter.

b. Reactor power is at 70% RTP; a steam leak to the Drywell occurs and Drywell pressure rises; the reactor SCRAMS at 1.85 psig; HPCI auto-actuation does not occur, but manual start is successful; the reactor is brought to a cold shutdown condition.

c. Reactor is in Start-Up, at 12% RTP; power is increased by rod pull; the reactor SCRAMS at 12.5% power, by APRM's; level and pressure are maintained by normal systems for the plant status.

d. The reactor is at 18% RTP; 1-1/2 BPV's are open in preparation for turbine warmup; controller failure reduces pressure to 875 psig; MSIV's close; reactor SCRAMS; level and pressure are maintained by normal systems for the plant status.

QUESTION 8.02 (1.00)

Unit 2 is operating at 90% RTP. As part of the normal surveillance program, functional tests of the MSL Radiation Detectors are performed.

(APPLICABLE TS's ARE ENCLOSED FOR REFERENCE)

Given that 2D11-K603 A tests UNSAT, which of the following is most TRUE?

(a) Establish a trip condition for the channels fed by K603A within 1 hour, and be in STARTUP with the MSIV's CLOSED within 2 hours, or be in HOT SHUTDOWN within 6 hours.

(b) Establish a trip condition for the channels fed by K603A within 1 hour, and be in STARTUP with the MSIV's CLOSED within 2 hours, or be in HOT SHUTDOWN within 6 hours and COLD SHUTDOWN within the next 30 hours.

(c) Establish a trip condition for the channels fed by K603A within 1 hour, but you may continue in Operational Condition 1.

(d) Establish a trip condition for the channels fed by K603A within 1 hour and be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the following 30 hours.

QUESTION 8.03 (.50)

STATE who can declare the unit/plant to be in an emergency condition (classification).

NOTE: Identify by Position Title and any special required qualifications.

QUESTION 8.04 (1.00)

Unit 2 Technical Specifications specify the frequency intervals for the performance of Surveillance requirements. This is accomplished by use of FREQUENCY NOTATION.

COMPLETE the following Table. (DO NOT INCLUDE GRACE PERIODS)

	NOTATION	FREQUENCY
a)	S	At least once per _____ hours.
b)	D	At least once per _____ days.
c)	M	At least once per _____ days.
d)	---	At least once per 18 months.

QUESTION 8.05 (1.50)

Unit 2 Technical Specifications define SHUTDOWN MARGIN as...

"Shutdown margin shall be the amount of reactivity by which the reactor is subcritical, or would be subcritical from its present condition, assuming..."

LIST the three conditions which complete the definition of SHUTDOWN MARGIN.

QUESTION 8.06 (3.00)

a. The following data was taken on Unit 2 during a single day of operation at Operational Condition 1:

		Identified Leakage	Unidentified Leakage
Shift 1:	0400	5020 gal	604 gal
	0800	4940 gal	1020 gal
Shift 2:	1200	5040 gal	900 gal
	1600	5340 gal	1032 gal
Shift 3:	2000	5840 gal	1100 gal
	2400	4640 gal	1248 gal

Indicate any TS (or other) limit(s) that was(were) exceeded. Justify your answer(s). (2.0)

b) What is the definition of "Pressure Boundary Leakage?" (1.0)

QUESTION 8.07 (1.00)

Temporary changes to operating procedures should be minimized. Under which one of the following conditions is a temporary change permitted and warranted, as the proper corrective action?

a. The addition of a CAUTION is necessary to prevent possible equipment damage.

b. A correction is required to a valve/electrical lineup.

c. The plant physical conditions assumed by a procedure are incorrect and prevent its completion as written.

d. A procedural step is determined to be unnecessary and should be deleted.

QUESTION 8.08 (1.00)

Per Administrative Procedure MNT-01-0, 'Maintenance Program', EMERGENCY MAINTENANCE ...(CHOOSE ONE)

a. ... is maintenance that must be performed to maintain safe operating conditions, as determined by the Operations Supervisor On Shift

b. ... may be performed without issuance, or approval, of a Maintenance Work Order (MWO), or procedure.

c. ... must be approved by the General Manager or Deputy General Manager -AND- the OSOS or SS on duty.

d. ... may be worked on a 24 hour/day, 7 day/week schedule, upon the specific approval of the General Manager.

QUESTION 8.09 (2.00)

Answer the following TRUE or FALSE questions with regard to the control of Lifted Wires and Temporary Jumpers (HNP-504 and HNP-9).

a. A lifted wire or jumper that is required by Tech Specs, such as placing an inoperable channel in the tripped condition, does NOT require PRB approval. (0.5)

b. When lifting wires or installing jumpers not requiring a 'J and LW' sheet, 'J and LW' tags must still be placed on the jumpers and/or lifted wires. (0.5)

c. The final approval to activate a 'J and LW' clearance sheet on a safety system that is required to be operable by Tech Specs is provided by two members of the plant staff, one of whom must be a licensed SRO. (0.5)

d. For surveillance procedures requiring the use of temporary jumpers, independent verification is ONLY required on system restoration and NOT on initial installation. (0.5)

QUESTION 8.10 (1.00)

HNP-501, "Equipment Clearance and Tagging", provides instructions for the proper method of requesting and issuing clearances and hold tags. Which of the following accurately describes the clearance process?

a. When a maintenance project will require a clearance for more than one shift, the Shift Supervisor can release the sub-clearance to the "Maintenance Foreman"; by name release is not required in this case.

b. Any clearance which requires the normal electrical lineup of the plant to be modified, will be issued by the Shift Supervisor in the form of written Switching Orders, per HNP-X-1646.

c. If a new MWO has identical isolation boundaries to a previously released MWO/Clearance, the new MWO may be added to the clearance.

d. When restoring a safety-related component to service, if NOT covered by procedure or surveillance requirement, INDEPENDENT VERIFICATION of the release is REQUIRED.

QUESTION 8.11 (1.00)

Procedure MNT 01-0, "Maintenance Program", designates certain responsibilities for the Shift Supervisor in returning components/systems to service after maintenance activities. Which of the following is NOT one of these responsibilities?

a. The Shift Supervisor will EVALUATE the inspections and tests performed to determine if the system or component may be returned to service.

b. The Shift Supervisor will PLACE the system or component in operation and DOCUMENT its operational status by signing the MWO.

c. The Shift Supervisor will attach a copy of any LCO report generated as a result of the work activity to the MWO package, once the MWO is closed out.

d. If the operational test(s) are UNSATISFACTORY, the Shift Supervisor will return the MWO, with amplifying remarks, to the Maintenance Foreman in charge of the work activity, to allow for further corrective maintenance to be performed.

QUESTION 8.12 (1.00)

Unit 2 is in Operational Condition 1, at 75% RTP, with two outstanding deficiencies:

ADS	1 ADS Valve INOP (1 Day)
CS	CST Suction INOP (3 Days)

The Auto - swap of the HPCI suction upon receiving CST low level is determined to be UNSATISFACTORY. The suction is MANUALLY switched to the Suppression Pool, and the suction to the CST is ISOLATED.

The Shift Supervisor determines that the required action(s), per the Unit Technical Specifications is(are) ...(CHOOSE ONE)

NOTE: APPLICABLE TS's ARE ENCLOSED FOR REFERENCE

a. ...no new limitations or TS Operational Condition restrictions are initiated by this re-alignment.

b. ...be in at least HOT SHUTDOWN within 12 hours and reduce reactor steam dome pressure to less than or equal to 150 psig within the following 24 hours.

c. ...be in at least HOT SHUTDOWN within 6 hours and COLD SHUTDOWN within the following 30 hours.

d. ...be in at least HOT SHUTDOWN within 6 hours and reduce reactor steam dome pressure to less than or equal to 150 psig within the next 30 hours.

QUESTION 8.13 (1.00)

Procedure HNP-514, "Control of Locked Valves", states that ...

> "... Confirmation of valve position is required periodically ... (and) all valves will normally be checked and manipulated by Operations Department personnel ..."

What is the proper way to CONFIRM a locked valve position?

a. Turn the valve hand wheel in the OPEN direction; confirm the locking device integrity and proper installation by visual inspection.

b. Turn the valve hand wheel in the CLOSED direction; confirm the locking device integrity and proper installation by attempting to misposition the valve.

c. Turn the valve hand wheel in the DESIRED POSITION direction; confirm the locking device integrity and proper installation by visual inspection.

d. Turn the valve hand wheel in the DESIRED POSITION direction; confirm the locking device integrity and proper installation by attempting to misposition the valve.

QUESTION 8.14 (1.00)

Unit 2 is in COLD SHUTDOWN during a reactor startup with no outstanding deficiencies. Hydrogen Recombiner A becomes INOP. It is anticipated that repairs will be complete within two (2) weeks.

The Shift Supervisor determines that the required action(s) per the Unit 2 Technical Specifications is(are) ... (CHOOSE ONE)

a. ...Operational Condition 4 must be maintained (Entry into Operational Condition 5 is acceptable)

b. ...Startup activities may continue; Operational Condition 3 may be entered, but not exceeded.

c. ...Startup activities may continue; Operational Condition 2 may be entered, but not exceeded; Oxygen concentration shall be maintained < 2 v/o.

d. ...Startup activities may continue; Operational Condition 1 and/or 2 may be entered, but the Recombiner must be returned to an OPERABLE status within 30 days.

NOTE: APPLICABLE TS's ARE ENCLOSED FOR REFERENCE

QUESTION 8.15 (.50)

Given the following conditions on Unit 2 :

Mode Switch - Refuel
Temperature - 180 deg F
Pressure - 0 psig
Level - 35 inches
RHR - SDC Mode
Head bolts to the RPV are DETENSIONED

STATE the above described Operational Condition.

QUESTION 8.16 (1.00)

HNP-507, "Control of Operator Aids", provides guidance on the use of Information Tags. Information Tags ...(CHOOSE ONE)

a. ...may supplement safety tags to protect a piece of equipment, but cannot serve as personnel protection devices.

b. ...should be used whenever a piece of equipment is physically removed from its normal position, except in the case of calibration and/or maintenance.

c. ...can be label tape notes on annunciator windows to denote an MWO request date. These do not require tracking.

d. ...shall be used in the Main Control Room, on the Refueling Bridge, and on Local Operating Panels only.

QUESTION 8.17 (1.00)

Procedure HNP-511, "Public Address Notification Signals", lists five (5) plant emergency conditions for which the public address system is used to announce. Which of the following IS NOT a condition having a DESIGNATED TONE.

a. FIRE in the Diesel Building.
b. "NOUE" Radiological Emergency declaration.
c. BOMB THREAT received by Control Room personnel.
d. "GENERAL EMERGENCY" Radiological Emergency declaration.

QUESTION 8.18 (2.50)

Unit 1 Technical Specifications provide guidance with respect to refueling operations. COMPLETE the following, as per U1 TS's.

a. When conducting refueling operations, at least ___(1)___ SRM channels must be operable and ___(2)___, with a minimum acceptable count rate of ___(3)___. Refueling operations may commence ___(4)___ after reactor shutdown. (2.0)

b. TRUE or FALSE

You are conducting a spiral reload on Unit 1. Up to four (4) fuel assemblies will be loaded into their previous core positions next to the four (4) SRM's. Until these assemblies have been loaded, the (Minimum Required) SRM count rate requirement is not necessary. (0.5)

QUESTION 8.19 (4.00)

UNit 1 Technical Specification 3.6.F.2 establishes the following conductivity and chloride limits:

PLANT CONDITION	CONDUCTIVITY LIMIT	CHLORIDE LIMIT
> 212 deg F/Pressurized w/o Steam Flow	5 umho/cm	0.1 ppm
> 1% rated steam flow	2 umho/cm	0.2 ppm

a. Per the TS basis, WHY is the chloride limit more restrictive at the lower steaming rate than when at power? (1.0)

b. STATE the conductivity and chloride limits which require Unit 1 to be immediately shutdown and placed in a Cold Shutdown condition. (1.0)

c. WHY, per the TS basis, is COLD SHUTDOWN the most desirable condition in which to place the reactor when the out-of-spec limits in part (b) are reached? (1.0)

d. WHY, per the TS basis, is it unnecessary to perform frequent chloride measurements as long as conductivity is continuously monitored and within its normal range? (1.0)

QUESTION 8.20 (2.00)

a. Unit 2 is in Operational 1 Condition with NO outstanding deficiencies. The current Surveillance Assignment printout sheet identifies a 'Latest Date' for the RCIC quarterly flow test, but the RCIC system becomes INOPERABLE before completing the surveillance. SELECT the statement which accurately describes the surveillance requirements as per HNP-831, 'Tech Spec Surveillance Program.' (1.0)

(1) The surveillance must be performed immediately AFTER returning the system (or subsystem) to an OPERABLE condition.

(2) The next regular surveillance interval shall commence UPON THE COMPLETION of the overdue surveillance.

(3) The surveillance shall NOT be documented as officially missed until the END of the 'Latest Date.'

(4) Since the RCIC system is already INOPERABLE, an LCO sheet need NOT be issued to track the missed surveillance.

b. The 'Earliest Date' block of the Surveillance Assignment printout sheet reads '00000' for a given surveillance. STATE the meaning of this reading AND for which Unit it would be applicable. (1.0)

QUESTION 8.21 (1.00)

Unit 2 has been recently shutdown and placed in COLD SHUTDOWN - Operational Condition 4. The shutdown/cooldown was necessitated by a requirement to drain and visually inspect the Suppression Pool.

The following plant conditions/requirements have been established:

CS system is aligned to the CST
Reactor Mode Switch is locked in the Shutdown Position
No maintenance affecting the reactor vessel is in progress

There is one outstanding deficiency:

D/G 2A Turbocharger is undergoing repairs (D/G INOP)

NOTE: APPLICABLE TS's ARE ENCLOSED FOR REFERENCE

The Shift Supervisor may ...(CHOOSE ONE)

a. ...commence Suppression Pool draining, since all TS LCO requirements are met.

b. ...commence Suppression Pool draining as soon as he ensures that NO POSITIVE REACTIVITY changes will occur during this condition.

c. ...commence Suppression Pool draining as soon as he ensures that NO POSITIVE REACTIVITY changes will occur AND that one LPCI subsystem is OPERABLE in this condition.

d. ...commence Suppression Pool draining only AFTER the D/G 2A Turbocharger is repaired and the D/G declared OPERABLE.

QUESTION 8.22 (1.00)

With regard to Procedure HNP-ADM-0903, "Control of Pulled Annunciator Cards":

EXPLAIN how an operator can determine if a particular Annunciator Card is pulled, WITHOUT looking at the Pulled Annunciator Card Control Sheet or Index.

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.01 (1.00)

d

REFERENCE
EIH, L-RQ-605 (15)

ANSWER 5.02 (1.00)

a

REFERENCE
EIH, L-RQ-602

ANSWER 5.03 (1.00)

d

REFERENCE
General Electric, NEDE-24810 (Jun 81)

ANSWER 5.04 (1.00)

a

REFERENCE
Steam Tables

ANSWER 5.05 (2.00)

a. (2) - Starting Pump 2 (0.5)
b. Curve B (0.5)
c. INCREASE (0.5)
d. Curve C (0.5)

REFERENCE
Pump Laws

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.06 (1.50)

F1. b
F2. c
F3. a
L1. c
L2. a
L3. b (.25 each)

REFERENCE
EIH, GPNT, Vol VII, Chapter 10.2-23

ANSWER 5.07 (1.00)

d

REFERENCE
EIH, L-RQ-667 (3), L-RQ-654

ANSWER 5.08 (1.00)

b - OR - d

REFERENCE
EIH, GPNT,Vol VII, Chapter 10.1-83-86

ANSWER 5.09 (1.00)

a

REFERENCE
EIH, L-RQ-675

ANSWER 5.10 (2.50)

a. Recirculation Pump Trip (Lo Lo Level)
b. MSIV Closure (Lo Lo Lo Level) - OR - CV Closure w/BFV F.S.
c. HPCI & RCIC Injection
d. HPCI and RCIC Cooldown Effects (Steam & Colder Water)
e. Recirculation Pump RunBack (#1 S.L.) (0.5 each)

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

ANSWERS -- HATCH 182 -85/03/11-K E BROCKMAN

REFERENCE
EIH, L-RO-732

ANSWER 5.11 (2.50)

a. Natural Circulation at reduced power (Scram)
b. Decreased suction from the downcomer due to the tripped RRP's
(Increased voiding in the core causing a swell in the downcomer)
c. In response to level increase
d. Loss of FW Heating (due to reduced extraction steam flow)
e. EHC established flow appropriate to control pressure
(Flow equivalent to reactor power) (0.5 each)

REFERENCE
EIH, L-RO-732

ANSWER 5.12 (1.00)

b

REFERENCE
EIH, L-RO-667 (10)

ANSWER 5.13 (~~2.00~~) 1.00

~~a. (2)~~ Deleted

b. (1)

REFERENCE
EIH, L-RO-672 (15); U2 TS 3.2.3

ANSWER 5.14 (1.00)

d

REFERENCE
EIH, L-RO-602 (9)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.15 (.50)

FALSE

REFERENCE
EIH, L-RQ-603 (4)

ANSWER 5.16 (2.00)

a. INCREASE
b. DECREASE
c. INCREASE
d. REMAIN THE SAME

REFERENCE
EIH, GPNT, Vol. VII, Chapter 10.2

ANSWER 5.17 (1.00)

b

REFERENCE
EIH, Thermodynamics L/P, pp 52-56

ANSWER 5.18 (2.00)

a. 2
b. 3 (Or, as appropriate for answer given in (a))

REFERENCE
EIH, GPNT, STA Training Manual, Section 9

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.19 (2.00)

a. By observing the Full-in and Full-out travel lights (the operator could determine if geometric distortion had occured. Inability to conduct full detector movement would indicate that internal misconfiguration had occured). (1.0)

b. By observing the neutron level while moving the nuclear instrumentation. A significantly HIGHER (approximately 300 times) count rate would be seen for the UNVOIDED areas of the core as opposed to the VOIDED. (1.0)

REFERENCE
EIH, L-RQ-540 (M.8)

ANSWER 5.20 (1.00) REFERENCE

c EIH, GPNT, Vol. II, Chapter 3.E; Nuclear Power Systems Handbook, Herrer & Beckerly, p 41.

ANSWER 5.21 (2.00)

a. lambda = Ln 2/T$_{1/2}$ = .693/55.6 = .0125 sec E -1 (CALC NOT REQUIRED)

T = 1/-lambda = 1/-.0125 = - 80 sec

After the initial prompt drop, power cannot decrease faster than the longest lived delayed neutrons appear (1.0)

b. Shorter (0.5) The initial prompt drop will only be due to prompt neutrons (0.5) -OR- Decay of short lived precursors (0.5)

REFERENCE
EIH, GPNT, Vol. VII, Chapter 10.1

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.01 (1.00)

b

REFERENCE
EIH, L-RO-752, DCR 80-111; L-RO-734

ANSWER 6.02 (1.00)

a

REFERENCE
EIH, L-RO-752; DCR 81-175; GPNT, Vol V, Chapter 4.5; GPNT, Vol VII, Chapter 8.1

ANSWER 6.03 (1.00)

c

REFERENCE
EIH, GPNT, Vol VI, Chapter 7.2; EIH Simulator

ANSWER 6.04 (1.00)

c

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1-9; GPNT, Vol VI, Chapter 5.5-10;
GPNT, Vol VII, Chapters 9.2.2-11 and 9.2.3-5

ANSWER 6.05 (1.00)

c

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1-23

ANSWER 6.06 (1.00)

d

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, GPNT, Vol V, Chapter 4.3-12

ANSWER 6.07 (1.00)

a

REFERENCE
EIH, GPNT, Vol V, Chapter 5.1.II.B

ANSWER 6.08 (2.00)

a. To prevent a loss of reactor water inventory to the Torus (0.8) through the Minimum Flow Valve (0.2)

b. SDC PCIS Valves (F008 & F009) - Auto Close
All running RHR Pumps - Trip
Head Spray Valve (F023) - Auto Closes
RHR Inboard Inj. Valve (F015) - Auto Closes (2 req'd @ 0.5 each)

REFERENCE
EIH, GPNT, Vol V, Chapter 4.4-15,17; GPNT, Vol VI, Chapter 8.3.c.3; HNP-2-1114, p6

ANSWER 6.09 (2.00)

a. 1.85 psig (.25) in Drywell (.25) and/or Lo Lo Level (.25) of - 55 inches (.25)

b. (1) WILL
(2) WILL
(3) WILL NOT
(4) WILL (.25 each)

REFERENCE
EIH, GPNT, VOL VI, Chapter 8.1

ANSWER 6.10 (1.00)

b

REFERENCE
EIH, L-RQ-733, p11, Fig 4

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.11 (1.00)

c

REFERENCE
EIH, L-RO-752; DCR 79-442; HNP-1-1500

ANSWER 6.12 (1.00)

b

REFERENCE
EIH, GPNT, Vol VI, Chapter 5.3; DCR 83-87

ANSWER 6.13 (1.00)

b - OR - d

REFERENCE
EIH, GPNT, Vol. V, Chapter 4.1-26; L-RO-714 (14)

ANSWER 6.14 (1.00)

d

REFERENCE
EIH, L-RO-719 (6.9); L-RO-720 (10)

ANSWER 6.15 (1.00)

b

REFERENCE
EIH, L-RO-704 (6)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.16 (2.00)

PARAMETERS MONITORED

Vessel level is monitored and becomes the controlling signal for operation of the Startup Level Control (F111) valve. (0.5)

dP signal across the SLC Bypass Valve (F110) is monitored and becomes the controlling signal for RFPT speed. (0.5)

SYSTEM/COMPONENT CONTROL

The input to the M/A stations is a dP error signal from the dP controller. The controller senses the dP across the F110 valve, compares it to the controller set dP, in order to maintain a constant dP across the valve. (0.5)

The F111 valve opens/shuts in response to reactor vessel water level. When the valve opens, the dP decreases and the signal sent is to increase RFPT speed; valve closure is the converse. (0.5)

REFERENCE
EIH, L-RQ-726 (3,5,6)

ANSWER 6.17 (1.00)

INCREASE (0.5) The vacuum breaker provides a direct path to the DRYWELL. (0.5)

REFERENCE
EIH, GPNT, Vol V, Chapter 3.1; NUREG/BR-005/Vol 5, No 4, Power Reactor Events, Jan 84, p 5 (Hatch occurance 8/25/82)

ANSWER 6.18 (1.00)

b

REFERENCE
EIH, GPNT, Vol. VI, Chapter 5.1-25, 26, 27

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.19 (2.00)

Level would be LOWER. (0.5)

Since measured steam flow is less than feedwater flow (0.25), an error signal is generated (0.25) which tends to decrease RFP speed (0.25). A lower vessel level generates an opposite error signal (0.25) which tends to increase RFP speed (0.25). Level will stabilize when the error signals are equal. (0.25)

REFERENCE
EIH, GPNT, Vol. VI, Chapter 5.3

ANSWER 6.20 (1.00)

d

REFERENCE
EIH, HNP-[illegible]-1001;

ANSWER 6.21 (3.00)

	(a)	(b)	(c)	
ROD GROUP	03	03	04	
INSERT ERROR	22-51	22-51	18-03	
INSERT ERROR	46-55	46-55	46-55	
WITHDRAW ERROR	34-27	Blank	Blank	(.25 each)

REFERENCE
EIH, GPNT, Vol. VII, Chapter 9.2.2

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.22 (2.00)

RED - Solenoid control valve has energized (0.33);
De-energized (0.33)

GREEEN - Power available to the solenoid control valve (0.33)
Energized (0.33)

AMBER - Pressure in tailpipe (>85 psig) (0.33)
Energized (0.33)

REFERENCE
EIH, GPNT, Vol. VI, Chapter 5.1.II.B.2

ANSWER 6.23 (1.00)

a

REFERENCE
EIH, GPNT, Vol. VI, Chapter 5.5-2; Vol. VII, Chapter 9.4-19, 20

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 7.01 (2.00)

a) 1. RPV level cannot be maintained (0.5)
2. Suppression Pool water temperature cannot be maintained below 110 deg F (0.5)

b) 1. Five (5), or more adjacent control rods not inserted below the 06 position (0.5)
2. Thirty (30), or more total control rods not inserted below the 06 position. (0.5)

REFERENCE
EIH, HNP-2-1909

ANSWER 7.02 (1.50)

a) ROUTINE (0.5)
b) REGULAR (0.5)
c) BLANKET (0.5)

REFERENCE
EIH, HNP-8008, pp 1, 6, 8

ANSWER 7.03 (1.00)

c

REFERENCE
EIH, HNP-2-1903, p2

ANSWER 7.04 (1.00)

d

REFERENCE
EIH, HNP-2-1910

ANSWER 7.05 (.50)

Every five (5) minutes (1/2 credit for more conservative response)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH. GET Handbook, p25

ANSWER 7.06 (1.00)

b

REFERENCE
EIH. HNP-2-1946

ANSWER 7.07 (1.00)

b

REFERENCE
EIH. HNP-2-1902

ANSWER 7.08 (1.00)

a

REFERENCE
EIH. HNP-2-1015

ANSWER 7.09 (1.00)

a) + 570 ° from Vessel Zero -OR- + 53° from Instrument Zero (0.5)

b) (a flow path for) Natural Circulation (0.5)

REFERENCE
EIH. HNP-2-1902

ANSWER 7.10 (1.00)

d

REFERENCE
EIH. HNP-2-1928

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 7.11 (1.00)

c

REFERENCE
EIH, HNP-2-1934,p1

ANSWER 7.12 (2.00)

d (.25); f, c, b (.75); g (.25); h (.25); e (.25); a (.25)

REFERENCE
EIH, HNP-2-1001, pp 18, 19, 20, 22, 23, 28, 29

ANSWER 7.13 (1.00)

a

REFERENCE
EIH, HNP-2-4207, p2

ANSWER 7.14 (2.00)

'B' is normally selected because a failure in the 'A/C' side, causing the transmitters to sense a LOW level, would cause the following:

A turbine trip on High Level (58") would not occur (0.5)

If 'A' transmitter were selected, a false signal would be sent out to the controllers to increase level (0.5)

Level would continue to increase until the operator terminated the transient

With 'B' selected, a failure of the 'A' transmitter would not result in level change since the 'B' transmitter has not failed. (But still do not have 2 out of 3 trip available) (0.5)

Failure of 'B' transmitter with 'D' selected would cause water level change, but the 2 out of 3 trip would still provide protection. (0.5)

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, L-RQ-726; GPNT, Vol VI, Chapter 5.3

ANSWER 7.15 (1.00)

To preclude establishing excessive stresses in the jet pumps due to flow reversals - OR - to prevent excessive radial bearing loads (on the recirc pumps)

REFERENCE
EIH, HNP-2-1437, p5; GPNT, Vol V, Chapter 4.1

ANSWER 7.16 (1.00)

Maximum licensed thermal power may be exceeded in the instances of THERMAL SPIKES.(0.5) Verification is accomplished by use of OD-3 Printouts from the Process Computer.(0.5)

REFERENCE
EIH, HNP-2-1005, pp 1,2

ANSWER 7.17 (1.00)

d

REFERENCE
EIH, HNP-2-9400; U2 TS 3.4.1.2

ANSWER 7.18 (.50)

H-2 - 1 v/o
O-2 - 5 v/o

REFERENCE
EIH, HNP-2-1906

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 7.19 (1.50)

1. Shut down the in-service SJAE. (Place the MVP in service)
2. Shut down the running RFP. (Control level with RCIC)
3. Temporarily discontinue control rod insertion. (0.5 each)

REFERENCE
EIH, HNP-2-1020

ANSWER 7.20 (1.00)

4160 V Buses 2A and 2B should have their startup supply transformer swapped from Startup Transformer 2C to Unit Auxiliary Transformer 2B. (0.5) 4160 V Buses 2C and 2D should have their startup supply transformer transferred from Startup Transformer 2D to Unit Auxiliary Transformer 2A. (0.5)

REFERENCE
EIH, HNP-2-1649

ANSWER 7.21 (1.00)

Tripping the Drive Motor will prevent MG Set damage during coastdown (0.5) in the event that the AC pumps are lost some time later and the MG Set trips. (0.5)

REFERENCE
EIH, HNP-2-1913

ANSWER 7.22 (1.00)

D

REFERENCE
EIH, GET Handbook, pp 25, 29

ANSWER 7.23 (1.00)

A

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, HNP-2-1930

ANSWER 7.24 (1.00)

d

REFERENCE
EIH, HNP-2-1902

ANSWER 7.25 (1.00)

c

REFERENCE
EIH, HNP-2-1940, p1

ANSWER 7.26 (1.00)

CAUTION - Equipment damaging conditions exist (0.5)

WARNING - Personnel injury hazards exist (0.5)

REFERENCE
EIH, HNP-3, p 25

ANSWER 7.27 (1.00)

b

REFERENCE
EIH, HNP-501, pp 8-15

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.01 (1.00)

B

REFERENCE
EIH, U1TS, 1.1.c

ANSWER 8.02 (1.00)

C

REFERENCE
EIH, U2 TS, 3.0.4, 3.3.1, 3.3.2

ANSWER 8.03 (50

SHIFT SUPERVISOR (SS) or OPERATIONS SUPERVISOR (OSOS) or ANY HIGHER RANKING LICENSED OR CERTIFIED PERSON PRESENT

REFERENCE
EIH, HNP - 4520, 4620, 4720

ANSWER 8.04 (1.00)

a) 12 hours (+ 0)
b) 72 days (+ 0)
c) 31 days (+ 0)
d) R (.25 each)

REFERENCE
EIH, U2 TS, Table 1.1; HNP-0-ADM-0831

ANSWER 8.05 (1.50)

(1) Highest worth rod (0.25) fully withdrawn (0.25)
(2) Xenon free
(3) Cold (68 deg F) (0.5 each)

REFERENCE
EIH, U2 TS, 1.0 "SDM"

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.06 (3.00)

a) UNIDENTIFIED LEAKAGE increased from a 2.51 gpm rate at 0400 to a 4.58 gpm rate at 2000, thus exceeding the 2 gpm increase limit within a 24 hour period. (0.67)

TOTAL LEAKAGE exceeded the 25 gpm limit over a 24 hour period (25.50 gpm) (0.66)

UNIDENTIFIED LEAKAGE exceeded the 5 gpm limit at 2400 (5.2 gpm) (0.67)

b) Pressure Boundary Leakage is leakage through a non-isolable fault (0.5) in a reactor coolant system component body, pipe wall, or vessel wall (0.5) (1.0)

REFERENCE
EIH, U2 TS, 1.0, 3.4.3.2; Confirmatory Order 7590-01, dtd 7-8-83

ANSWER 8.07 (1.00)

a - OR - c

REFERENCE
EIH, HNP - 9, p47

ANSWER 8.08 (1.00)

b

REFERENCE
EIH, MNT 01-0, p9

ANSWER 8.09 (2.00)

a) TRUE
b) TRUE
c) FALSE
d) TRUE

REFERENCE
EIH, HNP-504, pp 1-31 HNP-9, p35

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.10 (1.00)

c

REFERENCE
EIH, HNP-501, pp 1, 2, 8, 10

ANSWER 8.11 (1.00)

d

REFERENCE
EIH, MNT 01-0, p20

ANSWER 8.12 (1.00)

a

REFERENCE
EIH, U2 TS, 3.5.1, and 3.5.2

ANSWER 8.13 (1.00)

b

REFERENCE
EIH, HNP-514, p1

ANSWER 8.14 (1.00)

d

REFERENCE
EIH, U2 TS, 3.0.3, 3.0.4, 3.6.6.2

ANSWER 8.15 (.50)

[illegible]

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, U2 TS's, Table 1.2

ANSWER 8.16 (1.00)

c

REFERENCE
EIH, HNP-507, pp 2, 3

ANSWER 8.17 (1.00)

b

REFERENCE
EIH, HNP-511

ANSWER 8.18 (2.50)

a. (1) 2
(2) fully inserted
(3) 3 cps
(4) 24 hours

b. TRUE

REFERENCE
EIH, U1 TS, 3.10.C.1, 3.10.C.2, 3.10.H

ANSWER 8.19 (4.00)

a. Because the dissolved oxygen content of the reactor coolant is typically higher during low steaming rates (e.g. Startup of Hot Standby) (1.0)

b. Conductivity - 10 umho/cm (@75 deg C) (1.0)
Chloride - 0.5 ppm

c. The lower temperature reduces the corrosion rates (thereby providing RWCU more time to restore chemistry limits). (1.0)

d. When conductivity is within its normal range, then chloride (and any other impurities affecting conductivity) must also be within their normal ranges. (1.0)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, U1 TS's, 3.6-6

ANSWER 8.20 (2.00)

(1.0)

a. (3)

b. '00000' indicates that there is no Negative Grace Period for this surveillance.(0.5) It would be applicable for Unit 2. (0.5) (Since Unit 1 allows plus AND minus 25% interval variance)

REFERENCE
EIH, HNP-ADM-0831

ANSWER 8.21 (1.00)

d

REFERENCE
EIH, U2 TS's, 3.5.4; Standing Order 84-05

ANSWER 8.22 (1.00)

The annunciator window will be labeled with the appropriate pulled annunciator control number.

REFERENCE
EIH,HNP-ADM-0903

QUESTION	VALUE	REFERENCE
07.02	1.50	KEB0000017
07.03	1.00	KEB0000018
07.04	1.00	KEB0000019
07.05	.50	KEB0000020
07.06	1.00	KEB0000021
07.07	1.00	KEB0000022
07.08	1.00	KEB0000023
07.09	1.00	KEB0000024
07.10	1.00	KEB0000025
07.11	1.00	KEB0000027
07.12	2.00	KEB0000028
07.13	1.00	KEB0000029
07.14	2.00	KEB0000057
07.15	1.00	KEB0000058
07.16	1.00	KEB0000059
07.17	1.00	KEB0000101
07.18	.50	KEB0000102
07.19	1.50	KEB0000103
07.20	1.00	KEB0000104
07.21	1.00	KEB0000105
07.22	1.00	KEB0000106
07.23	1.00	KEB0000136
07.24	1.00	KEB0000144
07.25	1.00	KEB0000145
07.26	1.00	KEB0000146
07.27	1.00	KEB0000147
	30.00	
08.01	1.00	KEB0000001
08.02	1.00	KEB0000002
08.03	.50	KEB0000003
08.04	1.00	KEB0000004
08.05	1.50	KEB0000005
08.06	3.00	KEB0000008
08.07	1.00	KEB0000009
08.08	1.00	KEB0000010
08.09	2.00	KEB0000011
08.10	1.00	KEB0000012
08.11	1.00	KEB0000013
08.12	1.00	KEB0000014
08.13	1.00	KEB0000015
08.14	1.00	KEB0000092
08.15	.50	KEB0000107
08.16	1.00	KEB0000108
08.17	1.00	KEB0000109
08.18	2.50	KEB0000110
08.19	4.00	KEB0000111
08.20	2.00	KEB0000134
08.21	1.00	KEB0000135
08.22	1.00	KEB0000148
	30.00	

QUESTION	VALUE	REFERENCE
05.01	1.00	KEB0000042
05.02	1.00	KEB0000043
05.03	1.00	KEB0000044
05.04	1.00	KEB0000045
05.05	2.00	KEB0000046
05.06	1.50	KEB0000047
05.07	1.00	KEB0000048
05.08	1.00	KEB0000049
05.09	1.00	KEB0000050
05.10	2.50	KEB0000051
05.11	2.50	KEB0000052
05.12	1.00	KEB0000053
05.13	2.00	KEB0000054
05.14	1.00	KEB0000055
05.15	.50	KEB0000056
05.16	2.00	KEB0000095
05.17	1.00	KEB0000096
05.18	2.00	KEB0000097
05.19	2.00	KEB0000138
05.20	1.00	KEB0000139
05.21	2.00	KEB0000140
	30.00	
06.01	1.00	KEB0000030
06.02	1.00	KEB0000031
06.03	1.00	KEB0000032
06.04	1.00	KEB0000033
06.05	1.00	KEB0000034
06.06	1.00	KEB0000035
06.07	1.00	KEB0000036
06.08	2.00	KEB0000037
06.09	2.00	KEB0000038
06.10	1.00	KEB0000039
06.11	1.00	KEB0000040
06.12	1.00	KEB0000041
06.13	1.00	KEB0000060
06.14	1.00	KEB0000061
06.15	1.00	KEB0000062
06.16	2.00	KEB0000063
06.17	1.00	KEB0000064
06.18	1.00	KEB0000098
06.19	2.00	KEB0000100
06.20	1.00	KEB0000140
06.21	2.00	KEB0000141
06.22	2.00	KEB0000142
06.23	1.00	KEB0000143
	30.00	
07.01	2.00	KEB0000016

Georgia Power

DATE 21 SEP 84 TIME [illegible] WATCH-1 SEQ. NO. [illegible]

PERIODIC BWR CORE PERFORMANCE LOG

LOCATION	1	2	3	4	5	6	7	8	9	10	11	12
AXIAL REL PWR	0.60	1.12	1.15	1.12	1.16	1.08	1.08	1.05	1.04	1.07	0.99	0.60
REGION REL PWR	0.97	1.02	0.97	1.06	1.15	1.06	0.97	1.02	0.97			
RING REL PWR	0.96	1.17	1.20	1.22	1.12	1.00	0.50					
APRM GAF	0.97	0.97	0.95	0.96	0.93	0.98						

REGION	1	2	3	4	5	6	7	8	9
MFLCPR	0.694	0.704	0.694	0.715	0.698	[illegible]	[illegible]	[illegible]	[illegible]
LOC	17-14	21-14	35-14	9-28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FLOW	0.1326	0.1319	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PKF	1.35	1.33	1.35	1.38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MFLPD	0.684	0.670	0.684	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LOC	17-14 4	31-14 4	35-14 4	[illegible] 4	19-[illegible] 5	41-[illegible] 4	17-40 4	[illegible] 4	[illegible] 4
PKFL	1.94	1.94	1.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MAPRAT	0.642	0.640	0.641	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LOC	17-10 5	21-14 4	35-10 5	[illegible] 5	[illegible] 5	[illegible]	[illegible]	[illegible]	[illegible]
PKFS	1.72	1.70	1.71	1.69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FAILED SENSORS 7 12 17 18 15 [illegible] [illegible] [illegible] 25

FAILED LPRM LIST

2813-B-2 4813-C-1 2821-B-7 4821-B-1

[illegible]

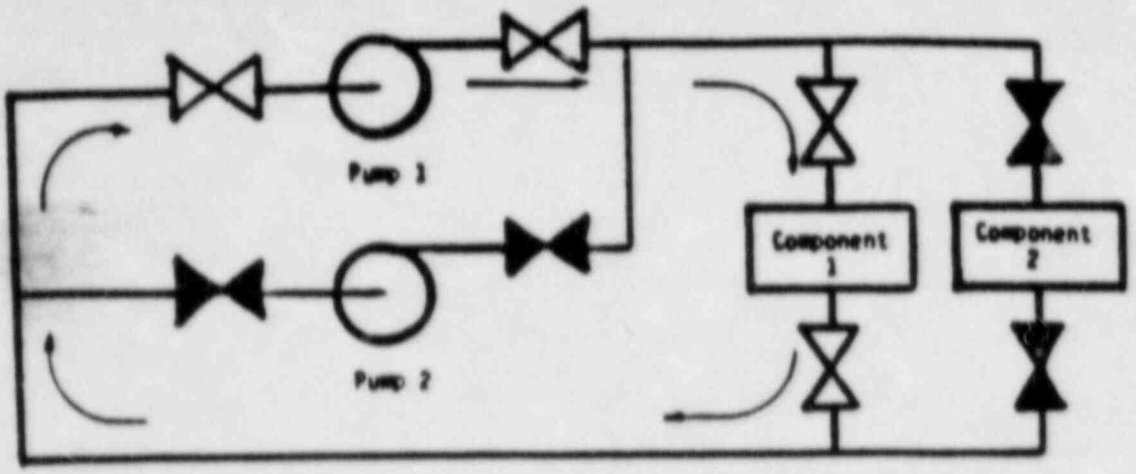
NONE

CMWT	2041.
PCT PWR	84.0
PCTLIP	81.4
CMWE	[illegible]
CMFCP	0.715
CMFLPD	[illegible]
CMAPRAT	0.642
[illegible]	[illegible]
CMFF	1.964
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	41.47
[illegible]	[illegible]
[illegible]	2.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	17.7[illegible]
[illegible]	[illegible]
WD	[illegible]
[illegible]	[illegible]
[illegible]	1.00
WT	[illegible]
PCT WTF	105.2
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

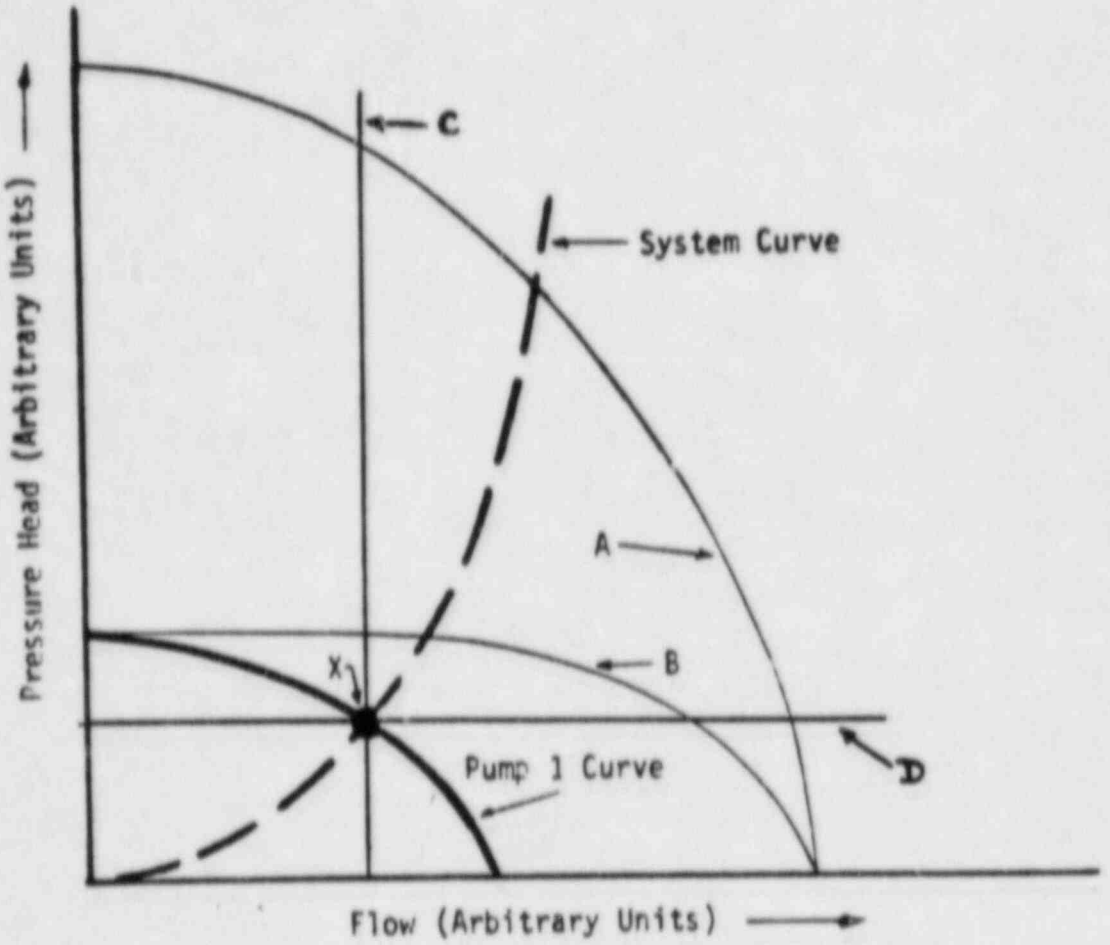
THE 12 MOST LIMITING BUNDLES

FOR MFLCPR				FOR MFLPD				FOR MAPRAT			
MFLCPR	LOC	MCPR	CPRLIM	MFLPD	LOC	MAPD	PDRLIM	MAPRAT	LOC	MAPLHGR	LIMLHGR
0.715	43-26	1.805	1.290	0.694	35-40- 4	[illegible]	13.40	[illegible]	17-38- 5	7.40	11.9[illegible]
0.715	9-28	1.805	1.290	[illegible]	17-14 4	9.19	13.40	0.647	17-10 5	[illegible]	11.90
0.715	43-28	1.805	1.290	[illegible]	35-14- 4	[illegible]	13.40	[illegible]	[illegible] 5	[illegible]	[illegible]
0.715	9-26	1.805	1.290	[illegible]	17-40- 4	9.19	13.40	[illegible]	35-44- 5	7.50	11.9[illegible]
0.704	31-40	1.832	1.290	[illegible]	31-18- 4	[illegible]	13.40	[illegible]	[illegible] 4	7.43	[illegible]
0.704	21-40	1.832	1.290	[illegible]	31-40 4	[illegible]	13.40	[illegible]	21-14 4	[illegible]	[illegible]
0.704	21-14	1.832	1.290	[illegible]	21-40 4	[illegible]	13.40	[illegible]	[illegible] 4	[illegible]	[illegible]
0.704	31-14	1.833	1.290	[illegible]	21-14 4	[illegible]	13.40	[illegible]	31-14 4	[illegible]	12.00
0.703	27-44	1.835	1.290	[illegible]	17-38- 5	[illegible]	13.40	[illegible]	27-38 4	7.45	[illegible]
0.703	27-10	1.835	1.290	[illegible]	19-12 5	9.05	13.40	[illegible]	27-15- 4	7.15	11.7[illegible]
0.703	25-44	1.835	1.290	0.676	35-42- 5	9.05	13.40	[illegible]	25-10- 4	7.15	11.97
0.703	25-10	1.835	1.290	[illegible]	13-42- 5	9.05	13.40	[illegible]	25-44 4	[illegible]	11.97

THE NUMBER OF BUNDLES WITH MFLCPR GREATER THAN 1.0 = 0
THE NUMBER OF BUNDLES WITH MFLPD GREATER THAN 1.0 = 0
THE NUMBER OF BUNDLES WITH MAPRAT GREATER THAN 1.0 = 0



SYSTEM



SYSTEM HEAD VS. FLOW PLOT

FIGURE FOR 5.05

LOSS OF ALL FEEDWATER

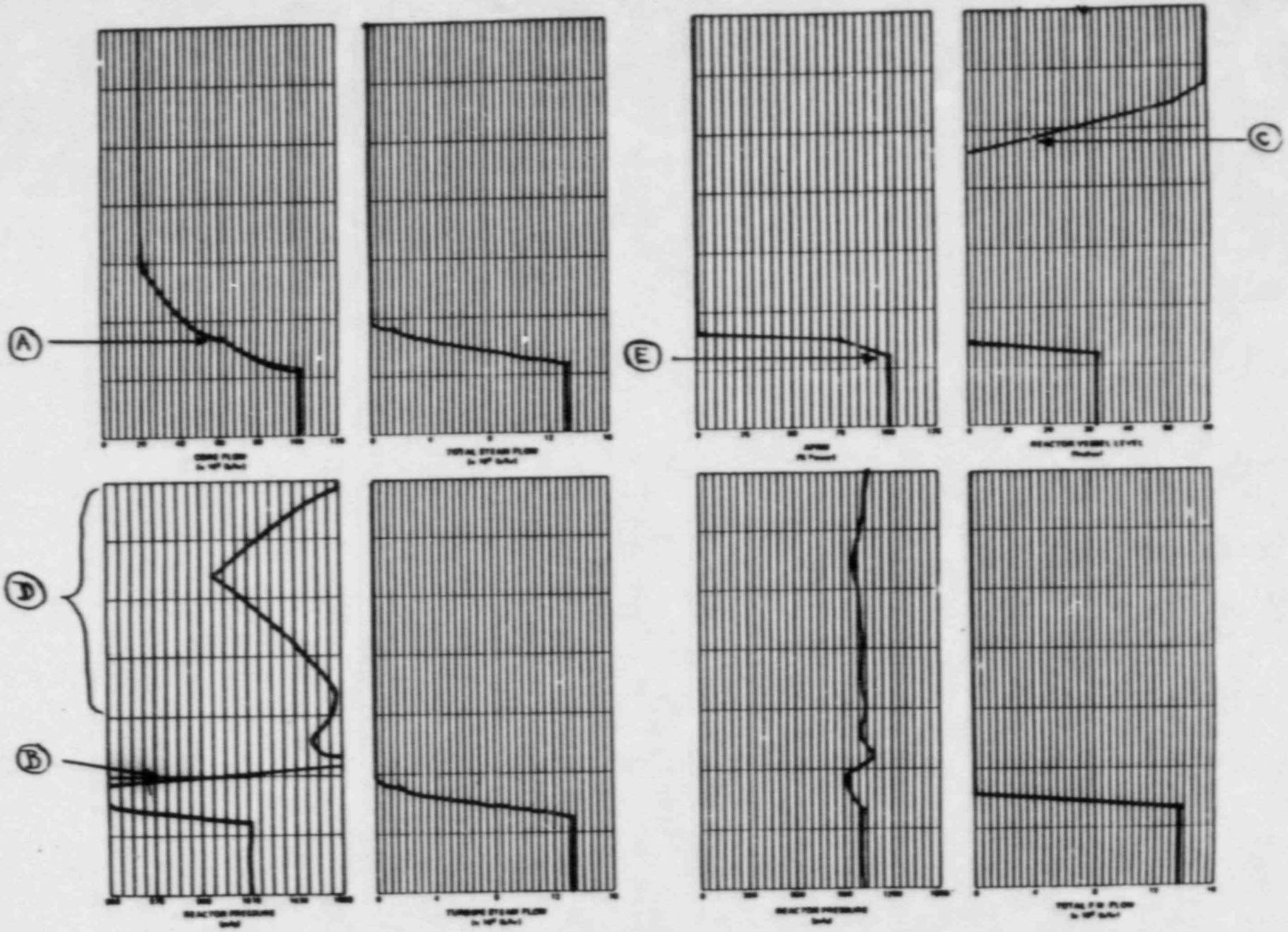


FIGURE FOR 5.10

LOSS OF BOTH RECIRC PUMPS

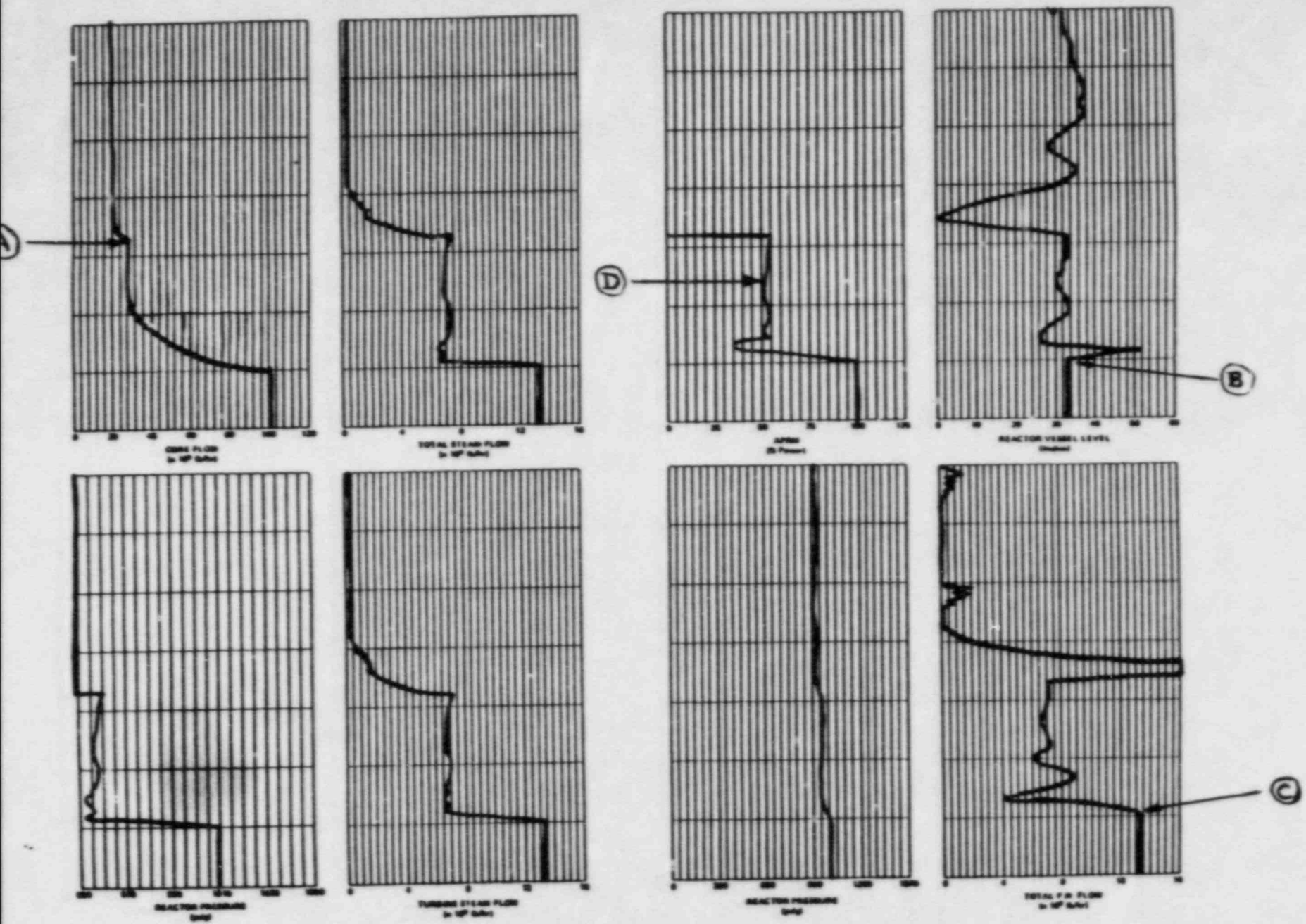
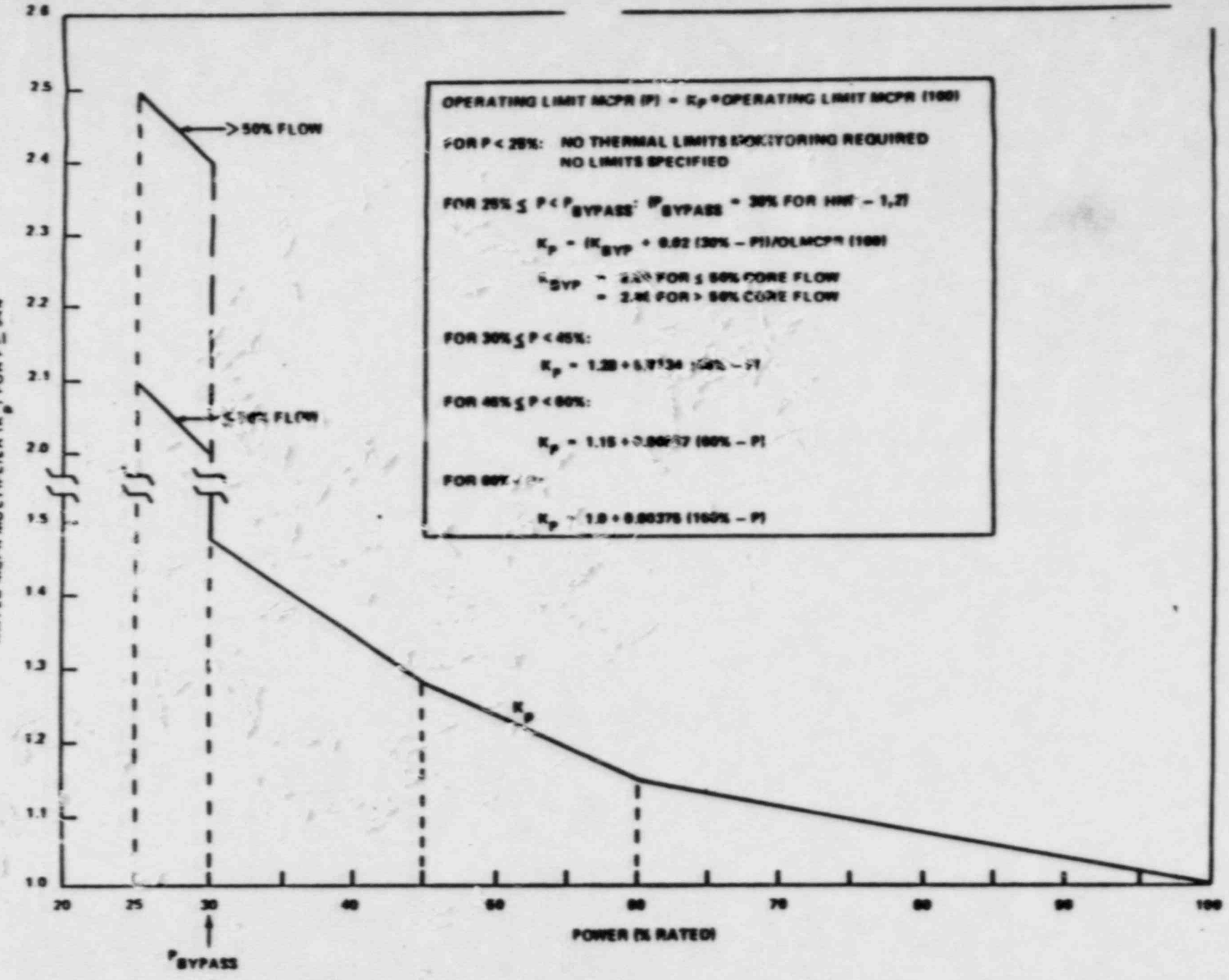


FIGURE FOR 5.11

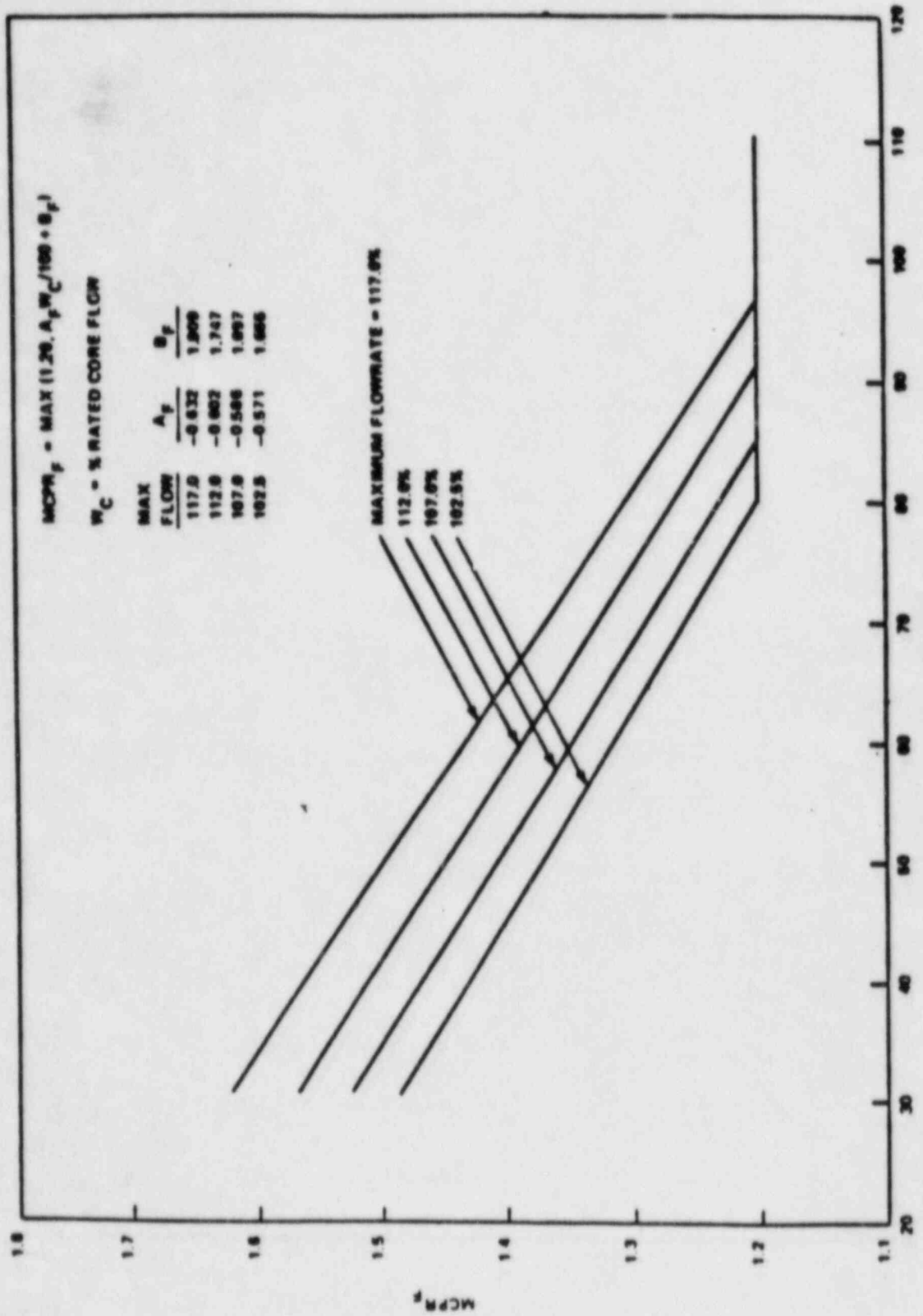


K_p

FIGURE 5.4

GENERAL ELECTRIC COMPANY PROPRIETARY INFORMATION

FIGURE FOR 5.13



MCPR$_P$
FIGURE 5.5

FIGURE FOR 5.13

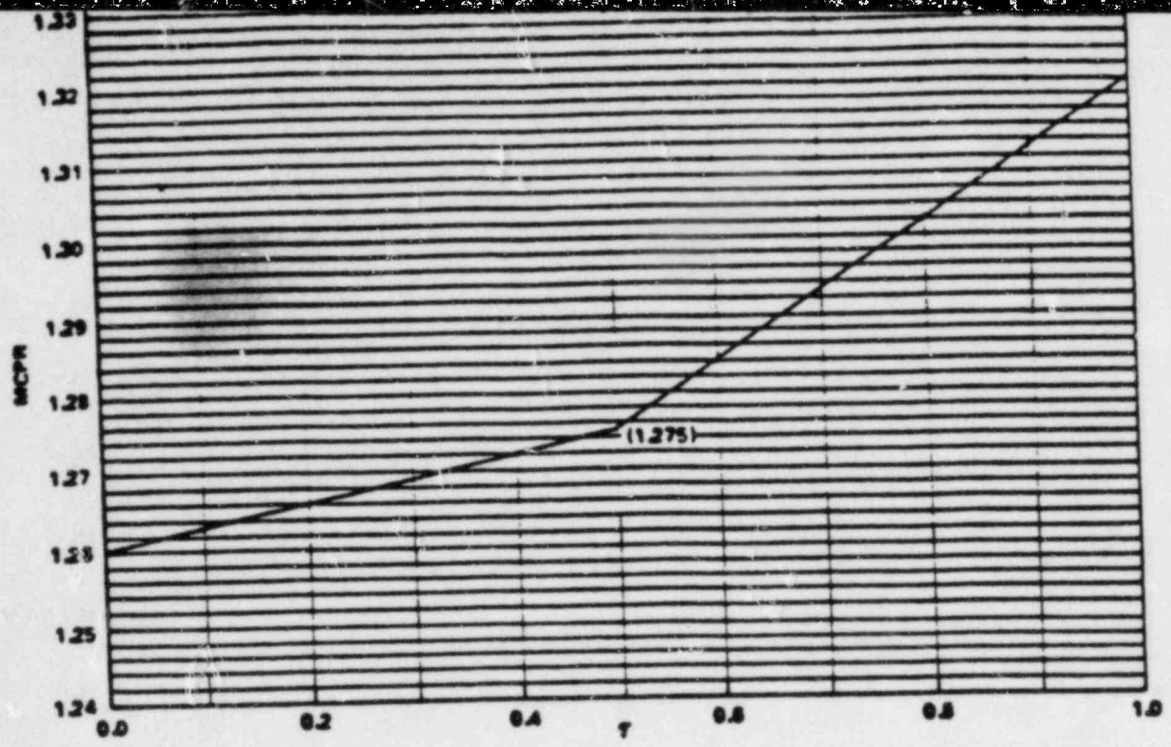
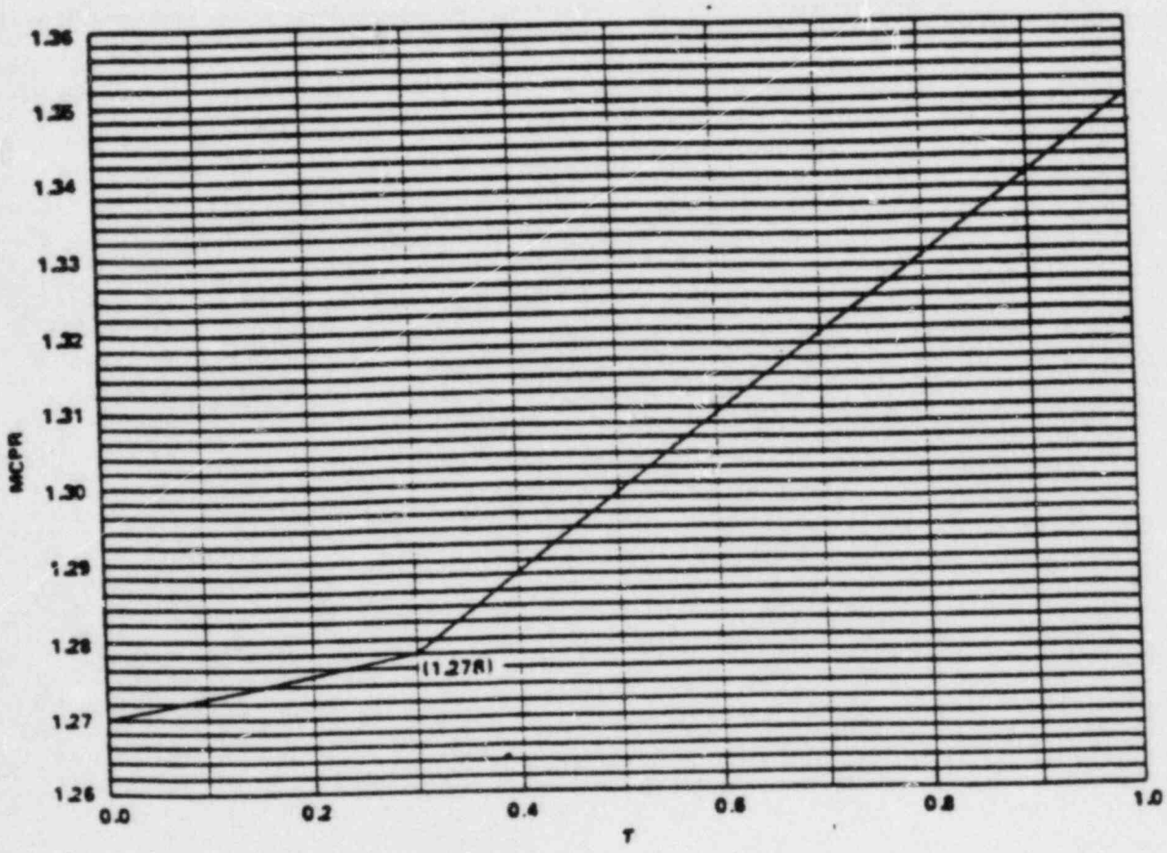


FIGURE 3.2.3-1
MCPR LIMIT FOR 8X8R FUEL
AT RATED FLOW AND RATED POWER



MCPR LIMIT FOR P8X8R FUEL
AT RATED FLOW AND RATED POWER
FIGURE 5.6

HATCH-2

FIGURE FOR 5.13

Figure 9.9(3) ATTS Master Trip Unit

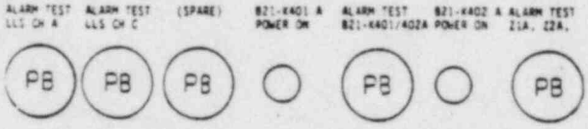


Figure 9.9(6) ATTS Panel Lights and Push Buttons

FIGURE FOR 6.15

See Title Page

E. REACTOR LEVEL READING CORRECTION FOR YARWAY INSTRUMENTS

1. Obtain Drywell Temperature Readings for the 185' Elevation. Temperature Indicator 2T47-R020 gives this reading for the north side and 2T47-R021 gives this reading for the south side.

2. Refer to Figure 1 and obtain the correction factor for each temperature reading.

3. _____* the correction factor found using the North Drywell Temperature Reading from the level indication shown on Level Indicator 2B21-R604A.

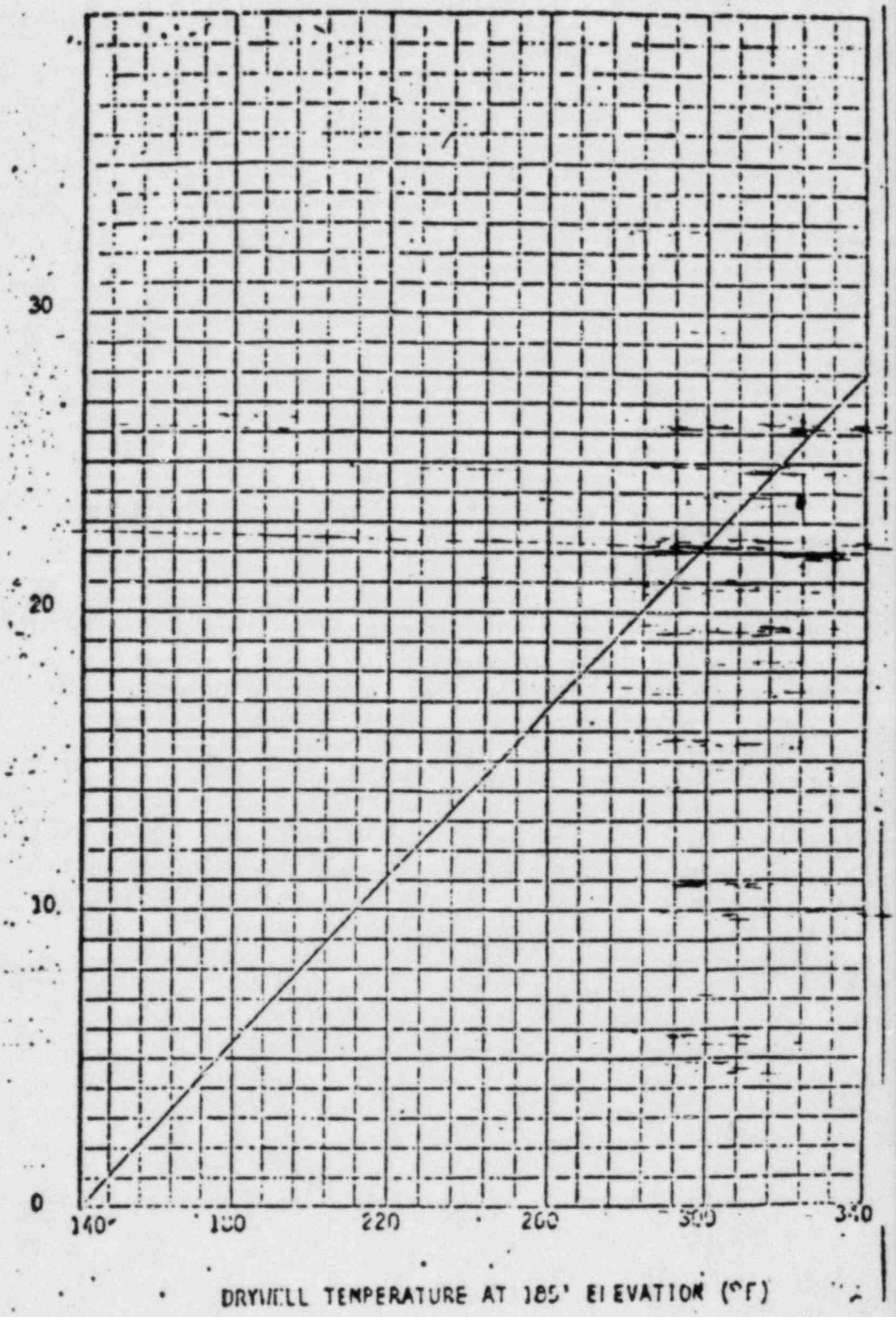
4. _____* the correction factor found using the South Drywell Temperature Reading from the level indication shown on Level Indicator 2B21 R604B.

5. The average of these two corrected level readings will give a good estimate of the Actual Reactor Water Level.

* The ADDITION or SUBTRACTION of the correction factor is left to you, based upon the known sensing line flashing to steam.

FIGURE FOR 7.07

FIGURE 1



INCHES TO IN
X
LEVEL READING
FROM 2021 B604A&B

reference only

FIGURE FOR 7.07

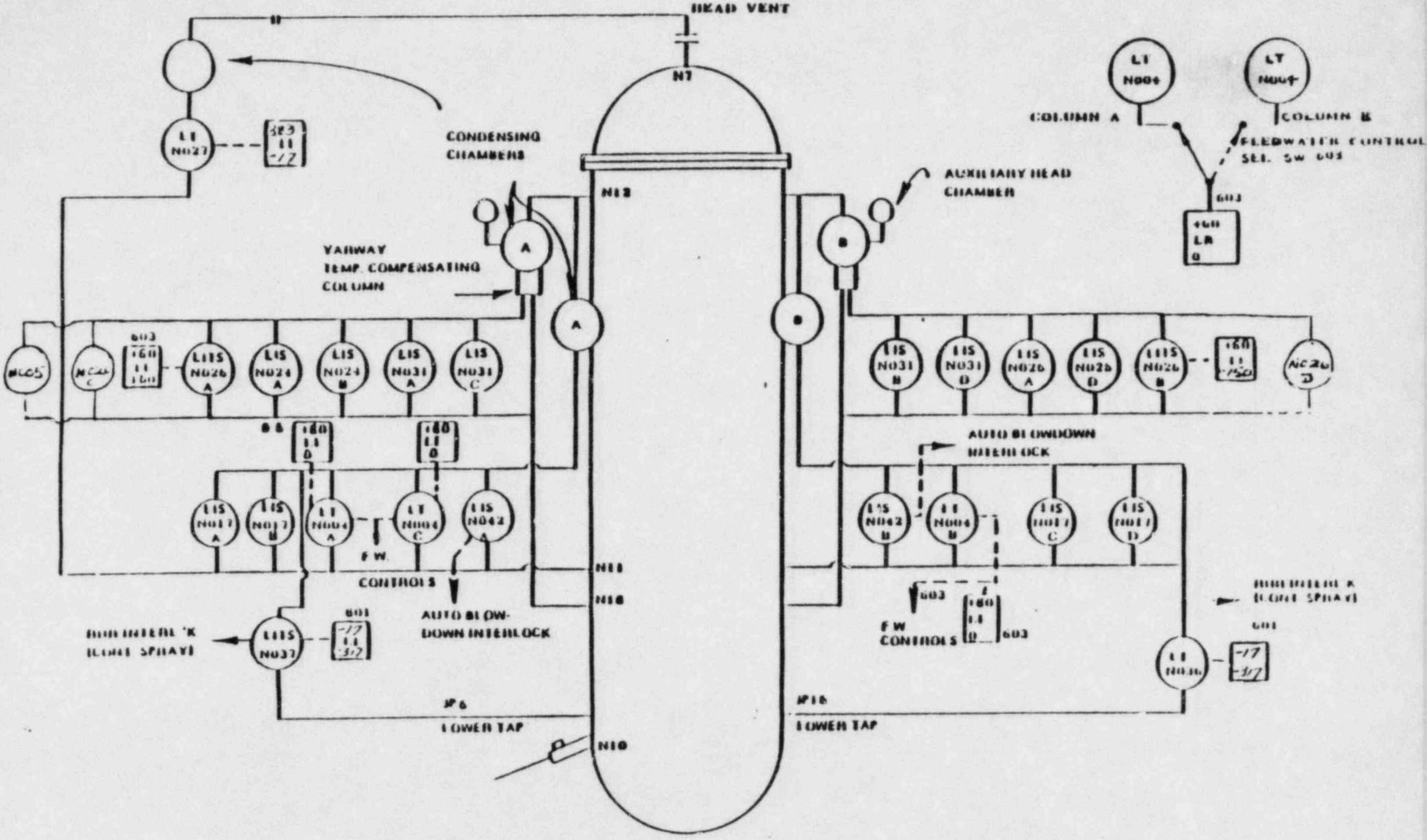


Figure 2.2(2) Reactor Vessel Level Instrumentation

FIGURE FOR 7.07

Unit 1 ( ) Unit 11 (✓) Plant (✓) HCS 11-2-84

STANDING ORDER

NO. 84-34

Date Issued 11-2-84

Date Deleted _____

TITLE CLARIFICATION OF OPERABILITY

APPROVED [signature] 11/2/84 [signature]

Site General Manager or Site Deputy General Manager

Manager of Operations, or Superintendent of Operations

The following clarification of the definition of operability is now in effect. Any questions concerning interpretation of the below beyond what is explicitly stated in the statement below should be referred to the General Manager or Deputy General Manager.

When a system, subsystem, train component, or device having Technical Specification operability requirements 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: (a) its corresponding normal or emergency power source is operable; and (b) all its redundant system(s), subsystem(s), train(s) component(s) and device(s) are operable, or likewise satisfy the requirements of this specification. Unless both condition(s) (a) and (b) are satisfied, enter the applicable Limiting Condition for Operation as specified by the Technical Specifications, or the unit shall be placed in at least Hot Shutdown within the next 6 hours, and in at least Cold Shutdown within the following 30 hours.

The clarification stated above is not applicable in Operational Conditions for 4 or 5 for Unit 2, ~~and Cold Shutdown or Refueling for Unit 1~~.

HCS 11-2-84

FIGURE 1
HNP-12 R10

3/4.3.1 REACTOR PROTECTION SYSTEM INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.1 As a minimum, the reactor protection system instrumentation channels shown in Table 3.3.1-1 shall be OPERABLE with the REACTOR PROTECTION SYSTEM RESPONSE TIME as shown in Table 3.3.1-2. Set points and interlocks are given in Table 2.2.1-1.

APPLICABILITY: As shown in Table 3.3.1-1.

ACTION:

a. With the requirements for the minimum number of OPERABLE channels not satisfied for one trip system, place at least one inoperable channel in the tripped condition within one hour.

b. With the requirements for the minimum number of OPERABLE channels not satisfied for both trip systems, place at least one inoperable channel in at least one trip system* in the tripped condition within one hour and take the ACTION required by Table 3.3.1-1.

c. The provisions of Specification 3.0.3 are not applicable in OPERATIONAL CONDITION 5.

SURVEILLANCE REQUIREMENTS

*If both channels are inoperable in one trip system, select at least one inoperable channel in that trip system to place in the tripped conditions, except when this could cause the Trip Function to occur.

TABLE 3.3.1-1

REACTOR PROTECTION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	APPLICABLE OPERATIONAL CONDITIONS	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(a)	ACTION
1. Intermediate Range Monitors: (2C51-K601, A, B, C, D, E, F, G, H)			
a. Neutron Flux - High	2(c), 5(b)	3	1
	3, 4(b)	2	2
b. Inoperative	2,5(b)	3	1
	3,4	2	2
2. Average Power Range Monitor: (2C51-K605 A, B, C, D, E, F)			
a. Neutron Flux - Upscale, 15%	2, 5	2	1
b. Flow Referenced Simulated Thermal Power - Upscale	1	2	3
c. Fixed Neutron Flux - Upscale, 118%	1	2	3
d. Inoperative	1, 2, 5	2	4
e. Downscale	1	2	3
f. LPRM	1, 2, 5	(d)	NA
3. Reactor Vessel Steam Dome Pressure - High (2B21-N678 A, B, C, D)	1, 2(e)	2(j, 2B21-N045 A, B, C, D)	5
4. Reactor Vessel Water Level - Low (Level 3) (2B21-N680 A, B, C, D)	1, 2	2(j, 2B21-N681 A, B, C, D)	5
5. Main Steam Line Isolation Valve - Closure (NA)	1(f)	4	3
6. Main Steam Line Radiation - High (2D11-K603 A, B, C, D)	1, 2(e)	2	6
7. Drywell Pressure - High (2C71-N650 A, B, C, D)	1, 2(g)	2	5

TABLE 3.3.1-1 (Continued)

REACTOR PROTECTION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	APPLICABLE OPERATIONAL CONDITIONS	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(a)	ACTION
8. Scram Discharge Volume Water Level - High (2C11-N013A,B,C,D)	1, 2, 5(h)	2	4
Level - High (2C11-N060A,B,C,D)	1, 2, 5	2	4
9. Turbine Stop Valve - Closure (NA)	1(i)	4(k)	7
10. Turbine Control Valve Fast Closure, Trip Oil Pressure - Low (2C71-N005A,B,C,D)	1(i)	2(k)	7
11. Reactor Mode Switch in Shutdown Position (NA)	1, 2, 3, 4, 5	1	8
12. Manual Scram (NA)	1, 2, 3, 4, 5	1	9

TABLE 3.3.1-1 (Continued)

REACTOR PROTECTION SYSTEM INSTRUMENTATION

ACTION

ACTION 1 - In OPERATIONAL CONDITION 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or postive reactivity changes and fully insert all insertable control rods within one hour.

ACTION 2 - Lock the reactor mode switch in the Shutdown position within one hour.

ACTION 3 - Be in at least STARTUP within 2 hours.

ACTION 4 - In OPERATIONAL CONDITION 1 or 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or positive reactivity changes and fully insert all insertable control rods within one hour.

ACTION 5 - Be in at least HOT SHUTDOWN within 6 hours.

ACTION 6 - Be in STARTUP with the main steam line isolation valves closed within 2 hours or in at least HOT SHUTDOWN within 6 hours.

ACTION 7 - Initiate a reduction in THERMAL POWER within 15 minutes and be at less than 30% of RATED THERMAL POWER within 2 hours.

ACTION 8 - In OPERATIONAL CONDITION 1 or 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 3 or 4, immediately and at least once per 12 hours verify that all control rods are fully inserted.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or positive reactivity changes and fully insert all insertable control rods within one hour.

ACTION 9 - In OPERATIONAL CONDITION 1 or 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 3 or 4, lock the reactor mode switch in the Shutdown position within one hour.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or positive reactivity changes and fully insert all insertable control rods within one hour.

TABLE NOTATIONS

a. A channel may be placed in an inoperable status for up to 2 hours for required surveillance without placing the trip system in the tripped condition provided at least one OPERABLE channel in the same trip system is monitoring that parameter.

b. The "shorting links" shall be removed from the RPS circuitry during CORE ALTERATIONS and shutdown margin demonstrations performed in accordance with Specification 3.10.3.

c. The IRM scrams are automatically bypassed when the reactor vessel mode switch is in the Run position and all APRM channels are OPERABLE and on scale.

d. An APRM channel is inoperable if there are less than 2 LPRM inputs per level or less than eleven LPRM inputs to an APRM channel.

e. These functions are not required to be OPERABLE when the reactor pressure vessel head is unbolted or removed.

f. This function is automatically bypassed when the reactor mode switch is in other than the Run position.

g. This function is not required to be OPERABLE when PRIMARY CONTAINMENT INTEGRITY is not required; this function may be bypassed when necessary for containment inerting or de-inerting (purging).

h. With any control rod withdrawn. Not applicable to control rods removed per Specification 3.9.11.1 or 3.9.11.2.

i. These functions are bypassed when turbine first stage pressure is $\leq$ 250* psig, equivalent to THERMAL POWER less than 30% of RATED THERMAL POWER.

j. Also trips reactor coolant system recirculation pump MG sets.

k. Also trips reactor coolant system recirculation pump motors.

*Initial setpoint. Final setpoint to be determined during startup testing.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.2 The isolation actuation instrumentation channels shown in Table 3.3.2-1 shall be OPERABLE with their trip setpoints set consistent with the values shown in the Trip Setpoint column of Table 3.3.2-2 and with ISOLATION SYSTEM RESPONSE TIME as shown in Table 3.3.2-3.

APPLICABILITY: As shown in Table 3.3.2-1.

ACTION:

a. With an isolation actuation instrumentation channel trip setpoint less conservative than the value shown in the Allowable Values column of Table 3.3.2-2, declare the channel inoperable and place the inoperable channel in the tripped condition* until the channel is restored to OPERABLE status with its trip setpoint adjusted consistent with the Trip Setpoint value.

b. With the requirements for the minimum number of OPERABLE channels not satisfied for one trip system, place at least one inoperable channel in the tripped condition* within one hour.

c. With the requirements for the minimum number of OPERABLE channels not satisfied for both trip systems, place at least one inoperable channel in at least one trip system** in the tripped condition within one hour and take the ACTION required by Table 3.3.2-1.

d. The provisions of Specification 3.0.3 are not applicable in OPERATIONAL CONDITION 5.

SURVEILLANCE REQUIREMENTS

* With a design providing only one channel per trip system, an inoperable channel need not be placed in the tripped condition where this would cause the Trip Function to occur. In these cases, the inoperable channel shall be restored to OPERABLE status within 2 hours or the ACTION required by Table 3.3.2-1 for that Trip Function shall be taken.

** If both channels are inoperable in one trip system, select at least one inoperable channel in that trip system to place in the tripped condition, except when that would cause the Trip Function to occur.

TABLE 3.2-1

ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
1. PRIMARY CONTAINMENT ISOLATION				
a. Reactor Vessel Water Level				
1. Low (Level 3) (2B21-N680 A, B, C, D)	2, 6, 10, 11, 12	2	1, 2, 3	20
2. Low-Low (Level 2) (2B21-N682 A, B, C, D)	5, #, *	2	1, 2, 3	20
3. Low-Low-Low (Level 1) (2B21-N681 A, B, C, D)	1	2	1, 2, 3	20
b. Drywell Pressure - High (2C71-N650 A, B, C, D)	2, 6, 7, 10, 12, #, *	2	1, 2, 3	20
c. Main Steam Line				
1. Radiation - High (2D11-K603 A, B, C, D)	1, 12, #, (d)	2	1, 2, 3	21
2. Pressure - Low (2B21-N015 A, B, C, D)	1	2	1	22
3. Flow - High (2B21-N686 A, B, C, D) (2B21-N687 A, B, C, D) (2B21-N688 A, B, C, D) (2B21-N689 A, B, C, D)	1, #	2/line	1, 2, 3	21
d. Main Steam Line Tunnel Temperature - High (2B21-N623 A, B, C, D) (2B21-N624 A, B, C, D) (2B21-N625 A, B, C, D) (2B21-N626 A, B, C, D)	1	2/line(e)	1, 2, 3	21
e. Condenser Vacuum - Low (2B21-N056 A, B, C, D)	1	2	1, 2,(f),3(f)	23
f. Turbine Building Area Temperature - High (2U61-R001, 2U61-R002, 2U61-R003, 2U61-R004)	1	2(e)	1, 2, 3	21

TABLE 3.3.2-1 (Continued)

ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
2. SECONDARY CONTAINMENT ISOLATION				
a. Reactor Building Exhaust Radiation - High (2D11-K609 A, B, C, D)	6, 10, 12, *	2	1,2,3,5 and**	24
b. Drywell Pressure - High (2C71-N650 A, B, C, D)	2, 6, 7, 10, 12, #, *	2	1, 2, 3	24
c. Reactor Vessel Water Level - Low Low (Level 2) (2B21-N682 A, B, C, D)	5, #, *	2	1, 2, 3	24
d. Refueling Floor Exhaust Radiation - High (2D11-K611 A, B, C, D)	6, 10, 12, #, *	2	1,2,3,5 and**	24
3. REACTOR WATER CLEANUP SYSTEM ISOLATION				
a. Δ Flow - High (2G31-N603 A, B)	5	1	1, 2, 3	25
b. Area Temperature - High (2G31-N662 A, D, E, H, J, M)	5	1	1, 2, 3	25
c. Area Ventilation Δ Temp. - High (2G31-N663 A, D, E, H, J, M; 2G31-N661 A, D, E, H, J, M; 2G31-N662 A, D, E, H, J, M)	5	1	1, 2, 3	25
d. SLCS Initiation (NA)	5(g)	NA	1, 2, 3	25
e. Reactor Vessel Water Level - Low Low (Level 2) (2B21-N682 A, B, C, D)	5, #, *	2	1, 2, 3	25

TABLE 3.3.2-1 (Continued)

ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
4. HIGH PRESSURE COOLANT INJECTION SYSTEM ISOLATION				
a. HPCI Steam Line Flow - High (2E41-N657 A,B)	3	1	1, 2, 3	26
b. HPCI Steam Supply Pressure - Low (2E41-N658 A,B,C,D)	3,8	2	1, 2, 3	26
c. HPCI Turbine Exhaust Diaphragm Pressure - High (2E41-N655 A,B,C,D)	3	2	1, 2, 3	26
d. HPCI Pipe Penetration Room Temperature - High (2E41-N671 A, B)	3	1	1, 2, 3	26
e. Suppression Pool Area Ambient Temperature-High (2E51-N666 C, D)	3	1	1, 2, 3	26
f. Suppression Pool Area Δ Temp.-High (2E51-N665 C, D; 2E51-N663 C, D; 2E51-N664 C, D)	3	1	1, 2, 3	26
g. Suppression Pool Area Temperature Timer Relays (2E41-M603 A, B)	3(i)	1	1, 2, 3	26
h. Emergency Area Cooler Temperature-High (2E41-N670 A, B)	3	1	1, 2, 3	26
i. Drywell Pressure-High (2E11-N694 C, D)	8	1	1, 2, 3	26
j. Logic Power Monitor (2E41-K1)	NA(h)	1	1, 2, 3	27

TABLE 3.3.2-1 (Continued)
ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
5. REACTOR CORE ISOLATION COOLING SYSTEM ISOLATION				
a. RCIC Steam Line Flow-High (2E51-N657 A,B)	4	1	1, 2, 3	26
b. RCIC Steam Supply Pressure - Low (2E51-N658 A, B, C, D)	4, 9	2	1, 2, 3	26
c. RCIC Turbine Exhaust Diaphragm Pressure - High (2E51-N685 A, B, C, D)	4	2	1, 2, 3	26
d. Emergency Area Cooler Temperature - High (2E51-N661 A, B)	4	1	1, 2, 3	26
e. Suppression Pool Area Ambient Temperature-High (2E51-N666 A, B)	4	1	1, 2, 3	26
f. Suppression Pool Area Δ T-High (2E51-N665 A, B; 2E51-N663 A,B; 2E51-N664 A,B)	4	1	1, 2, 3	26
g. Suppression Pool Area Temperature Timer Relays (2E51-N602 A, B)	4(f)	1	1, 2, 3	26
h. Drywell Pressure - High (2E11-N694 A, B)	9	1	1, 2, 3	26
i. Logic Power Monitor (2E51-K1)	NA(h)	1	1, 2, 3	27
6. SHUTDOWN COOLING SYSTEM ISOLATION				
a. Reactor Vessel Water Level-Low (Level 3)(2B21-N680 A, B, C, D)	6, 10, 11, 2 12	2	3, 4, 5	26
b. Reactor Steam Dome Pressure-High (2B31-N679 A, D)	11	1	1, 2, 3	28

TABLE 3.3.2-1 (Continued)

ISOLATION ACTUATION INSTRUMENTATION

ACTION

ACTION 20 - Be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the next 30 hours.

ACTION 21 - Be in at least STARTUP with the main steam line isolation valves closed within 2 hours or be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the next 30 hours.

ACTION 22 - Be in at least STARTUP within 2 hours.

ACTION 23 - Be in at least STARTUP with the Group 1 isolation valves closed within 2 hours or in at least HOT SHUTDOWN within 6 hours.

ACTION 24 - Establish SECONDARY CONTAINMENT INTEGRITY with the standby gas treatment system operating within one hour.

ACTION 25 - Isolate the reactor water cleanup system.

ACTION 26 - Close the affected system isolation valves and declare the affected system inoperable.

ACTION 27 - Verify power availability to the bus at least once per 12 hours or close the affected system isolation valves and declare the affected system inoperable.

ACTION 28 - Close the shutdown cooling supply and reactor vessel head spray isolation valves unless reactor steam dome pressure $\leq$ 145 psig.

NOTES

Actuates operation of the main control room environmental control system in the pressurization mode of operation.

* Actuates the standby gas treatment system.

** When handling irradiated fuel in the secondary containment.

a. See Specification 3.6.3, Table 3.6.3-1 for valves in each valve group.

b. A channel may be placed in an inoperable status for up to 2 hours for required surveillance without placing the trip system in the tripped condition provided at least one other OPERABLE channel in the same trip system is monitoring that parameter.

c. With a design providing only one channel per trip system, an inoperable channel need not be placed in the tripped condition where this would cause the Trip Function to occur. In these cases, the inoperable channel shall be restored to OPERABLE status within 2 hours or the ACTION required by Table 3.3.2-1 for that Trip Function shall be taken.

d. Trips the mechanical vacuum pumps.

e. A channel is OPERABLE if 2 of 4 instruments in that channel are OPERABLE.

f. May be bypassed with all turbine stop valves closed.

g. Closes only RWCU outlet isolation valve 2G31-F004.

h. Alarm only.

i. Adjustable up to 60 minutes.

3/4.5.1 HIGH PRESSURE COOLANT INJECTION SYSTEM

LIMITING CONDITION FOR OPERATION

3.5.1 The High Pressure Coolant Injection (HPCI) system shall be OPERABLE with:

a. One OPERABLE high pressure coolant injection pump, and

b. An OPERABLE flow path capable of taking suction from the suppression chamber and transferring the water to the reactor pressure vessel.

APPLICABILITY: CONDITIONS 1*, 2* and 3* with reactor vessel steam dome pressure > 150 psig.

ACTION:

a. With the HPCI system inoperable, POWER OPERATION may continue and the provisions of 3.0.4 do not apply*, provided the RCIC system, ADS, CSS and LPCI system are OPERABLE; restore the inoperable HPCI system to OPERABLE status within 14 days or be in at least HOT SHUTDOWN within the next 12 hours and reduce reactor steam dome pressure to ≤ 150 psig within the following 24 hours.

b. With the surveillance requirements of Specification 4.5.1 not performed at the required frequencies due to low reactor steam pressure, the provisions of Specification 4.0.4 are not applicable provided the appropriate surveillance is performed within 12 hours after reactor steam pressure is adequate to perform the tests.

c. In the event the HPCI 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 actuations cycles to date.

SURVEILLANCE REQUIREMENTS

*See Special Test Exception 3.10.5

3/4.5.2 AUTOMATIC DEPRESSURIZATION SYSTEM

LIMITING CONDITION FOR OPERATION

ad.6

3.5.2 The Automatic Depressurization System (ADS) shall be OPERABLE with at least seven OPERABLE ADS valves.

APPLICABILITY: CONDITIONS 1, 2 and 3 with reactor vessel steam dome pressure >150 psig.

ACTION:

a. With one of the above required ADS valves inoperable, POWER OPERATION may continue provided the HPCI, CSS and LPCI systems are OPERABLE; restore the inoperable ADS valve to OPERABLE status within 14 days or be in at least HOT SHUTDOWN within the next 12 hours and reduce reactor vessel steam dome pressure to $\leq$ 150 psig within the following 24 hours.

b. With two or more of the above required ADS valves inoperable, be in at least HOT SHUTDOWN within 12 hours and reduce reactor steam dome pressure to $\leq$ 150 psig within the next 24 hours.

c. With the Surveillance Requirement of Specification 4.5.2.b not performed at the required interval due to low reactor steam pressure, the provisions of Specification 4.0.4 are not applicable provided the appropriate surveillance is performed within 12 hours after reactor steam pressure is adequate to perform the tests.

SURVEILLANCE REQUIREMENTS

3/4.5.3 LOW PRESSURE CORE COOLING SYSTEMS

CORE SPRAY SYSTEM

LIMITING CONDITION FOR OPERATION

3.5.3.1 Two independent Core Spray System (CSS) subsystems shall be OPERABLE with each subsystem comprised of:

a. One OPERABLE CSS pump, and

b. An OPERABLE flow path capable of taking suction from at least one of the following OPERABLE sources and transferring the water through the spray sparger to the reactor vessel;

1. In CONDITION 1, 2 or 3, from the suppression pool.

2. In CONDITION 4 or 5*;

a) From the suppression pool, or

b) When the suppression pool is being drained, from the condensate storage tank containing at least (150,000) gallons of water.

APPLICABILITY: CONDITIONS 1, 2, 3, 4, and 5*.

ACTION:

a. In CONDITION 1, 2 or 3;

1. With one CSS subsystem inoperable, POWER OPERATION may continue provided both LPCI subsystems are OPERABLE; restore the inoperable CSS subsystem to OPERABLE status within 7 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

2. With both CSS subsystems inoperable, be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours.

3. In the event the CSS 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.

* The core spray system and the suppression chamber are not required to be OPERABLE provided that the reactor vessel head is removed and the cavity is flooded, the spent fuel pool gates are removed, and the water level is maintained within the limits of Specifications 3.9.9 and 3.9.10

LIMITING CONDITION FOR OPERATION (Continued)

ACTION (Continued)

b. In CONDITION 4 or 5*;

1. With one CSS subsystem inoperable, operation may continue provided that at least one LPCI subsystem is OPERABLE within 4 hours; otherwise, suspend all operations that have a potential for draining the reactor vessel.

2. With both CSS subsystems inoperable, operation may continue provided that at least one LPCI subsystem is OPERABLE and both LPCI subsystems are OPERABLE within 4 hours. Otherwise, suspend all operations that have a potential for draining the reactor vessel and verify that at least one LPCI subsystem is OPERABLE within 4 hours.

3. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

LOW PRESSURE COOLANT INJECTION SYSTEM

LIMITING CONDITION FOR OPERATION

3.5.3.2 Two independent Low Pressure Coolant Injection (LPCI) subsystems of the residual heat removal system (RHR) shall be OPERABLE with each subsystem comprised of:

a. Two OPERABLE RHR pumps,

b. An OPERABLE flow path capable of taking suction from the suppression chamber and transferring the water to the reactor pressure vessel.

APPLICABILITY: CONDITIONS 1, 2, 3, 4* and 5*, **.

ACTION:

a. In CONDITION 1, 2 or 3;

1. With one LPCI subsystem or one LPCI pump inoperable, POWER OPERATION may continue provided both CSS subsystems are OPERABLE; restore the inoperable LPCI subsystem or pump to OPERABLE status within 7 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

2. With both LPCI subsystems inoperable, be in at least HOT SHUTDOWN within 12 hours and either be in COLD SHUTDOWN or maintain reactor coolant temperature $\leq$ 400°F by use of alternate heat removal methods within the following 24 hours.

3. With the LPCI system cross-tie valve open or power not removed from the valve operator, be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the following 24 hours.

4. In the event the LPCI system 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.

b. In CONDITION 4* or 5*, ** with one or more LPCI subsystems inoperable, take the ACTION required by Specification 3.5.3.1. The provisions of Specification 3.0.3 are not applicable.

* Not applicable when two CSS subsystems are OPERABLE per Specification 3.5.3.1.

**Not applicable when the CSS is not required to be OPERABLE per Specification 3.5.3.1.

LIMITING CONDITION FOR OPERATION

3.5.4 The suppression chamber shall be OPERABLE with a minimum contained water volume of 653,000 gallons, equivalent to a level of 12'2", and the water level instrumentation channels alarms adjusted to actuate at a low water level ≥ 12'2", except that the suppression chamber may be drained:

a. In OPERATIONAL CONDITION 4, provided that;

1. No work is performed which has a potential for draining the reactor vessel,

2. The reactor mode switch is locked in the Shutdown position, and

3. The core spray system is OPERABLE per Specification 3.5.3.1 with an OPERABLE flow path capable of taking suction from the OPERABLE condensate storage tank and transferring the water through the spray sparger to the reactor vessel.

b. In OPERATIONAL CONDITION 5, provided that the reactor mode switch is locked in the Refuel position, and:

1. The core spray system is OPERABLE per Specification 3.5.3.1 with an OPERABLE flow path capable of taking suction from the OPERABLE condensate storage tank and transferring the water through the spray sparger to the reactor vessel, or

2. The reactor vessel head is removed and the cavity is flooded, the spent fuel pool gates are removed, and the water level is maintained within the limits of Specifications 3.9.9 and 3.9.10

APPLICABILITY: CONDITION 1, 2, 3, 4 and 5.

ACTION:

a. In CONDITION 1, 2 or 3 with the suppression chamber water level less than the above limit, restore the water level to within the limit within 1 hour or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

b. In CONDITION 4 or 5 with the suppression chamber drained and the conditions of Specification 3.5.4.a or 3.5.4.b, as applicable, not satisfied, suspend all operations in the reactor vessel and all positive reactivity changes. The provisions of Specification 3.0.3 are not applicable.

LIMITING CONDITION FOR OPERATION (Continued)

ACTION (Continued)

c. With one suppression chamber water level instrumentation channel inoperable, restore the inoperable channel to OPERABLE status within 30 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours and verify the suppression chamber water level to be $\geq$ 12'2" at least once per 12 hours.

d. With both suppression chamber water level instrumentation channels inoperable, restore at least one inoperable channel to OPERABLE status within 6 hours or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours and verify the suppression chamber water level to be $\geq$ 12'2" at least once per hour.

SURVEILLANCE REQUIREMENTS

PRIMARY CONTAINMENT HYDROGEN RECOMBINER SYSTEMS

LIMITING CONDITION FOR OPERATION

3.6.6.2 Two independent primary containment hydrogen recombiner systems shall be OPERABLE.

APPLICABILITY: CONDITIONS 1 and 2.

ACTION

a. With one hydrogen recombiner system inoperable, restore the inoperable system to OPERABLE status within 30 days or be in at least HOT SHUTDOWN within the next 12 hours. The provisions of Specification 3.0.4 are not applicable.

b. With both hydrogen recombiner systems inoperable, be in at least HOT SHUTDOWN within 12 hours.

SURVEILLANCE REQUIREMENTS

Table 3. Superheated Steam

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 200	250	300	350	400	450	500	600	700	800	900	1000	1100	1200
1 (101.74)	Sh			98.26	148.26	198.26	248.26	298.26	348.26	398.26	498.26	598.26	698.76	798.76	898.76	998.76	1098.76
	v	0.01614	333.6	392.5	422.4	452.3	482.1	511.9	541.7	571.5	631.1	690.7	750.3	809.8	869.4	929.0	988.6
	h	69.73	1105.8	1150.2	1172.9	1195.7	1218.7	1241.8	1265.1	1288.6	1336.1	1384.5	1433.7	1483.8	1534.9	1586.8	1639.7
	s	0.1326	1.9781	2.0509	2.0841	2.1152	2.1445	2.1722	2.1985	2.2237	2.2708	2.3144	2.3551	2.3934	2.4296	2.4640	2.4966
5 (162.24)	Sh			37.76	87.76	137.76	187.76	237.76	287.76	337.76	437.76	537.76	637.76	737.76	837.76	937.76	1037.76
	v	0.01641	73.53	78.14	84.21	90.24	96.25	102.24	108.23	114.21	126.15	138.08	150.01	161.94	173.86	185.78	197.70
	h	130.20	1131.1	1148.6	1171.7	1194.8	1218.0	1241.3	1264.7	1288.2	1335.9	1384.3	1433.6	1483.7	1534.7	1586.7	1639.6
	s	0.2349	1.8443	1.8716	1.9054	1.9369	1.9664	1.9943	2.0208	2.0460	2.0932	2.1369	2.1776	2.2159	2.2521	2.2866	2.3194
10 (193.21)	Sh			6.79	56.79	106.79	156.79	206.79	256.79	306.79	406.79	506.79	606.79	706.79	806.79	906.79	1006.79
	v	0.01659	38.42	38.84	41.93	44.98	48.02	51.03	54.04	57.04	63.03	69.00	74.98	80.94	86.91	92.87	98.84
	h	161.26	1143.3	1146.6	1170.2	1193.7	1217.1	1240.6	1264.1	1287.8	1335.5	1384.0	1433.4	1483.5	1534.6	1586.6	1639.5
	s	0.2836	1.7879	1.7928	1.8273	1.8593	1.8892	1.9173	1.9439	1.9692	2.0166	2.0603	2.1011	2.1394	2.1757	2.2101	2.2430
14.696 (212.00)	Sh				38.00	88.00	138.00	188.00	238.00	288.00	388.00	488.00	588.00	688.00	788.00	888.00	988.00
	v	0167	26.799		28.42	30.52	32.60	34.67	36.72	38.77	42.86	46.93	51.00	55.06	59.13	63.19	67.25
	h	180.17	1150.5		1168.8	1192.6	1216.3	1239.9	1263.6	1287.3	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4
	s	3121	1.7568		1.7833	1.8158	1.8459	1.8743	1.9010	1.9265	1.9739	2.0177	2.0585	2.0969	2.1332	2.1676	2.2004
15 (213.03)	Sh				36.97	86.97	136.97	186.97	236.97	286.97	386.97	486.97	586.97	686.97	786.97	886.97	986.97
	v	0.01673	26.790		27.837	29.899	31.939	33.963	35.977	37.985	41.986	45.978	49.964	53.946	57.926	61.905	65.88
	h	181.21	1150.5		1168.7	1192.5	1216.2	1239.9	1263.6	1287.3	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4
	s	0.3137	1.7552		1.7809	1.8134	1.8437	1.8720	1.8988	1.9242	1.9717	2.0155	2.0563	2.0946	2.1309	2.1653	2.1982
20 (227.96)	Sh				22.04	72.04	122.04	172.04	222.04	272.04	372.04	472.04	572.04	672.04	772.04	872.04	972.04
	v	0.01683	20.087		20.788	22.356	23.900	25.428	26.946	28.457	31.466	34.465	37.458	40.447	43.435	46.420	49.405
	h	196.27	1156.3		1167.1	1191.4	1215.4	1239.2	1263.0	1286.9	1334.9	1383.5	1432.9	1483.2	1534.3	1586.3	1639.2
	s	0.3358	1.7320		1.7475	1.7805	1.8111	1.8397	1.8666	1.8921	1.9397	1.9836	2.0244	2.0628	2.0991	2.1336	2.1667
25 (240.07)	Sh				9.93	59.93	109.93	159.93	209.93	259.93	359.93	459.93	559.93	659.93	759.93	859.93	959.93
	v	0.01693	16.301		16.558	17.829	19.076	20.307	21.527	22.740	25.153	27.557	29.954	32.348	34.740	37.130	39.518
	h	208.52	1160.6		1165.6	1190.2	1214.5	1238.5	1262.5	1286.4	1334.6	1383.3	1432.7	1483.0	1534.2	1586.2	1639.1
	s	0.3535	1.7141		1.7212	1.7547	1.7856	1.8145	1.8415	1.8672	1.9149	1.9588	1.9997	2.0381	2.0744	2.1089	2.1418
30 (250.34)	Sh					49.66	99.66	149.66	199.66	249.66	349.66	449.66	549.66	649.66	749.66	849.66	949.66
	v	0.01701	13.744			14.810	15.859	16.892	17.914	18.929	20.945	22.951	24.952	26.949	28.943	30.936	32.927
	h	218.93	1164.1			1189.0	1212.5	1237.8	1261.9	1286.0	1334.2	1383.0	1432.5	1482.8	1534.0	1586.1	1639.0
	s	0.3682	1.6995			1.7334	1.7647	1.7937	1.8210	1.8467	1.8946	1.9386	1.9795	2.0179	2.0543	2.0888	2.1217
35 (259.29)	Sh					40.71	90.71	140.71	190.71	240.71	340.71	440.71	540.71	640.71	740.71	840.71	940.71
	v	0.01708	11.896			12.654	13.562	14.452	15.334	16.207	17.939	19.662	21.379	23.092	24.803	26.512	28.220
	h	228.03	1167.1			1187.8	1212.7	1237.2	1261.3	1285.5	1333.9	1382.8	1432.3	1482.7	1533.9	1586.0	1638.9
	s	0.3809	1.6872			1.7152	1.7468	1.7761	1.8035	1.8294	1.8774	1.9214	1.9624	2.0009	2.0372	2.0717	2.1046
40 (267.25)	Sh					32.75	82.75	132.75	182.75	232.75	332.75	432.75	532.75	632.75	732.75	832.75	932.75
	v	0.01715	10.497			11.036	11.838	12.624	13.398	14.165	15.685	17.195	18.699	20.199	21.697	23.194	24.689
	h	236.14	1169.8			1186.6	1211.7	1236.4	1260.8	1285.0	1333.6	1382.5	1432.1	1482.5	1533.7	1585.8	1638.8
	s	0.3921	1.6765			1.6992	1.7312	1.7608	1.7883	1.8143	1.8624	1.9065	1.9476	1.9860	2.0224	2.0569	2.0899
45 (274.44)	Sh					25.56	75.56	125.56	175.56	225.56	325.56	425.56	525.56	625.56	725.56	825.56	925.56
	v	0.01721	9.399			9.777	10.497	11.201	11.892	12.577	13.932	15.276	16.614	17.950	19.282	20.613	21.943
	h	243.49	1172.1			1185.4	1210.4	1235.7	1260.2	1284.6	1333.3	1382.3	1431.9	1482.3	1533.6	1585.7	1638.7
	s	0.4021	1.6671			1.6849	1.7173	1.7471	1.7748	1.8010	1.8492	1.8934	1.9345	1.9730	2.0093	2.0439	2.0768
50 (281.02)	Sh					18.98	68.98	118.98	168.98	218.98	318.98	418.98	518.98	618.98	718.98	818.98	918.98
	v	0.01727	8.514			8.769	9.424	10.062	10.688	11.306	12.529	13.741	14.947	16.150	17.350	18.549	19.746
	h	250.21	1174.1			1184.1	1209.9	1234.9	1259.6	1284.1	1332.9	1382.0	1431.7	1482.2	1533.4	1585.6	1638.6
	s	0.4112	1.6586			1.6720	1.7048	1.7349	1.7628	1.7890	1.8374	1.8816	1.9227	1.9613	1.9977	2.0322	2.0651
55 (287.07)	Sh					12.93	62.93	112.93	162.93	212.93	312.93	412.93	512.93	612.93	712.93	812.93	912.93
	v	0.01733				7.945	8.546	9.130	9.702	10.267	11.384	12.485	13.583	14.677	15.769	16.859	17.946
	h	256.43				1182.9	1208.9	1234.2	1259.1	1283.6	1332.6	1381.8	1431.5	1482.0	1533.3	1585.5	1638.5
	s	0.4196				1.6601	1.6933	1.7237	1.7518	1.7781	1.8266	1.8710	1.9121	1.9507	1.987	2.022	2.055
60 (292.71)	Sh					7.29	57.29	107.29	157.29	207.29	307.29	407.29	507.29	607.29	707.29	807.29	907.29
	v	0.01738	7.174			7.257	7.815	8.354	8.881	9.400	10.425	11.438	12.446	13.450	14.452	15.452	16.450
	h	262.21	1177.6			1181.6	1208.0	1233.5	1258.5	1283.2	1332.3	1381.5	1431.3	1481.8	1533.2	1585.3	1638.4
	s	0.4273	1.6440			1.6492	1.6934	1.7134	1.7417	1.7681	1.8168	1.8612	1.9024	1.9410	1.9774	2.0120	2.0450
65 (297.98)	Sh					2.02	52.02	102.02	152.02	202.02	302.02	402.02	502.02	602.02	702.02	802.02	902.02
	v	0.01743	6.653			6.675	7.195	7.697	8.186	8.667	9.615	10.552	11.484	12.412	13.337	14.261	15.183
	h	267.63	1179.1			1180.3	1207.0	1232.7	1257.9	1282.7	1331.9	1381.3	1431.1	1481.6	1533.0	1585.2	1638.3
	s	0.4344	1.6375			1.6390	1.6731	1.7040	1.7324	1.7590	1.8077	1.8522	1.8935	1.9321	1.9685	2.0031	2.0361
70 (302.93)	Sh						47.07	97.07	147.07	197.07	297.07	397.07	497.07	597.07	697.07	797.07	897.07
	v	0.01748	6.205				6.664	7.133	7.590	8.039	8.922	9.793	10.659	11.522	12.382	13.240	14.097
	h	272.74	1180.6				1206.0	1232.0	1257.3	1282.2	1331.6	1381.0	1430.9	1481.5	1532.9	1585.1	1638.2
	s	0.4411	1.6316				1.6640	1.6951	1.7237	1.7504	1.7993	1.8439	1.8852	1.9238	1.9603	1.9949	2.0279
75 (307.61)	Sh						42.39	92.39	142.39	192.39	292.39	392.39	492.39	592.39	692.39	792.39	892.39
	v	0.01753	5.814				6.204	6.645	7.074	7.494	8.320	9.135	9.945	10.750	11.553	12.355	13.155
	h	277.56	1181.9				1205.0	1231.2	1256.7	1281.7	1331.3	1380.7	1430.7	1481.3	1532.7	1585.0	1638.1
	s	0.4474	1.6260				1.6554	1.6868	1.7156	1.7424	1.7915	1.8361	1.8774	1.9161	1.9526	1.9872	2.0202

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – Continued

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400
				Temperature – Degrees Fahrenheit													
	Sh			37.96	87.96	137.96	187.96	237.96	287.96	387.96	487.96	587.96	687.96	787.96	887.96	987.96	1087.96
80	v	0.01757	5.471	5.801	6.218	6.622	7.018	7.408	7.794	8.560	9.319	10.075	10.829	11.581	12.331	13.081	13.829
(312.04)	h	282.15	1183.1	1204.0	1230.5	1256.1	1281.3	1306.2	1330.9	1380.5	1430.5	1481.1	1532.6	1584.9	1638.0	1692.0	1746.8
	s	0.4534	1.6208	1.6473	1.6790	1.7080	1.7349	1.7602	1.7842	1.8289	1.8702	1.9089	1.9454	1.9800	2.0131	2.0446	2.0750
	Sh			33.74	83.74	133.74	183.74	233.74	283.74	383.74	483.74	583.74	683.74	783.74	883.74	983.74	1083.74
85	v	0.01762	5.167	5.445	5.840	6.223	6.597	6.966	7.330	8.052	8.768	9.480	10.190	10.898	11.604	12.310	13.014
(316.26)	h	286.52	1184.2	1203.0	1229.7	1255.5	1280.8	1305.8	1330.6	1380.2	1430.3	1481.0	1532.4	1584.7	1637.9	1691.9	1746.8
	s	0.4590	1.6159	1.6396	1.6716	1.7008	1.7279	1.7532	1.7772	1.8220	1.8634	1.9021	1.9386	1.9733	2.0063	2.0379	2.0682
	Sh			29.72	79.72	129.72	179.72	229.72	279.72	379.72	479.72	579.72	679.72	779.72	879.72	979.72	1079.72
90	v	0.01766	4.895	5.128	5.505	5.869	6.223	6.572	6.917	7.600	8.277	8.950	9.621	10.290	10.958	11.625	12.290
(320.28)	h	290.69	1185.3	1202.0	1228.9	1254.9	1280.3	1305.4	1330.2	1380.0	1430.1	1480.8	1532.3	1584.6	1637.8	1691.8	1746.7
	s	0.4643	1.6113	1.6323	1.6646	1.6940	1.7212	1.7467	1.7707	1.8156	1.8570	1.8957	1.9323	1.9669	2.0000	2.0316	2.0619
	Sh			25.87	75.87	125.87	175.87	225.87	275.87	375.87	475.87	575.87	675.87	775.87	875.87	975.87	1075.87
95	v	0.01770	4.651	4.845	5.205	5.551	5.889	6.221	6.548	7.196	7.838	8.477	9.113	9.747	10.380	11.012	11.643
(324.13)	h	294.70	1186.2	1200.9	1228.1	1254.3	1279.8	1305.0	1329.9	1379.7	1429.9	1480.6	1532.1	1584.5	1637.7	1691.7	1746.6
	s	0.4694	1.6069	1.6253	1.6580	1.6876	1.7149	1.7404	1.7645	1.8094	1.8509	1.8897	1.9262	1.9609	1.9940	2.0256	2.0559
	Sh			22.18	72.18	122.18	172.18	222.18	272.18	372.18	472.18	572.18	672.18	772.18	872.18	972.18	1072.18
100	v	0.01774	4.431	4.590	4.935	5.266	5.588	5.904	6.216	6.833	7.443	8.050	8.655	9.258	9.860	10.460	11.060
(327.82)	h	298.54	1187.2	1199.9	1227.4	1253.7	1279.3	1304.6	1329.6	1379.5	1429.7	1480.4	1532.0	1584.4	1637.6	1691.6	1746.5
	s	0.4743	1.6027	1.6187	1.6516	1.6814	1.7088	1.7344	1.7586	1.8036	1.8451	1.8839	1.9205	1.9552	1.9883	2.0199	2.0502
	Sh			18.63	68.63	118.63	168.63	218.63	268.63	368.63	468.63	568.63	668.63	768.63	868.63	968.63	1068.63
105	v	0.01778	4.231	4.359	4.690	5.007	5.315	5.617	5.915	6.504	7.086	7.665	8.241	8.816	9.389	9.961	10.532
(331.37)	h	302.24	1188.0	1198.8	1226.6	1253.1	1278.8	1304.2	1329.2	1379.2	1429.4	1480.3	1531.8	1584.2	1637.5	1691.5	1746.4
	s	0.4790	1.5988	1.6122	1.6455	1.6755	1.7031	1.7288	1.7530	1.7981	1.8396	1.8785	1.9151	1.9498	1.9828	2.0145	2.0448
	Sh			15.21	65.21	115.21	165.21	215.21	265.21	365.21	465.21	565.21	665.21	765.21	865.21	965.21	1065.21
110	v	0.01782	4.048	4.149	4.468	4.772	5.068	5.357	5.642	6.205	6.761	7.314	7.865	8.413	8.961	9.507	10.053
(334.79)	h	305.80	1188.9	1197.7	1225.8	1252.5	1278.3	1303.8	1328.9	1379.0	1429.2	1480.1	1531.7	1584.1	1637.4	1691.4	1746.4
	s	0.4834	1.5950	1.6061	1.6396	1.6698	1.6975	1.7233	1.7476	1.7928	1.8344	1.8732	1.9099	1.9446	1.9777	2.0093	2.0397
	Sh			11.92	61.92	111.92	161.92	211.92	261.92	361.92	461.92	561.92	661.92	761.92	861.92	961.92	1061.92
115	v	0.01785	3.881	3.957	4.265	4.558	4.841	5.119	5.392	5.932	6.465	6.994	7.521	8.046	8.570	9.093	9.615
(338.08)	h	309.25	1189.6	1196.7	1225.0	1251.8	1277.9	1303.3	1328.6	1378.7	1429.0	1479.9	1531.6	1584.0	1637.2	1691.4	1746.3
	s	0.4877	1.5913	1.6001	1.6340	1.6644	1.6922	1.7181	1.7425	1.7877	1.8294	1.8682	1.9049	1.9396	1.9727	2.0044	2.0347
	Sh			8.73	58.73	108.73	158.73	208.73	258.73	358.73	458.73	558.73	658.73	758.73	858.73	958.73	1058.73
120	v	0.01789	3.7275	3.7815	4.0786	4.3610	4.6341	4.9009	5.1637	5.6813	6.1928	6.7006	7.2060	7.7096	8.2119	8.7130	9.2134
(341.27)	h	312.58	1190.4	1195.6	1224.1	1251.2	1277.4	1302.9	1328.2	1378.4	1428.8	1479.8	1531.4	1583.9	1637.1	1691.3	1746.2
	s	0.4919	1.5879	1.5943	1.6286	1.6592	1.6872	1.7132	1.7376	1.7829	1.8246	1.8635	1.9000	1.9349	1.9680	1.9996	2.0300
	Sh			2.67	52.67	102.67	152.67	202.67	252.67	352.67	452.67	552.67	652.67	752.67	852.67	952.67	1052.67
130	v	0.01796	3.4544	3.4699	3.7489	4.0129	4.2672	4.5151	4.7589	5.2384	5.7118	6.1814	6.6486	7.1140	7.5781	8.0411	8.5033
(347.33)	h	318.95	1191.7	1193.4	1222.5	1249.9	1276.4	1302.1	1327.5	1377.9	1428.4	1479.4	1531.1	1583.6	1636.9	1691.1	1746.1
	s	0.4998	1.5813	1.5833	1.6182	1.6493	1.6775	1.7037	1.7283	1.7737	1.8155	1.8545	1.8911	1.9259	1.9591	1.9907	2.0211
	Sh				46.96	96.96	146.96	196.96	246.96	346.96	446.96	546.96	646.96	746.96	846.96	946.96	1046.96
140	v	0.01803	3.2190		3.4661	3.7143	3.9526	4.1844	4.4119	4.8588	5.2995	5.7364	6.1709	6.6036	7.0349	7.4652	7.8946
(353.04)	h	324.96	1193.0		1220.8	1248.7	1275.3	1301.3	1326.8	1377.4	1428.0	1479.1	1530.8	1583.4	1636.7	1690.9	1745.9
	s	0.5071	1.5752		1.6085	1.6400	1.6686	1.6949	1.7196	1.7652	1.8071	1.8461	1.8833	1.9176	1.9508	1.9825	2.0129
	Sh				[illegible]	[illegible]	141.57	191.57	241.57	341.57	441.57	541.57	641.57	741.57	841.57	[illegible]	[illegible]
150	v	0.01809	[illegible]		[illegible]	[illegible]	[illegible]	3.8478	4.1112	4.5298	[illegible]	5.3507	5.7568	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	h	330.65	[illegible]		[illegible]	[illegible]	[illegible]	1300.5	1326.1	1376.9	1427.6	[illegible]	1530.5	1583.1	1636.5	[illegible]	[illegible]
	s	[illegible]	[illegible]		[illegible]	[illegible]	1.6607	1.6867	1.7115	1.7573	1.7992	1.8383	1.8751	1.9099	[illegible]	[illegible]	[illegible]
	Sh				36.45	86.45	136.45	186.45	236.45	336.45	436.45	536.45	636.45	736.45	836.45	936.45	1036.45
160	v	0.01815	2.8336		3.0060	3.2288	3.4413	3.6469	3.8480	4.2420	4.6295	5.0132	5.3945	5.7741	6.1522	6.5293	6.9055
(363.55)	h	336.07	1195.1		1217.4	1246.0	1273.3	1299.6	1325.4	1376.4	1427.2	1478.4	1530.3	1582.9	1636.3	1690.5	1745.6
	s	0.5206	1.5641		1.5906	1.6231	1.6522	1.6790	1.7039	1.7499	1.7919	1.8310	1.8678	1.9027	1.9359	1.9676	1.9980
	Sh				31.58	81.58	131.58	181.58	231.58	331.58	431.58	531.58	631.58	731.58	831.58	931.58	1031.58
170	v	0.01821	2.6738		2.8162	3.0288	3.2306	3.4255	3.6158	3.9879	4.3536	4.7155	5.0749	5.4325	5.7888	6.1440	6.4983
(368.42)	h	341.24	1196.0		1215.6	1244.7	1272.2	1298.8	1324.7	1375.8	1426.8	1478.0	1530.0	1582.6	1636.[illegible]	1690.4	1745.4
	s	0.5269	1.5591		1.5823	1.6152	1.6447	1.6717	1.6968	1.7428	1.7850	1.8241	1.8610	1.8959	1.9291	1.9608	1.9913
	Sh				26.92	76.92	126.92	176.92	226.92	326.92	426.92	526.92	626.92	726.92	826.92	926.92	1026.92
180	v	0.01827	2.5312		2.6474	2.8508	3.0433	3.2286	3.4093	3.7621	4.1084	4.4508	4.7907	5.1283	5.4657	5.8014	6.1363
(373.08)	h	346.19	1196.9		1213.8	1243.4	1271.2	1297.9	1324.0	1375.3	1426.3	1477.7	1529.7	1582.4	1635.9	1690.2	1745.3
	s	0.5328	1.5543		1.5743	1.6078	1.6376	1.6647	1.6900	1.7362	1.7784	1.8176	1.8545	1.8894	1.9227	1.9545	1.9849
	Sh				22.47	72.47	122.47	172.47	222.47	322.47	422.47	522.47	622.47	722.47	822.47	922.47	1022.47
190	v	0.01833	2.4030		2.4961	2.6915	2.8756	3.0525	3.2246	3.5601	3.8889	4.2140	4.5365	4.8572	5.1766	5.4949	5.8124
(377.53)	h	350.94	1197.6		1212.0	1242.0	1270.1	1297.1	1323.3	1374.8	1425.9	1477.4	1529.4	1582.1	1635.7	1690.0	1745.1
	s	0.5384	1.5498		1.5667	1.6006	1.6307	1.6581	1.6835	1.7299	1.7722	1.8115	1.8484	1.8834	1.9166	1.9484	1.9789
	Sh				18.20	68.20	118.20	168.20	218.20	318.20	418.20	518.20	618.20	718.20	818.20	918.20	1018.20
200	v	0.01839	2.2873		2.3598	2.5480	2.7247	2.8939	3.0583	3.3783	3.6915	4.0008	4.3077	4.6128	4.9165	5.2191	5.5209
(381.80)	h	355.51	1198.3		1210.1	1240.6	1269.0	1296.2	1322.6	1374.3	1425.5	1477.0	1529.1	1581.9	1635.4	1689.8	1745.0
	s	0.5438	1.5454		1.5593	1.5938	1.6242	1.6518	1.6773	1.7239	1.7663	1.8057	1.8426	1.8776	1.9109	1.9427	1.9732

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press Lb/Sq In (Sat. Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400	1500
	Sh			14.09	64.09	114.09	164.09	214.09	314.09	414.09	514.09	614.09	714.09	814.09	914.09	1014.09	1114.09
210	v	0.01844	2.1822	2.2364	2.4181	2.5880	2.7504	2.9078	3.2137	3.5128	3.8080	4.1007	4.3915	4.6811	4.9695	5.2571	5.5440
(385.91)	h	359.91	1199.0	1208.02	1239.2	1268.0	1295.3	1321.9	1373.7	1425.1	1476.7	1528.8	1581.6	1635.2	1689.6	1744.8	1800.8
	s	0.5490	1.5413	1.5522	1.5872	1.6180	1.6458	1.6715	1.7182	1.7607	1.8001	1.8371	1.8721	1.9054	1.9372	1.9677	1.9970
	Sh			10.12	60.12	110.12	160.12	210.12	310.12	410.12	510.12	610.12	710.12	810.12	910.12	1010.12	1110.12
220	v	0.01850	2.0863	2.1240	2.2999	2.4638	2.6199	2.7710	3.0642	3.3504	3.6327	3.9125	4.1905	4.4671	4.7426	5.0173	5.2913
(389.88)	h	364.17	1199.6	1206.3	1237.8	1266.9	1294.5	1321.2	1373.2	1424.7	1476.3	1528.5	1581.4	1635.0	1689.4	1744.7	1800.6
	s	0.5540	1.5374	1.5453	1.5808	1.6120	1.6400	1.6658	1.7128	1.7553	1.7948	1.8318	1.8668	1.9002	1.9320	1.9625	1.9919
	Sh			6.30	56.30	106.30	156.30	206.30	306.30	406.30	506.30	606.30	706.30	806.30	906.30	1006.30	1106.30
230	v	0.01855	1.9985	2.0212	2.1919	2.3503	2.5008	2.6461	2.9276	3.2020	3.4726	3.7406	4.0068	4.2717	4.5355	4.7984	5.0606
(393.70)	h	368.28	1200.1	1204.4	1236.3	1265.7	1293.6	1320.4	1372.7	1424.2	1476.0	1528.2	1581.1	1634.8	1689.3	1744.5	1800.5
	s	0.5588	1.5336	1.5385	1.5747	1.6062	1.6344	1.6604	1.7075	1.7502	1.7897	1.8268	1.8618	1.8952	1.9270	1.9576	1.9869
	Sh			2.61	52.61	102.61	152.61	202.61	302.61	402.61	502.61	602.61	702.61	802.61	902.61	1002.61	1102.61
240	v	0.01860	1.9177	1.9268	2.0928	2.2462	2.3915	2.5316	2.8074	3.0661	3.3259	3.5831	3.8385	4.0926	4.3456	4.5977	4.8492
(397.39)	h	372.27	1200.6	1202.4	1234.9	1264.6	1292.7	1319.7	1372.1	1423.8	1475.6	1527.9	1580.9	1634.6	1689.1	1744.3	1800.4
	s	0.5634	1.5299	1.5320	1.5687	1.6006	1.6291	1.6552	1.7025	1.7452	1.7848	1.8219	1.8570	1.8904	1.9223	1.9528	1.9822
	Sh				49.03	99.03	149.03	199.03	299.03	399.03	499.03	599.03	699.03	799.03	899.03	999.03	1099.03
250	v	0.01865	1.8432		2.0016	2.1504	2.2909	2.4262	2.6872	2.9410	3.1909	3.4382	3.6837	3.9278	4.1709	4.4131	4.6546
(400.97)	h	376.14	1201.1		1233.4	1263.5	1291.8	1319.0	1371.6	1423.4	1475.3	1527.6	1580.6	1634.4	1688.9	1744.2	1800.2
	s	0.5679	1.5264		1.5629	1.5951	1.6239	1.6502	1.6976	1.7405	1.7801	1.8173	1.8524	1.8858	1.9177	1.9482	1.9776
	Sh				45.56	95.56	145.56	195.56	295.56	395.56	495.56	595.56	695.56	795.56	895.56	995.56	1095.56
260	v	0.01870	1.7742		1.9173	2.0619	2.1981	2.3289	2.5808	2.8256	3.0663	3.3044	3.5408	3.7758	4.0097	4.2427	4.4750
(404.44)	h	379.90	1201.5		1231.9	1262.4	1290.9	1318.2	1371.1	1423.0	1474.9	1527.3	1580.4	1634.2	1688.7	1744.0	1800.1
	s	0.5722	1.5230		1.5573	1.5899	1.6189	1.6453	1.6930	1.7359	1.7756	1.8128	1.8480	1.8814	1.9133	1.9439	1.9732
	Sh				42.20	92.20	142.20	192.20	292.20	392.20	492.20	592.20	692.20	792.20	892.20	992.20	1092.20
270	v	0.01875	1.7101		1.8391	1.9799	2.1121	2.2388	2.4824	2.7186	2.9509	3.1806	3.4084	3.6349	3.8603	4.0849	4.3087
(407.80)	h	383.56	1201.9		1230.4	1261.2	1290.0	1317.5	1370.5	1422.6	1474.6	1527.1	1580.1	1634.0	1688.5	1743.9	1800.0
	s	0.5764	1.5197		1.5518	1.5848	1.6140	1.6406	1.6885	1.7315	1.7713	1.8085	1.8437	1.8771	1.9090	1.9396	1.9690
	Sh				38.93	88.93	138.93	188.93	288.93	388.93	488.93	588.93	688.93	788.93	888.93	988.93	1088.93
280	v	0.01880	1.6505		1.7665	1.9037	2.0322	2.1551	2.3909	2.6194	2.8437	3.0655	3.2855	3.5042	3.7217	3.9384	4.1543
(411.07)	h	387.12	1202.3		1228.8	1260.0	1289.1	1316.8	1370.0	1422.1	1474.2	1526.8	1579.9	1633.8	1688.4	1743.7	1799.8
	s	0.5803	1.5166		1.5464	1.5798	1.6093	1.6361	1.6841	1.7273	1.7671	1.8043	1.8395	1.8730	1.9050	1.9356	1.9649
	Sh				35.75	85.75	135.75	185.75	285.75	385.75	485.75	585.75	685.75	785.75	885.75	985.75	1085.75
290	v	0.01885	1.5948		1.6988	1.8327	1.9578	2.0772	2.3058	2.5269	2.7440	2.9585	3.1711	3.3824	3.5926	3.8019	4.0106
(414.25)	h	390.60	1202.6		1227.3	1258.9	1288.1	1316.0	1369.5	1421.7	1473.9	1526.5	1579.6	1633.5	1688.2	1743.6	1799.7
	s	0.5844	1.5135		1.5412	1.5750	1.6048	1.6317	1.6799	1.7232	1.7630	1.8003	1.8356	1.8690	1.9010	1.9316	1.9610
	Sh				32.65	82.65	132.65	182.65	282.65	382.65	482.65	582.65	682.65	782.65	882.65	982.65	1082.65
300	v	0.01889	1.5427		1.6356	1.7665	1.8883	2.0044	2.2263	2.4407	2.6509	2.8585	3.0643	3.2688	3.4721	3.6746	3.8764
(417.35)	h	393.99	1202.9		1225.7	1257.7	1287.2	1315.2	1368.9	1421.3	1473.6	1526.2	1579.4	1633.3	1688.0	1743.4	1799.6
	s	0.5882	1.5105		1.5361	1.5703	1.6003	1.6274	1.6758	1.7192	1.7591	1.7964	1.8317	1.8652	1.8972	1.9278	1.9572
	Sh				29.64	79.64	129.64	179.64	279.64	379.64	479.64	579.64	679.64	779.64	879.64	979.64	1079.64
310	v	0.01894	1.4939		1.5763	1.7044	1.8233	1.9363	2.1520	2.3600	2.5638	2.7650	2.9644	3.1625	3.3594	3.5555	3.7509
(420.36)	h	397.30	1203.2		1224.1	1256.5	1286.3	1314.5	1368.4	1420.9	1473.2	1525.9	1579.2	1633.1	1687.8	1743.3	1799.4
	s	0.5920	1.5076		1.5311	1.5657	1.5960	1.6233	1.6719	1.7153	1.7553	1.7927	1.8280	1.8615	1.8935	1.9241	1.9536
	Sh				26.69	76.69	126.69	176.69	276.69	376.69	476.69	576.69	676.69	776.69	876.69	976.69	1076.69
320	v	0.01899	1.4480		1.5207	1.6462	1.7623	1.8725	2.0823	2.2843	2.4821	2.6774	2.8708	3.0628	3.2538	3.4438	3.6332
(423.31)	h	400.53	1203.4		1222.5	1255.2	1285.3	1313.7	1367.8	1420.5	1472.9	1525.6	1578.9	1632.9	1687.6	1743.1	1799.3
	s	0.5956	1.5048		1.5261	1.5612	1.5918	1.6192	1.6680	1.7116	1.7516	1.7890	1.8243	1.8579	1.8899	1.9206	1.9500
	Sh				23.82	73.82	123.82	173.82	273.82	373.82	473.82	573.82	673.82	773.82	873.82	973.82	1073.82
330	v	0.01903	1.4048		1.4684	1.5915	1.7050	1.8125	2.0168	2.2132	2.4054	2.5950	2.7828	2.9692	3.1545	3.3389	3.5227
(426.18)	h	403.70	1203.6		1220.9	1254.0	1284.4	1313.0	1367.3	1420.0	1472.5	1525.3	1578.7	1632.7	1687.5	1742.9	1799.2
	s	0.5991	1.5021		1.5213	1.5568	1.5876	1.6153	1.6643	1.7079	1.7480	1.7855	1.8208	1.8544	1.8864	1.9171	1.9466
	Sh				21.01	71.01	121.01	171.01	271.01	371.01	471.01	571.01	671.01	771.01	871.01	971.01	1071.01
340	v	0.01908	1.3640		1.4191	1.5399	1.6511	1.7561	1.9552	2.1463	2.3333	2.5175	2.7000	2.8811	3.0611	3.2402	3.4186
(428.99)	h	406.80	1203.8		1219.2	1252.8	1283.4	1312.2	1366.7	1419.6	1472.2	1525.0	1578.4	1632.5	1687.3	1742.8	1799.0
	s	0.6026	1.4994		1.5165	1.5525	1.5836	1.6114	1.6606	1.7044	1.7445	1.7820	1.8174	1.8510	1.8831	1.9138	1.9432
	Sh				18.27	68.27	118.27	168.27	268.27	368.27	468.27	568.27	668.27	768.27	868.27	968.27	1068.27
350	v	0.01912	1.3255		1.3725	1.4913	1.6002	1.7028	1.8970	2.0832	2.2652	2.4445	2.6219	2.7980	2.9730	3.1471	3.3205
(431.73)	h	409.83	1204.0		1217.5	1251.5	1282.4	1311.4	1366.2	1419.2	1471.8	1524.7	1578.2	1632.3	1687.1	1742.6	1798.9
	s	0.6059	1.4968		1.5119	1.5483	1.5797	1.6077	1.6571	1.7009	1.7411	1.7787	1.8141	1.8477	1.8798	1.9105	1.9400
	Sh				15.59	65.59	115.59	165.59	265.59	365.59	465.59	565.59	665.59	765.59	865.59	965.59	1065.59
360	v	0.01917	1.2891		1.3285	1.4454	1.5521	1.6525	1.8421	2.0237	2.2009	2.3755	2.5482	2.7196	2.8898	3.0592	3.2279
(434.41)	h	412.81	1204.1		1215.8	1250.3	1281.5	1310.6	1365.6	1418.7	1471.5	1524.4	1577.9	1632.1	1686.9	1742.5	1798.8
	s	0.6092	1.4943		1.5073	1.5441	1.5758	1.6040	1.6536	1.6976	1.7379	1.7754	1.8109	1.8445	1.8766	1.9073	1.9368
	Sh				10.39	60.39	110.39	160.39	260.39	360.39	460.39	560.39	660.39	760.39	860.39	960.39	1060.39
380	v	0.01925	1.2218		1.2472	1.3606	1.4635	1.5598	1.7410	1.9139	2.0825	2.2484	2.4124	2.5750	2.7366	2.8973	3.0572
(439.61)	h	418.59	1204.4		1212.4	1247.7	1279.5	1309.0	1364.5	1417.9	1470.8	1523.8	1577.4	1631.6	1686.5	1742.2	1798.5
	s	0.6156	1.4894		1.4982	1.5360	1.5683	1.5969	1.6470	1.6911	1.7315	1.7692	1.8047	1.8384	1.8705	1.9012	1.9307

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 450	500	550	600	650	700	800	900	1000	1100	1200	1300	1400	1500
	Sh			5 40	55 40	105 40	155 40	205 40	255 40	355 40	455 40	555 40	655 40	755 40	855 40	955 40	1055 40
400	v	0 01934	1 1610	1 1738	1 2841	1 3836	1 4763	1 5646	1 6499	1 8151	1 9759	2 1339	2 2901	2 4450	2 5987	2 7515	2 9037
(444 60)	h	424 17	1204 6	1208 8	1245 1	1277 5	1307 4	1335 9	1363 4	1417 0	1470 1	1523 3	1576 9	1631 2	1686 2	1741 9	1798 2
	s	0 6217	1 4847	1 4894	1 5282	1 5611	1 5901	1 6163	1 6406	1 6850	1 7255	1 7637	1 7988	1 8325	1 8647	1 8955	1 9250
	Sh			60	50 60	100 60	150 60	200 60	250 60	350 60	450 60	550 60	650 60	750 60	850 60	950 60	1050 60
420	v	0 01942	1 1057	1 1071	1 2148	1 3113	1 4007	1 4856	1 5676	1 7258	1 8795	2 0304	2 1795	2 3273	2 4739	2 6196	2 7647
(449 40)	h	429 56	1204 7	1205 7	1242 4	1275 4	1305 8	1334 5	1362 3	1416 2	1469 4	1522 7	1576 4	1630 8	1685 8	1741 6	1798 0
	s	0 6276	1 4802	1 4808	1 5206	1 5542	1 5835	1 6100	1 6345	1 6791	1 7197	1 7575	1 7932	1 8269	1 8591	1 8899	1 9195
	Sh				45 97	95 97	145 97	195 97	245 97	345 97	445 97	545 97	645 97	745 97	845 97	945 97	1045 97
440	v	0 01950	1 0554		1 1517	1 2454	1 3319	1 4138	1 4926	1 6445	1 7918	1 9363	2 0790	2 2203	2 3605	2 4998	2 6384
(454 03)	h	434 77	1204 8		1239 7	1273 4	1304 2	1333 2	1361 1	1415 3	1468 7	1522 1	1575 9	1630 4	1685 5	1741 2	1797 7
	s	0 6332	1 4759		1 5132	1 5474	1 5772	1 6040	1 6286	1 6734	1 7142	1 7521	1 7878	1 8216	1 8538	1 8847	1 9145
	Sh				41 50	91 50	141 50	191 50	241 50	341 50	441 50	541 50	641 50	741 50	841 50	941 50	1041 50
460	v	0 01959	1 0092		1 0939	1 1857	1 2691	1 3487	1 4247	1 5703	1 7117	1 8504	1 9872	2 1226	2 2569	2 3903	2 5230
(458 50)	h	439 83	1204 8		1236 9	1271 3	1302 5	1331 8	1360 0	1414 4	1468 0	1521 5	1575 4	1629 9	1685 1	1740 9	1797 4
	s	0 6387	1 4718		1 5060	1 5409	1 5711	1 5982	1 6230	1 6680	1 7089	1 7469	1 7826	1 8165	1 8488	1 8797	1 9093
	Sh				37 18	87 18	137 18	187 18	237 18	337 18	437 18	537 18	637 18	737 18	837 18	937 18	1037 18
480	v	0 01967	0 9668		1 0409	1 1300	1 2115	1 2881	1 3615	1 5023	1 6384	1 7716	1 9030	2 0330	2 1619	2 2900	2 4173
(462 82)	h	444 75	1204 8		1234 1	1269 1	1300 8	1330 5	1358 8	1413 6	1467 3	1520 9	1574 9	1629 5	1684 7	1740 6	1797 2
	s	0 6439	1 4677		1 4990	1 5346	1 5652	1 5925	1 6176	1 6628	1 7038	1 7419	1 7777	1 8116	1 8439	1 8748	1 9045
	Sh				32 99	82 99	132 99	182 99	232 99	332 99	432 99	532 99	632 99	732 99	832 99	932 99	1032 99
500	v	0 01975	0 9276		0 9919	1 0791	1 1584	1 2377	1 3037	1 4397	1 5708	1 6992	1 8256	1 9507	2 0746	2 1977	2 3200
(467 01)	h	449 52	1204 7		1231 2	1267 0	1299 1	1329 1	1357 7	1412 7	1466 6	1520 3	1574 4	1629 1	1684 4	1740 3	1796 9
	s	0 6490	1 4639		1 4921	1 5284	1 5595	1 5871	1 6123	1 6578	1 6990	1 7371	1 7730	1 8069	1 8393	1 8702	1 8998
	Sh				28 93	78 93	128 93	178 93	228 93	328 93	428 93	528 93	628 93	728 93	828 93	928 93	1028 93
520	v	0 01982	0 8914		0 9466	1 0371	1 1094	1 1816	1 2504	1 3819	1 5085	1 6323	1 7542	1 8746	1 9940	2 1125	2 2302
(471 07)	h	454 18	1204 5		1228 3	1264 8	1297 4	1327 7	1356 5	1411 8	1465 9	1519 7	1573 9	1628 7	1684 0	1740 0	1796 7
	s	0 6540	1 4601		1 4853	1 5223	1 5539	1 5818	1 6072	1 6530	1 6943	1 7325	1 7684	1 8024	1 8348	1 8657	1 8954
	Sh				24 99	74 99	124 99	174 99	224 99	324 99	424 99	524 99	624 99	724 99	824 99	924 99	1024 99
540	v	0 01990	0 8577		0 9045	0 9884	1 0640	1 1342	1 2010	1 3284	1 4508	1 5704	1 6880	1 8047	1 9193	2 0336	2 1471
(475 01)	h	458 71	1204 4		1225 3	1262 5	1295 7	1326 3	1355 3	1410 9	1465 1	1519 1	1573 4	1628 2	1683 6	1739 7	1796 4
	s	0 6587	1 4565		1 4786	1 5164	1 5485	1 5767	1 6023	1 6483	1 6897	1 7280	1 7640	1 7981	1 8305	1 8615	1 8911
	Sh				21 16	71 16	121 16	171 16	221 16	321 16	421 16	521 16	621 16	721 16	821 16	921 16	1071 16
560	v	0 01998	0 8264		0 8653	0 9479	1 0217	1 0902	1 1552	1 2787	1 3972	1 5129	1 6266	1 7388	1 8500	1 9603	2 0699
(478 84)	h	463 14	1204 2		1222 2	1260 3	1293 9	1324 9	1354 2	1410 0	1464 4	1518 6	1572 9	1627 8	1683 3	1739 4	1796 1
	s	0 6634	1 4529		1 4720	1 5106	1 5431	1 5717	1 5975	1 6438	1 6853	1 7237	1 7598	1 7939	1 8263	1 8573	1 8870
	Sh				17 43	67 43	117 43	167 43	217 43	317 43	417 43	517 43	617 43	717 43	817 43	917 43	1017 43
580	v	0 02006	0 7971		0 8287	0 9100	0 9824	1 0492	1 1125	1 2324	1 3473	1 4593	1 5693	1 6780	1 7855	1 8921	1 9980
(482 57)	h	467 47	1203 9		1219 1	1258 0	1292 1	1323 4	1353 0	1409 2	1463 7	1518 0	1572 4	1627 4	1682 9	1739 1	1795 9
	s	0 6679	1 4495		1 4654	1 5049	1 5380	1 5668	1 5929	1 6394	1 6811	1 7196	1 7556	1 7898	1 8223	1 8533	1 8832
	Sh				13 80	63 80	113 80	163 80	213 80	313 80	413 80	513 80	613 80	713 80	813 80	913 80	1013 80
600	v	0 02013	0 7697		0 7944	0 8746	0 9456	1 0109	1 0726	1 1892	1 3009	1 4096	1 5160	1 6211	1 7252	1 8284	1 9309
(486 20)	h	471 70	1203 7		1215 9	1255 6	1290 7	1322 0	1351 4	1407 9	1462 8	1517 4	1571 9	1627 0	1682 6	1738 8	1795 5
	s	0 6723	1 4461		1 4590	1 4990	1 5329	1 5621	1 5884	1 6351	1 6764	1 7155	1 7517	1 7859	1 8184	1 8494	1 8791
	Sh				5 11	55 11	105 11	155 11	205 11	305 11	405 11	505 11	605 11	705 11	805 11	905 11	1005 11
650	v	0 02032	0 7084		0 7173	0 7954	0 8634	0 9254	0 9838	1 0959	1 1989	1 2979	1 3969	1 4944	1 5909	1 6864	1 7811
(494 89)	h	481 89	1202 8		1207 6	1249 6	1285 7	1318 3	1348 7	1406 0	1461 7	1515 9	1570 7	1625 9	1681 6	1738 0	1794 9
	s	1 6828	1 4381		1 4430	1 4858	1 5207	1 5507	1 5775	1 6249	1 6671	1 7059	1 7422	1 7765	1 8092	1 8403	1 8701
	Sh					46 97	96 97	146 97	196 97	296 97	396 97	496 97	596 97	696 97	796 97	896 97	996 97
700	v	0 02050	0 6556			0 7271	0 7928	0 8520	0 9072	1 0102	1 1076	1 2013	1 2948	1 3858	1 4757	1 5647	1 6531
(503 08)	h	491 60	1201 8			1243 4	1281 0	1314 6	1345 6	1403 3	1459 4	1514 4	1569 4	1624 8	1680 7	1737 2	1794 3
	s	0 6928	1 4304			1 4726	1 5090	1 5399	1 5673	1 6154	1 6580	1 6970	1 7335	1 7679	1 8006	1 8318	1 8617
	Sh					39 16	89 16	139 16	189 16	289 16	389 16	489 16	589 16	689 16	789 16	889 16	989 16
750	v	0 02069	0 6095			0 6676	0 7313	0 7882	0 8409	0 9386	1 0306	1 1195	1 2063	1 2916	1 3759	1 4592	1 5419
(510 84)	h	500 89	1200 7			1236 9	1276 1	1310 7	1342 5	1401 5	1457 6	1512 9	1568 2	1623 8	1679 8	1736 4	1793 6
	s	0 7022	1 4232			1 4598	1 4977	1 5296	1 5577	1 6065	1 6494	1 6886	1 7252	1 7598	1 7926	1 8239	1 8538
	Sh					31 79	81 79	131 79	181 79	281 79	381 79	481 79	581 79	681 79	781 79	881 79	981 79
800	v	0 02087	0 5690			0 6151	0 6774	0 7323	0 7828	0 8759	0 9631	1 0470	1 1289	1 2093	1 2885	1 3669	1 4448
(518 21)	h	509 81	1199 4			1230 1	1271 1	1306 8	1339 3	1395	1455 8	1511 4	1566 9	1622 7	1678 9	1735 7	1792 9
	s	0 7111	1 4163			1 4472	1 4869	1 5198	1 5484	1 5980	1 6413	1 6807	1 7175	1 7522	1 7851	1 8164	1 8464
	Sh					24 76	74 76	124 76	174 76	274 76	374 76	474 76	574 76	674 76	774 76	874 76	974 76
850	v	0 02105	0 5330			0 5683	0 6296	0 6829	0 7315	0 8205	0 9034	0 9830	1 0606	1 1366	1 2115	1 2855	1 3588
(525 24)	h	518 40	1198 0			1223 0	1265 9	1302 8	1336 0	1396 8	1454 0	1510 0	1565 7	1621 6	1678 0	1734 9	1792 3
	s	0 7197	1 4096			1 4347	1 4763	1 5102	1 5396	1 5899	1 6336	1 6733	1 7102	1 7450	1 7780	1 8094	1 8395
	Sh					18 05	68 05	118 05	168 05	268 05	368 05	468 05	568 05	668 05	768 05	868 05	968 05
900	v	0 02123	0 5009			0 5263	0 5869	0 6380	0 6858	0 7713	0 8504	0 9267	0 9998	1 0720	1 1430	1 2131	1 2825
(531 95)	h	526 70	1196 4			1215 5	1260 6	1298 6	1332 7	1394 4	1452 2	1508 5	1564 4	1620 6	1677 1	1734 1	1791 6
	s	0 7279	1 4032			1 4223	1 4659	1 5010	1 5311	1 5822	1 6263	1 6662	1 7033	1 7382	1 7713	1 8028	1 8329

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	550	600	650	700	750	800	850	900	1000	1100	1200	1300	1400	1500
950	Sh			11.61	61.61	111.61	161.61	211.61	261.61	311.61	361.61	461.61	561.61	661.61	761.61	861.61	961.61
(538.39)	v	0.02141	0.4721	0.4883	0.5485	0.5993	0.6449	0.6871	0.7272	0.7656	0.8030	0.8753	0.9455	1.0142	1.0817	1.1484	1.2143
	h	534.74	1194.7	1207.6	1255.1	1294.4	1329.3	1361.5	1392.0	1421.5	1450.3	1507.0	1563.2	1619.5	1676.2	1733.3	1791.0
	s	0.7358	1.3970	1.4098	1.4557	1.4921	1.5228	1.5500	1.5748	1.5977	1.6193	1.6595	1.6967	1.7317	1.7649	1.7965	1.8267
1000	Sh			5.42	55.42	105.42	155.42	205.42	255.42	305.42	355.42	455.42	555.42	655.42	755.42	855.42	955.42
(544.58)	v	0.02159	0.4460	0.4535	0.5137	0.5636	0.6080	0.6489	0.6875	0.7245	0.7603	0.8295	0.8966	0.9622	1.0266	1.0901	1.1529
	h	542.55	1192.9	1199.3	1249.3	1290.1	1325.9	1358.7	1389.6	1419.4	1448.5	1505.4	1561.9	1618.4	1675.3	1732.5	1790.3
	s	0.7434	1.3910	1.3973	1.4457	1.4833	1.5149	1.5426	1.5677	1.5908	1.6126	1.6530	1.6905	1.7256	1.7589	1.7905	1.8207
1050	Sh				49.47	99.47	149.47	199.47	249.47	299.47	349.47	449.47	549.47	649.47	749.47	849.47	949.47
(550.53)	v	0.02177	0.4222		0.4821	0.5312	0.5745	0.6142	0.6515	0.6872	0.7216	0.7881	0.8524	0.9151	0.9767	1.0373	1.0973
	h	550.15	1191.0		1243.4	1285.7	1322.4	1355.8	1387.2	1417.3	1446.6	1503.9	1560.7	1617.4	1674.4	1731.8	1789.6
	s	0.7507	1.3851		1.4358	1.4748	1.5072	1.5354	1.5608	1.5842	1.6062	1.6469	1.6845	1.7197	1.7531	1.784[illegible]	1.8151
1100	Sh				43.72	93.72	143.72	193.72	243.72	293.72	343.72	443.72	543.72	643.72	743.72	843.72	943.72
(556.28)	v	0.02195	0.4006		0.4531	0.5017	0.5440	0.5826	0.6188	0.6533	0.6865	0.7505	0.8121	0.8723	0.9313	0.9894	1.0468
	h	557.55	1189.1		1237.3	1281.2	1318.8	1352.9	1384.7	1415.2	1444.7	1502.4	1559.4	1616.3	1673.5	1731.0	1789.0
	s	0.7578	1.3794		1.4259	1.4664	1.4996	1.5284	1.5542	1.5779	1.6000	1.6410	1.6787	1.7141	1.7475	1.7793	1.8097
1150	Sh				39.18	89.18	139.18	189.18	239.18	289.18	339.18	439.18	539.18	639.18	739.18	839.18	939.18
(561.82)	v	0.02214	0.3807		0.4263	0.4746	0.5167	0.5538	0.5889	0.6223	0.6544	0.7161	0.7754	0.8332	0.8899	0.9456	1.0007
	h	564.78	1187.0		1230.9	1276.6	1315.2	1349.9	1382.2	1413.0	1442.8	1500.9	1558.1	1615.2	1672.6	1730.2	1788.3
	s	0.7647	1.3738		1.4160	1.4582	1.4923	1.5216	1.5478	1.5717	1.5941	1.6353	1.6732	1.7087	1.7422	1.7741	1.8045
1200	Sh				32.81	82.81	132.81	182.81	232.81	282.81	332.81	432.81	532.81	632.81	732.81	832.81	932.81
(567.19)	v	0.02232	0.3624		0.4016	0.4497	0.4905	0.5273	0.5615	0.5939	0.6250	0.6845	0.7418	0.7974	0.8519	0.9055	0.9584
	h	571.85	1184.8		1224.2	1271.8	1311.5	1346.9	1379.7	1410.8	1440.9	1499.4	1556.9	1614.2	1671.6	1729.4	1787.6
	s	0.7714	1.3683		1.4061	1.4501	1.4851	1.5150	1.5415	1.5658	1.5883	1.6298	1.6679	1.7035	1.7371	1.7691	1.7996
1300	Sh				22.58	72.58	122.58	172.58	222.58	272.58	322.58	422.58	522.58	622.58	722.58	822.58	922.58
(577.42)	v	0.02269	0.3299		0.3570	0.4052	0.4451	0.4804	0.5129	0.5436	0.5729	0.6287	0.6822	0.7341	0.7847	0.8345	0.8836
	h	585.58	1180.2		1209.9	1261.9	1303.9	1340.8	1374.6	1406.4	1437.1	1496.3	1554.3	1612.0	1669.8	1727.9	1786.3
	s	0.7843	1.3577		1.3860	1.4340	1.4711	1.5022	1.5296	1.5544	1.5773	1.6194	1.6578	1.6937	1.7275	1.7596	1.7902
1400	Sh				12.93	62.93	112.93	162.93	212.93	262.93	312.93	412.93	512.93	612.93	712.93	812.93	912.93
(587.07)	v	0.02307	0.3018		0.3176	0.3667	0.4059	0.4400	0.4712	0.5004	0.5282	0.5809	0.6311	0.6798	0.7272	0.7737	0.8195
	h	598.83	1175.3		1194.1	1251.4	1296.1	1334.5	1369.3	1402.0	1433.2	1493.2	1551.8	1609.9	1668.0	1726.3	1785.0
	s	0.7966	1.3474		1.3652	1.4181	1.4575	1.4900	1.5182	1.5436	1.5670	1.6096	1.6484	1.6845	1.7185	1.7508	1.7815
1500	Sh				3.80	53.80	103.80	153.80	203.80	253.80	303.80	403.80	503.80	603.80	703.80	803.80	903.80
(596.20)	v	0.02346	0.2772		0.2820	0.3328	0.3717	0.4049	0.4350	0.4629	0.4894	0.5394	0.5869	0.6327	0.6773	0.7210	0.7639
	h	611.68	1170.1		1176.3	1240.2	1287.9	1328.0	1364.0	1397.4	1429.2	1490.1	1549.2	1607.7	1666.2	1724.8	1783.7
	s	0.8085	1.3373		1.3431	1.4022	1.4443	1.4782	1.5073	1.5333	1.5572	1.6004	1.6395	1.6759	1.7101	1.7425	1.7734
1600	Sh					45.13	95.13	145.13	195.13	245.13	295.13	395.13	495.13	595.13	695.13	795.13	895.13
(604.87)	v	0.02387	0.2555			0.3026	0.3415	0.3741	0.4032	0.4301	0.4555	0.5031	0.5482	0.5915	0.6336	0.6748	0.7153
	h	624.20	1164.5			1228.3	1279.4	1321.4	1358.5	1392.8	1425.2	1486.9	1546.6	1605.6	1664.3	1723.2	1782.3
	s	0.8199	1.3274			1.3861	1.4312	1.4667	1.4968	1.5235	1.5478	1.5916	1.6312	1.6678	1.7022	1.7347	1.7657
1700	Sh					36.87	86.87	136.87	186.87	236.87	286.87	386.87	486.87	586.87	686.87	786.87	886.87
(613.13)	v	0.02428	0.2361			0.2754	0.3147	0.3468	0.3751	0.4011	0.4255	0.4711	0.5140	0.5552	0.5951	0.6341	0.6724
	h	636.45	1158.6			1215.3	1270.5	1314.5	1352.9	1388.1	1421.2	1483.8	1544.0	1603.4	1662.5	1721.7	1781.0
	s	0.8309	1.3176			1.3697	1.4183	1.4555	1.4867	1.5140	1.5388	1.5833	1.6232	1.6601	1.6947	1.7274	1.7585
1800	Sh					28.98	78.98	128.98	178.98	228.98	278.98	378.98	478.98	578.98	678.98	778.98	878.98
(621.02)	v	0.02472	0.2186			0.2505	0.2906	[illegible]	[illegible]	0.3752	0.3988	0.4426	0.4846	0.5229	0.5604	0.5980	0.634[illegible]
	h	648.49	1152.3			1201.2	1261.1	1307.4	1347.2	1385.3	1417.1	1480.6	1541.4	1601.2	1660.7	1720.1	1779.7
	s	0.8417	1.3079			1.3526	1.4054	1.444[illegible]	1.4768	1.5049	1.5302	1.5753	1.6156	1.6528	1.6876	1.7204	1.7516
1900	Sh					21.44	71.44	121.44	171.44	221.44	271.44	371.44	471.44	571.44	671.44	771.44	871.44
(628.56)	v	0.02517	0.2028			0.2274	0.2687	0.3064	0.3275	0.3571	0.3749	0.4171	0.4565	0.4940	0.5303	0.5656	0.600[illegible]
	h	660.36	1145.6			1185.7	1251.3	1300.2	1341.4	1378.4	1412.9	1477.4	1538.8	1599.1	1658.8	1718.6	1778.4
	s	0.8522	1.2981			1.3346	1.3925	1.4338	1.4672	1.4960	1.5219	1.5677	1.6084	1.6458	1.6808	1.7138	1.7451
2000	Sh					14.20	64.20	114.20	164.20	214.20	264.20	364.20	464.20	564.20	664.20	764.20	864.20
(635.80)	v	0.02565	0.1883			0.2056	0.2488	0.2805	0.3072	0.3312	0.3534	0.3942	0.4320	0.4680	0.5027	0.5365	0.5695
	h	672.11	1138.3			1168.3	1240.9	1292.6	1335.4	1373.5	1408.7	1474.1	1536.2	1596.9	1657.0	1717.0	1771.1
	s	0.8625	1.2881			1.3154	1.3794	1.4231	1.4578	1.4874	1.5138	1.5603	1.6014	1.6391	1.6743	1.7075	1.7389
2100	Sh					7.24	57.24	107.24	157.24	207.24	257.24	357.24	457.24	557.24	657.24	757.24	857.24
(642.76)	v	0.02615	0.1750			0.1847	0.2304	0.2624	0.2888	0.3123	0.3339	0.3734	0.4099	0.4445	0.4778	0.5101	0.5418
	h	683.79	1130.5			1148.5	1229.8	1284.9	1329.3	1368.4	1404.4	1470.9	1533.6	1594.7	1655.2	1715.4	1775.7
	s	0.8727	1.2780			1.2942	1.3661	1.4125	1.4486	1.4790	1.5060	1.5532	1.5948	1.6327	1.6681	1.7014	1.7330
2200	Sh					.55	50.55	100.55	150.55	200.55	250.55	350.55	450.55	550.55	650.55	750.55	850.55
(649.45)	v	0.02669	0.1627			0.1636	0.2134	0.2458	0.2720	0.2950	0.3161	0.3545	0.3897	0.4231	0.4551	0.4862	0.5165
	h	695.46	1122.2			1123.9	1218.0	1276.8	1323.1	1363.3	1400.0	1467.6	1530.9	1592.5	1653.3	1713.9	1774.4
	s	0.8828	1.2676			1.2691	1.3523	1.4020	1.4395	1.4708	1.4984	1.5463	1.5883	1.6266	1.6622	1.6956	1.7273
2300	Sh						44.11	94.11	144.11	194.11	244.11	344.11	444.11	544.11	644.11	744.11	844.11
(655.89)	v	0.02727	0.1513				0.1975	0.2305	0.2566	0.2793	0.2999	0.3372	0.3714	0.4035	0.4344	0.4643	0.4935
	h	707.18	1113.2				1205.3	1268.4	1316.7	1358.1	1395.7	1464.2	1528.3	1590.3	1651.5	1712.3	1773.1
	s	0.8929	1.2569				1.3381	1.3914	1.4305	1.4628	1.4910	1.5397	1.5821	1.6207	1.6565	1.6901	1.7219

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

MASTER COPY

Enclosure 4

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: HATCH 1&2

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 85/03/11

EXAMINER: K E BROCKMAN

APPLICANT: _____

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up ~~six (6)~~ four (4) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
~~20.00~~ 19.00	25.00			1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
20.00	25.00			2. PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
~~20.00~~ 19.00	25.00			3. INSTRUMENTS AND CONTROLS
20.00	25.00			4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
~~80.00~~ 78.00	100.00			TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

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

QUESTION 1.01 (1.00)

Which of the following is NOT CORRECT as applies to the impact of delayed neutrons on reactor operations?

a. When calculating reactor period, the delayed neutron term may be considered INSIGNIFICANT if the reactivity addition is GREATER than Beta.

b. The magnitude of the effective delayed neutron fraction (Beta-bar) is GREATER at EOL than at BOL.

c. The delayed neutron fraction (Beta) is the RATIO of the number of delayed neutrons produced to the number of fission neutrons produced.

d. The presence of delayed neutrons causes the average neutron generation time (l-bar) to INCREASE.

QUESTION 1.02 (1.00)

A steam condenser must remove more heat energy to condense ...(CHOOSE ONE)

a. ...one pound of steam at 300 psia

b. ...two pounds of steam at 600 psia

c. ...two pounds of steam at 1200 psia

d. ...one pound of steam at 15 psia

QUESTION 1.03 (1.00)

Given: A normal power reduction from 90% RTP to 70% RTP by use of recirculation flow. Which of the following statements is TRUE?

a. The pressure difference between the reactor and the turbine steam chest INCREASES due to EHC shutting down.

b. Condensate depression DECREASES due to the decreased steam flow/load on the condenser.

c. Final feedwater temperature DECREASES due to the reduced feedwater heating.

d. Turbine efficiency DECREASES due to INCREASED windage losses in the low pressure stages.

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

QUESTION 1.04 (1.00)

Which of the following statements best describes the operating characteristics of an LPRM detector?

a. Depletion of the detector's Uranium coating causes both the neutron and the gamma sensitivity to DECREASE with detector age; the resulting neutron to gamma signal ratio remains relatively CONSTANT.

b. Since the detector functions as an ionization chamber and the Argon gas pressure remains relatively CONSTANT, BOTH the neutron and the gamma sensitivity, as well as the neutron to gamma signal ratio, remain relatively CONSTANT as the detector ages.

c. Depletion of the detector's Uranium coating causes neutron sensitivity to DECREASE, but has an INSIGNIFICANT effect on gamma sensitivity; this results in a neutron to gamma signal ratio DECREASE as the detector ages.

d. Depletion of the detector's Uranium coating has an insignificant effect on neutron sensitivity, but causes gamma sensitivity to DECREASE; this results in a neutron to gamma signal ratio INCREASE as the detector ages.

QUESTION 1.05 (2.00)

As part of the scram procedure, the operator is directed to insert the SRM's and IRM's.

a. Following a severe LOCA, EXPLAIN how these systems could be used to detect gross core damage. (1.0)

b. EXPLAIN how these systems could be used to provide a crude indication of water level if level could not be confirmed by normal instrumentation. (1.0)

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

QUESTION 1.06 (2.50)

The attached figure represents a transient that could occur at a BWR.

GIVEN: (1) An SRV is manually lifted at time T = 2 min
(2) The SRV is closed at time T = 4.5 min
(3) No other operator actions occur
(4) Recorder speed = 1 division = 1 minute

EXPLAIN the cause(s) of the following recorder indications:

a. Pressure DECREASE (Point A)

b. Total Steam Flow REDUCTION (Point B)

c. Turbine Steam Flow REDUCTION (Point C)

d. Level INCREASE (Point D)

e. NEW STABLE Level (Point E)

QUESTION 1.07 (1.00)

Which of the following is NOT a characteristic of Subcritical Multiplication?

a. The subcritical neutron level is directly proportional to the neutron source strength.

b. Doubling the indicated count rate by reactivity additions will reduce the margin to criticality by approximately one-half.

c. For equal reactivity additions, it takes longer for the new equilibrium count rate to be reached, as K-eff approaches unity.

d. If ten (10) notches of rod withdrawal increased the SRM count rate by 10 cps, then twenty (20) notches of rod withdrawal will increase the SRM count rate by 20 cps. ASSUME CONSTANT ROD WORTH.

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

QUESTION 1.08 (2.00)

The attached figure shows a basic closed loop fluid system with its head vs. flow plot (BOLD LINES). The two pumps are identical, variable speed, radial, centrifugal pumps. Pump 1 is initially operating at one-half speed to supply flow to component 1, as shown.

a. Component 2 is placed into service, thereby increasing the system heat load. Would total power consumption be less by ...(CHOOSE ONE)
(1) Doubling the speed of Pump 1
(2) Starting Pump 2 at one-half speed (0.5)

b. Which Pump Curve - A, B, C, or D - most accurately shows BOTH PUMPS operating to supply the system flow? (0.5)

c. With only Pump 1 operating at one-half speed - If component 2 were throttled open from its initial position, would the system flow INCREASE, DECREASE, or REMAIN THE SAME? (COMPONENTS 1 & 2 ARE IDENTICAL!) (0.5)

d. Given one operating pump, that is changed to a POSITIVE DISPLACEMENT pump. Is the correct Pump Curve to reflect this Curve A, B, C, or D? (0.5)

QUESTION 1.09 (1.50)

MATCH the appropriate Thermal Limit (a-c),

a. Linear Heat Generation Rate (LHGR)
b. Average Planar Linear Heat Generation Rate (APLHGR)
c. Minimum Critical Power Ratio (MCPR)

to each FAILURE MECHANISM, AND to each LIMITING CONDITION given below:

FAILURE MECHANISM	LIMITING CONDITION
F1. Clad melting caused by decay heat & stored heat following a LOCA	L1. Coolant transition boiling
F2. Clad cracking from the surface becoming vapor "blanketed"	L2. Clad plastic strain $\leq$ 1%
F3. Clad cracking caused by high stress from pellet expansion	L3. Maximum clad temperature of 2200 deg F

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

QUESTION 1.10 (1.00)

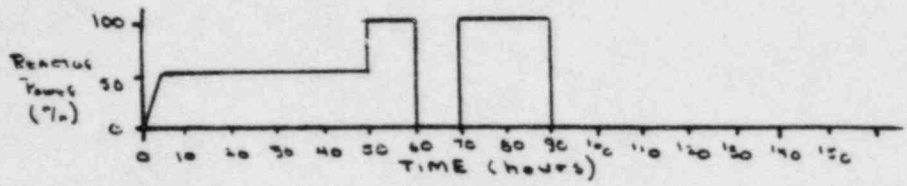
Which of the following describes the changes to the steam that occurs between the inlet and the outlet of a REAL turbine?

a. Enthalpy DECREASES, Entropy DECREASES, Quality DECREASES
b. Enthalpy INCREASES, Entropy INCREASES, Quality INCREASES
c. Enthalpy CONSTANT , Entropy DECREASES, Quality DECREASES
d. Enthalpy DECREASES, Entropy INCREASES, Quality DECREASES

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

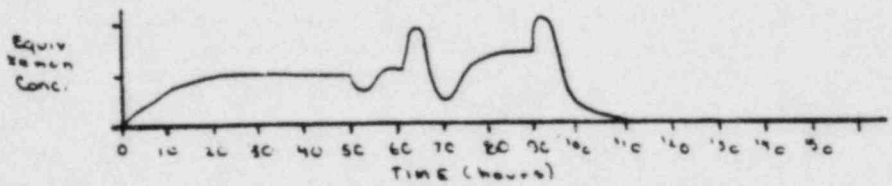
QUESTION 1.11 (1.00)

Given the following Power History:

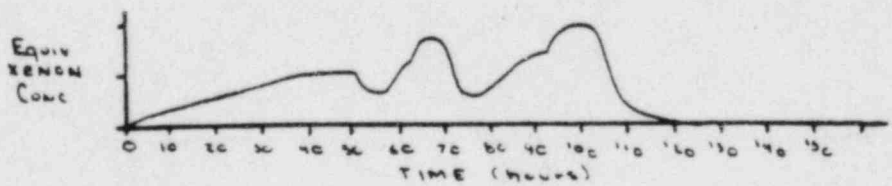


Select the most accurate curve displaying the expected XENON transient.

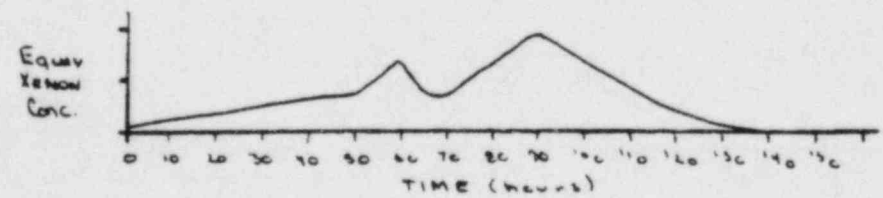
a.



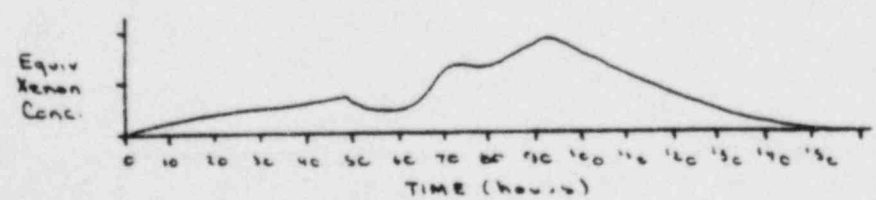
b.



c.



d.



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

QUESTION 1.12 (1.00)

Which of the following accurately describes a benefit of the Control Cell Core (CCC)?

a. The Capacity Factor is increased due to the elimination of rod pattern exchanges.

b. Operations are simplified since flux shaping is no longer required.

c. Thermal Limit margins are increased due to the elimination of all high power fuel bundles.

d. Fuel reliability has been improved due to the increased PCIOMR ramping rates which have been incorporated.

QUESTION 1.13 (1.00)

A reactor heat balance was performed (by hand) during the 00-08 shift due to the Process Computer being OOC. The GAF's were computed, but the APRM GAIN ADJUSTMENTS HAVE NOT BEEN MADE. Which of the following statements is TRUE concerning reactor power?

a. If the feedwater temperature used in the heat balance calculation was LOWER than the actual feedwater temperature, then the actual power is HIGHER than the currently calculated power.

b. If the reactor recirculation pump heat input used in the heat balance calculation was OMITTED, then the actual power is LOWER than the currently calculated power.

c. If the steam flow used in the heat balance calculation was LOWER than the actual steam flow, then the actual power is LOWER than the currently calculated power.

d. If the RWCU return temperature used in the heat balance calculation was HIGHER than the actual RWCU return temperature, then the actual power is LOWER than the currently calculated power.

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

QUESTION 1.14 (~~2.00~~ 1.00)

Given: Reactor Power 60%
Core Flow 40%
T (Tau) .6
Fuel Type P8x8R
Max Flow Rate 107%
Figures 5.4, 5.5, 5.6 Enclosed

~~a. OLMCPR is ...(CHOOSE ONE)~~

~~(1) 1.931~~
~~(2) 1.632~~
~~(3) 1.539~~
~~(4) 1.403~~

Deleted

(1.0)

b. If the MCPR Printout from the Process Computer for Rod 29-17 read 1.973, which of the following would be required per Unit 2 Tech Specs?

(1) No Action Required

(2) Initiate corrective action within 15 minutes and continue the corrective action so that MCPR is within the applicable limit within 2 hours, or reduce thermal power to < 25% within the next 4 hours.

(3) Initiate corrective action within 15 minutes and continue the corrective action so that MCPR is within the applicable limit within 4 hours, or reduce thermal power to < 25% within the next 8 hours.

(4) Place the reactor in HOT SHUTDOWN within 2 hours and reduce steam dome pressure to < 785 psig and core flow to < 10% within the next 4 hours.

QUESTION 1.15 (1.00)

The fission process in a commercial reactor requires the neutrons that are "born" by fission to be "thermalized." The interaction in the reactor core which is most efficient in thermalizing neutrons for fission occurs with the .../CHOOSE ONE

a. OXYGEN atoms in the water molecules
b. BORON atoms in the control rods
c. ZIRCONIUM atoms in the fuel cladding
d. HYDROGEN atoms in the water molecules

QUESTION 2.01 (3.00)

With the plant operating at 100% power (Unit 1) and recirc in Master Manual, an operator inadvertantly DECREASES the 'Pressure Set' by 5 psig. LIST the INITIAL response and the FINAL status of the following parameters due to this action. Briefly EXPLAIN the reasons for these responses. Figure 7.4(7) is attached for reference.

NOTE: ASSUME NO CORRECTIVE OPERATOR ACTIONS
ASSUME TCV STARTS AT THE 100% STEAM FLOW POSITION

Use the attached handout page to answer the question.

a. TCV Position

b. BPV Position

c. Power

d. Pressure

QUESTION 2.02 (1.00)

Backup Scram valves provide a redundant means of venting air from the scram pilot valves and scram discharge valves. These backup valves are ...(CHOOSE ONE)

a. ...normally energized and will de-energize upon a RPS Scram signal.

b. ...aligned such that two valves in series, one from each RPS trip channel, must actuate to vent the scram air header.

c. ...designed such that both RPS channels must trip in order for any one of the valves to actuate.

d. ...powered from the RPS Buses A and B.

QUESTION 2.03 (1.00)

Diesel generators A, B, and C have started and are running in response to a High Drywell Pressure signal on Unit 2. Which of the following conditions will NOT trip the diesel generators?

a. Loss of Excitation

b. High Differential Current

c. Low Lube Oil Pressure

d. Engine Overspeed

QUESTION 2.04 (1.00)

The Reactor Recirculation Pump seal cartridge assemblies consist of two sets of sealing surfaces and breakdown bushing assemblies. Failure of the #2 seal assembly at rated conditions would result in ...(CHOOSE ONE)

a. ...an INCREASE in #2 seal cavity pressure from approximately 500 psig to approximately 1000 psig.

b. ...a DECREASE in #2 seal cavity pressure from approximately 500 psig to approximately 0 psig.

c. ...an INCREASE in #1 seal cavity pressure from approximately 500 psig to approximately 1000 psig.

d. ...a DECREASE in #1 seal cavity pressure from approximately 500 psig to approximatrely 0 psig.

QUESTION 2.05 (2.00)

With regard to the RBCCW System:

a. STATE the relative relationship between the RBCCW system pressure and the pressure(s) of its heat sink and loads. EXPLAIN why this relationship is desirable. (1.0)

b. LIST two (2) loads cooled by RBCCW on Unit 2 that are NOT cooled by RBCCW on Unit 1. (1.0)

QUESTION 2.06 (1.00)

The High Pressure Coolant Injection (HPCI) System utilizes a steam turbine to drive a pair of centrifugal pumps to inject water into the reactor pressure vessel under emergency conditions. The main HPCI pump ...(CHOOSE ONE)

a. ...takes its suction directly from the CST and discharges to the HPCI booster pump, which then 'boosts' the pressure high enough for reactor injection.

b. ...takes its suction from the discharge of the HPCI booster pump which shares a common shaft with the main pump via a speed reduction coupler.

c. ...discharges, at least, 5000 gpm at rated pressure into the 'A' feedwater line, upstream of the feed header flow detectors.

d. ...is driven by a two-stage, Terry turbine, which receives its steam supply from the 'B' main steam line, downstream of the flow restrictors.

QUESTION 2.07 (1.00)

Reactor Feed Pump (RFP) turbine speed is controlled by either a Motor Speed Changer (MSC) or an Electric Automatic Positioner (EAP). The EAP ...(CHOOSE ONE)

a. ...will control the RFP turbine's speed only if its speed signal is greater than that from the MSC.

b. ...is normally used to control feed flow rate over a turbine speed of 0 - 5500 rpm.

c. ...unlike the MSC, does NOT afford the capability of manual speed control by use of a local handwheel.

d. ...will lock in place to prevent a ramp response to a false signal, if it loses its signal from the flow controller.

QUESTION 2.08 (1.00)

Which of the following lists of responses (a - d) CORRECTLY describes the main turbine's response to an OVERSPEED condition?

	RESPONSES			
SPEEDS	(a)	(b)	(c)	(d)
102%	"Master" ICV's begin to throttle	All ICV's begin to throttle	All ICV's begin to throttle	"Master" ICV's begin to throttle
	"Slave" ICV's begin to throttle			"Slave" ICV's begin to throttle
	All ICV's Full Closed	All ICV's Full Closed	All ICV's Full Closed	All ICV's Full Closed
110%	Mechanical O'Spd Trip	Electrical O'Spd Trip	Mechanical O'Spd Trip	Electrical O'Spd Trip
111.5%	Electrical O'Spd Trip	Mechanical O'Spd Trip	Electrical O'Spd Trip	Mechanical O'Spd Trip

QUESTION 2.09 (1.00)

Regarding the Standby Gas Treatment System (SGTS):

LIST the two (2) automatic actions which will occur in the operating train of SGTS, given that the deluge sprinklers for that train receive a valid initiation signal.

QUESTION 2.10 (1.00)

The Drywell Pneumatics System is operating in its normal line-up (Mode B). Pressure DECREASES (to approximately 100 psig). The system will automatically align such that ...(CHOOSE ONE)

a. ...the back-up Nitrogen supply line isolation valve (F001A) will OPEN and the bypass valve (F001B) will CLOSE.

b. ...the back-up Nitrogen supply line isolation valve (F001A) will OPEN and the bypass valve (F001B) will OPEN.

c. ...the Essential/Uninterruptable Instrument Air supply line isolation valves (F029 & F053) will OPEN.

d. ...the Non-essential/Interruptable Instrument Air supply line isolation valves (F036 & F038) will OPEN and the Drywell Pneumatics Compressors will TRIP and ISOLATE.

QUESTION 2.11 (1.00)

Which one of the following accurately describes Low-Low Set (LLS) logic, as applied at Plant Hatch?

a. Lowers BOTH the opening and closing setpoints of the LLS valves.
b. Controls the operation of all relief valves, excepting E and H.
c. Is activated by a position switch which confirms any SRV opening.
d. Is applicable to Unit 2 ONLY.

QUESTION 2.12 (2.00)

Regarding the Residual Heat Removal (RHR) System while operating in the Shutdown Cooling (SDC) mode:

a. STATE why it is necessary to prevent the RHR pump's discharge from decreasing below 400 gpm. (1.0)

b. LIST 2 ways in which the system will be effected if reactor pressure increases to above 135 psig. (1.0)

QUESTION 2.13 (1.00)

The Unit 2 Vital AC Power 120/240 v Distribution Cabinet 2A is normally supplied from 600 v Bus 2D through a Battery Charger and a Static Inverter. If the Static Inverter fails ...(CHOOSE ONE)

a. ... the 125 vdc battery will maintain power to the Vital AC Cabinet for up to 6 hours.

b. ...the power supply can be manually transfered to the alternate 600 v Bus 2C / Vital AC Transformer 2A by depressing a transfer PB.

c. ...the power supply will automatically transfer to the alternate 600 v Bus 2C / Vital AC Transformer 2A.

d. ...the power supply can be manually transfered to the alternate 600 v Bus 2C / alternate Static Inverter by depressing a transfer PB.

QUESTION 2.14 (1.00)

Unit 1 is operating at 48% RTP using Reactor Feedwater Pumps 1A and 1B. Feedwater Line A is isolated (MOV F006A Shut). With this condition a flowpath for RWCU ... (CHOOSE ONE)

a. ...CAN BE MAINTAINED. The RWCU connection to FW Line A is isolated by removing the spool piece between RWCU and the HPCI discharge. RWCU is operated via RCIC and FW Line B.

b. ...CAN BE MAINTAINED. The RWCU connection to FW Line A is isolated by manually valving shut the connection between RWCU and the HPCI discharge. RWCU is operated via RCIC and FW Line B.

c. ...CANNOT BE MAINTAINED. The RWCU flow to FW Line A is not isolable since the RWCU to HPCI discharge connection is not valved.

d. ...CANNOT BE MAINTAINED. RWCU only has a discharge isolation valve on its common discharge header; no FW line can be isolated without securing RWCU.

QUESTION 2.15 (1.00)

Which of the displays of the indicator lights for ATTS indicate that the system is in its normal operating mode with NO ALARM CONDITIONS present? (CHOOSE ONE)

NOTE: FIGURES 9.9(3) AND 9.9(6) PROVIDED FOR REFERENCE

	DISPLAY/COLOR			
LITE/PANEL	(a)	(b)	(c)	(d)
TRIP STATUS/MTU	ON/Green	OUT	ON/Amber	OUT
STATUS/MTU	ON/Green	ON/Green	OUT	On/Red
GROSS FAIL/MTU	ON/Green	OUT	ON/Green	OUT
POWER/P925	ON/Green	ON/Clear	ON/Red	ON/Green

QUESTION 2.16 (1.00)

STATE how (INCREASE, DECREASE, REMAIN THE SAME) Drywell Pressure would be expected to respond to an SRV discharge line vacuum breaker STICKING OPEN during actuation of the SRV. EXPLAIN YOUR CHOICE.

QUESTION 3.01 (1.00)

~~A normal cold plant startup is in progress with the RSCS~~ Sequence Mode Selector (SMS) Switch in 'Withdraw.' When the last 'A-12' rod is fully withdrawn, the operator selects 'A-34' on the Rod Sequence Selector (RSS) Switch to continue the startup. When this is done ...(CHOOSE ONE)

a. ...the dim backlights for all the 'A-12' sequence rods will extinguish, and the backlights for all the 'A-34' sequence rods will illuminate.

b. ...the RSCS will specify that the 'A-34' rods be withdrawn in a specific order, since the withdrawal sequence is hardwired as Subgroups 3 & 4.

c. ...if a 'full-out' reed switch for an 'A-12 or A-34' rod fails, its required input in the RSCS logic may be simulated with the remote bypass switch.

d. ...all the 'A-34' rods should be fully withdrawn; the RSS Switch should then be placed in 'B-12' to allow withdrawal of the 'B' sequence rods.

Deleted

QUESTION 3.02 (1.00)

Each Hydraulic Control Unit (HCU) has a pair of normally CLOSED Scram valves that provide a path for CRD water during a reactor Scram. The Scram inlet valves ...(CHOOSE ONE)

a. ...open faster than the Scram outlet valves in order to provide adequate driving force to the CRD mechanism to ensure positive Scram insertion.

b. ...are normally held closed by air pressure and will open by spring pressure when either one of the two associated Scram pilot air valves is deenergized.

c. ...will not prevent their associated CRD's from Scramming if they fail to open, providing that reactor pressure is greater than 200 psig.

d. ...connect the Scram accumulator to the under-piston port in the Control Rod Drive.

QUESTION 3.03 (3.00)

Assume the following initial rod position distribution:

All rods in Groups 1 - 3 are FULLY WITHDRAWN, except for one rod in each Group --- 22-51 in Group 1, 46-55 in Group 2, and 18-03 in Group 3 (These 3 rods are FULLY INSERTED). All rods in Groups 4 - 10 are FULLY INSERTED to position 00 except for rod 34-27 (Group 4) which is FULLY WITHDRAWN.

Fill in the following table with the Rod/Rod Group number you would expect to see displayed in each RWM window for EACH of the situations (a - c). If nothing will appear, write 'Blank.'

	SITUATIONS		
RWM WINDOW	(a) Initial Conditions (IC)	(b) IC with Rod 34-27 INSERTED to 00	(c) IC with Rod 22-51 withdrawn to [redacted]
ROD GROUP	--------	--------	--------
INSERT ERROR	--------	--------	--------
INSERT ERROR	--------	--------	--------
WITHDRAW ERROR	--------	--------	--------

QUESTION 3.04 (1.00)

The Reactor Manual Control System includes several manual control switches on the 603 Panel; one of these is the 'Rod Out Notch Override' (RONOR) switch. This three-position switch ...(CHOOSE ONE)

a. ...must be held in the 'notch override' position while the 'CRD Control' switch is held in the 'Rod In' position if continuous rod insertion is desired.

b. ...if held in the 'Emergency Rod In' position, will bypass all rod insert blocks except those imposed by the RSCS.

c. ...if held in the 'Emergency Rod In' position, will illuminate an amber light above the switch.

d. ...when used for emergency rod insertion, bypasses the automatic sequence timer and acts directly on the insert bus.

QUESTION 3.05 (2.00)

Regarding the SRV's and the associated Low Low Set (LLS) logic:

There are three lights associated with each SRV - RED, GREEN, and AMBER. EXPLAIN what each of the different colored lights indicates, and STATE whether each would be energized or de-energized during the time the SRV was open as a result of reactor pressure reaching the SRV's relief setpoint.

QUESTION 3.06 (2.00)

With regard to the Off-gas Radiation Monitoring System:

a. LIST the three (3) combinations of radiation instrument trip signals that will cause an Off-gas System auto-isolation. (1.5)

b. LIST the Off-gas System valve(s) which CLOSE on an auto-isolation. (0.5)

QUESTION 3.07 (1.00)

Unit 2 is in the process of a plant startup with reactor power at 3% RTP. SELECT which one of the following signals will result in a Group I Isolation.

a. Reactor water level DECREASES to -55 inches below instrument zero.

b. MSL tunnel temperature INCREASES to 200 deg F.

c. Reactor pressure DECREASES to 825 psig.

d. Drywell pressure INCREASES to 1.85 psig.

QUESTION 3.08 (1.00)

Given a Low CST Level on Unit 1 AND a High Torus Level on Unit 2. Which one of the following accurately describes the responses of the HPCI and RCIC Systems?

a. BOTH units' HPCI AND RCIC will auto-swap to Torus Suction.
b. Unit 2 HPCI AND RCIC will auto-swap to Torus Suction; Unit 1 will auto-swap for HPCI ONLY.
c. Unit 1 HPCI AND RCIC will auto-swap to Torus Suction; Unit 2 will auto-swap for HPCI ONLY.
d. BOTH units' HPCI will auto-swap to Torus Suction; RCIC does not swap

3. INSTRUMENTS AND CONTROLS

QUESTION 3.09 (1.00)

Given: Unit 2 in control of D/G "B"
D/G "B" Mode Switch in TEST (Surveillance being performed)
Electrical distribution NORMAL (Full Power Lineup)

D/G "B" is at rated speed and voltage, but not synchronized, when power is lost to 4160 volt Bus 2F. Which of the following accurately describes the system operation?

a. Bus 2F can be powered by D/G "B" when the operator takes the Output Breaker Switch to CLOSE and has the SYNC SCOPE activated.

b. Bus 2F will be powered by D/G "B" automatically, after 12 seconds; appropriate loads will be picked up sequentially.

c. Bus 2F can not be powered by D/G "B" while it is in the TEST mode, given these conditions.

d. Bus 2F can be powered by D/G "B" when the operator resets the Lockout Relay, activates the SYNC SCOPE, and takes the Output Breaker to CLOSE.

QUESTION 3.10 (1.00)

The Main Turbine first stage pressure switches provide permissives and/or control signals for several plant functions. Which of the following is NOT one of these control functions?

a. Recirculation Pump RPT breaker trip permissive
b. RCIC bypass
c. RWM LPAP
d. TSV, 10% Closure Scram bypass

3. INSTRUMENTS AND CONTROLS

QUESTION 3.11 (1.00)

The Recirculation Flow Control System contains a 44% Speed Limiter to control Recirculation pump speed under certain plant conditions. This 44% Limiter ...(CHOOSE ONE)

a. ...is first activated when total feedwater flow decreases below 70% and a reactor vessel low water level alarm is received.

b. ...is designed to prevent Recirculation pump cavitation by ensuring adequate Net Positive Suction Head.

c. ...enables the FWCS to recover reactor vessel water level upon loss of one Reactor Feedwater pump.

d. ...automatically resets when the initiating signal clears to enable the operator to restore normal recirculation flow.

QUESTION 3.12 (2.00)

With regard to the Unit 2 HPCI System:

a. LIST the two (2) conditions (including setpoints) which will automatically initiate HPCI. (1.0)

b. For each of the situations listed below, STATE whether HPCI WILL or WILL NOT Automatically Inject into the reactor vessel. (1.0)

NOTE: ASSUME NO OPERATOR ACTIONS; ASSUME ANY FAILED COMPONENTS WERE IN THE FAILED CONDITION AT THE TIME OF THE AUTO INITIATION SIGNAL.

(1) The GLAND SEAL EXHAUSTER VACUUM PUMP fails to operate.

(2) The MINIMUM FLOW VALVE fails to auto open (stays shut) when system conditions require it to be open.

(3) After decreasing to 50 psig, HPCI Steam Line Pressure increases to 150 psig.

(4) After increasing to +60 inches, Reactor Vessel Water Level decreases to -60 inches.

QUESTION 3.13 (1.00)

The Unit 1 Primary Containment Atmospheric Control System can be used to vent the primary containment under normal operating conditions. To do this, the operator must manipulate the key-locked bypass switches. The direct effect of doing this, and the method by which this is done, is to ...(CHOOSE ONE)

a. ...override the HI MSL PRESSURE (> 850 psig) isolation signal by HOLDING the bypass switches in the BYPASS position.

b. ...override the HI MSL PRESSURE (> 850 psig) and the LOCA isolation signals by HOLDING the bypass switches in the BYPASS position.

c. ...override the HI MSL PRESSURE (> 850 psig) isolation signals by PLACING the bypass switches in the BYPASS position.

d. ...override the HI MSL PRESSURE (> 850 psig) and the LOCA isolation signals by PLACING the bypass switches in the BYPASS position.

QUESTION 3.14 (1.00)

Which of the following statements correctly describes the protective trip function(s) associated with the Reactor Recirculation pumps motor generator sets?

a. The "EOC-RPT" trip protects the plant from overpressurization transients (e.g. MSIV Closure) by tripping the recirculation pumps, when reactor pressure exceeds 1120 psig.

b. The motor generator field breaker stays closed in most instances when the MG Set drive motor breaker trips, in order to maximize coastdown flow.

c. The two "EOC-RPT" breakers for each recirculation pump are redundant to the MG Set drive motor breakers, and interrupt power to the MG Set during overpressurization transients.

d. The reactor recirculation pumps trip on low low reactor vessel water level, to ensure Net Positive Suction Head (NPSH) requirements are met.

QUESTION 3.15 (1.00)

A reactor startup/power ascent is in progress with the "B" IRM failed upscale and in BYPASS. The mode switch has just been taken to "Run". WHICH one of the following situations/events will cause a reactor HALF-SCRAM?

a. APRM Flow Converter (Unit) "A" goes INOP
b. APRM "B" fails DOWNSCALE
c. One of the 11 valid LPRM inputs to APRM "B" fails DOWNSCALE
d. APRM "B" Mode Switch is taken to STANDBY

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

QUESTION 4.01 (1.00)

Procedure HNP-2-1902, "Pipe Break Inside Primary Containment", lists numerous conditions indicative of a break. Which of the following supports the suspicion of a SMALL break inside containment.

a. Decrease in reactor water level; pressure and/or temperature increase in Drywell; airborne activity increase in Drywell; increased DWFDS operating frequency.

b. Decrease in reactor pressure; pressure and/or temperature increase in Drywell; generator load decrease; DWFDS high level.

c. Reactor Scram from low water level; pressure and/or temperature increase in Drywell; generator load decrease; increased DWFDS operating frequency.

d. Reactor Scram from high Drywell pressure; generator load decrease; airborne activity increase in Drywell; DWFDS high level.

QUESTION 4.02 (1.00)

The reactor is at power and the CRD System is lost. Per HNP-2-1940, "Loss of CRD Systems", if the operator CANNOT restore CRD flow, he should ...(CHOOSE ONE)

a. ... with reactor pressure less than 800 psig, and more than five (5) accumulator trouble lights, commence a fast reactor shutdown.

b. ... with reactor pressure greater than 800 psig, and five (5) adjacent accumulator trouble lights or thirty (30) total trouble lights, manually Scram the reactor.

c. ... with reactor pressure less than 800 psig, and more than three (3) accumulator trouble lights, manually Scram the reactor.

d. ... with reactor pressure greater than 800 psig, and three (3) adjacent accumulator trouble light's or thirty (30) total trouble lights, commence a fast reactor shutdown.

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

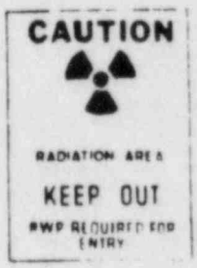
QUESTION 4.03 (1.50)

Procedure HNP-8008, "Radiation Work Permit", provides guidance for where the ORIGINAL copy of RWP's should be maintained. MATCH the proper location with the type of RWP.

TYPE OF RWP	LOCATION
a. Routine RWP	1. Main Control Room
	2. Job Site Entrance (Unattended)
b. Blanket RWP	3. Job Site Control Point (Attended)
	4. H.P. Office
c. Regular RWP	5. Radwaste Control Room
	6. Security Building (CAS)

QUESTION 4.04 (.50)

You enter an area posted with the following sign:



As a minimum, how often should you read your pocket dosimeter?

QUESTION 4.05 (1.00)

Regarding Hatch procedures, in general, EXPLAIN when you would expect to see a CAUTION statement AND when you would expect to see a WARNING statement. (Include the difference between the two)

QUESTION 4.06 (1.00)

Procedure HNP-501, "Equipment Clearance and Tagging", states:

"Under no circumstances is anyone ever authorized to attach or remove a red HOLD tag without first having a proper clearance. The only exception to this is ..." (CHOOSE ONE)

a. ...to isolate DC systems of less than 24 vdc.

b. ...to rack in/rack out a station service feeder breaker.

c. ...to isolate multi-divisional power transmission circuits.

d. ...to rack in/rack out bus ties of 480 vac, or less.

QUESTION 4.07 (2.00)

Procedure HNP-2-1909, "Inability to Shutdown With Control Rods", states that:

"... if at any time, either condition b(1) or b(2) exists, and either _____(a.1)____ or ____(a.2)____, and if it is obvious that the reactor cannot be shutdown and, in the judgment of the Shift Supervisor, or in his absence, a licensed operator, a hazard exists to the environs, personnel, or the plant, utilize the standby liquid control system per HNP-2-1400 ..."

a. LIST conditions (a.1) and (a.2). (1.0)

b. LIST conditions b(1) and b(2). (1.0)

QUESTION 4.08 (1.00)

You enter HNP-2-1910, "Loss of All Plant Service Water", and are unable to restore PSW operation. Subsequent operator actions require you to place Fuel Pool Cooling in operation at maximum flow. This is done to ...(CHOOSE ONE)

a. ... provide a long-term heat sink for RHRSW via the Fuel Pool Cooling Assist connection.

b. ... prepare for the high heat load from the impending reactor shutdown and required fuel unload.

c. ... provide a long term heat sink for TBCCW.

d. ... provide a short term heat sink for RBCCW.

QUESTION 4.09 (1.00)

A CAUTION in HNP-2-1902, "Pipe Break Inside Primary Containment", states that:

> "A Pipe Break in the Drywell could result in Reactor Level Reading inaccuracies due to increased temperature. Refer to Section "E" ... for erratic correction method before proceeding. Erratic level indication could be due to water in the sensing line flashing to steam."

Using Section "E", enclosed, and given the following readings:

2T47-R620	192 deg F
2T47-R621	228 deg F
2B21-604A	+26 inches
2B21-604B	+23 inches

What is the best estimate of Actual Water Level?

a. +9-1/2 inches
b. +15 inches
c. +34 inches
d. +27-1/2 inches

QUESTION 4.10 (1.00)

Both Recirculation Pumps trip. You place the Mode Switch to SHUTDOWN but are, subsequently, UNSUCCESSFUL in restarting either Recirc Pump.

COMPLETE THE FOLLOWING: (HNP-2-1932)

"Subsequent to Reactor Shutdown, and without both recirculation pumps operating, maintain vessel level from (greater than) ____(a)____, to ensure ____(b)____."

QUESTION 4.11 (1.00)

Procedure HNP-2-1934, "Torus Water Temperature Above 95 deg F", directs:

"If any point indicates a torus temperature greater than or equal to 95 deg F, initiate torus cooling..."

Additionally,

"Operator should not initiate torus cooling unless water level is ___(1)___ and at a level greater than ___(2)___."

Which of the following are the MINIMUM requirements for (1) and (2)?

a. (1) Stable
(2) that required for Natural Circulation

b. (1) Increasing
(2) Top of Active Fuel

c. (1) Stable
(2) 2/3 Core Height

d. (1) Increasing
(2) Reactor Vessel Zero

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

QUESTION 4.12 (2.00)

Place the following procedural steps from HNP-2-1001 into the proper sequence, as they would be performed during an actual reactor plant startup and pressurization according to the procedure:

a. Stabilize reactor power with 1-1/2 BPV's open
b. Start a Mechanical Vacuum Pump
c. Open the Steam Seal Feed and Bypass Valves
d. Establish vessel water reject thru the RWCU System
e. Place a SJAE into service
f. Start a Steam Packing Exhauster
g. Place RCIC in Standby, per HNP-2-1125
h. Start Reactor Feedwater Pump 2A (or 2B)

QUESTION 4.13 (1.00)

Procedure HNP-2-4207, "Transformer Fire", lists three (3) Operator Action Steps for a Startup Auxiliary Transformer fire. Which of the following is NOT a required Operator Action?

a. Confirm CARDOX system actuated.
b. Manually start the required D/G's and synchronize to the E-bus.
c. Deenergize the Transformer.
d. Evaluate the plant conditions for possible shutdown.

QUESTION 4.14 (2.00)

Procedure HNP-2-1001, "Normal Startup", instructs the operator to:

REAC Water level select switch (select level B; level A to be used only when performing maintenance or surveillance on level B).

NOTE: FIGURE 2.3(2) IS PROVIDED AS REFERENCE

EXPLAIN why level B is specified.

QUESTION 4.15 (1.00)

Procedure HNP-2-1437, "Reactor Recirculation Pump Speed Changes", cautions the operator not to start an idle pump unless the other pump is operating at < 50% loop speed.

EXPLAIN the reason for this procedural CAUTION.

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

QUESTION 4.16 (1.00)

Procedure HNP-2-1005, "Power Changes", states that Unit 2's licensed maximum thermal power for steady state operations is 2436 MWT.

EXPLAIN in what instance(s) this maximum power may be exceeded and how this is verified.

QUESTION 4.17 (1.00)

Which of the following is NOT required to be immediately verified or executed by the operator in response to a "Suspected Fuel Element Failure", per HNP-2-1930?

a. Verify the Off-gas adsorber bypass valve (F043) CLOSES on an Off-gas Pre-treatment high alarm.

b. Verify the Off-gas stack inlet valve (F057) CLOSES on an Off-gas Post-treatment high-high-high alarm.

c. Lock out all the Drywell and Reactor Building Sump pumps until analysis can be performed, or the SS's approval.

d. DO NOT reject any reactor water to the Main Condenser or Radwaste without the SS's approval.

MASTER COPY

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 1.01 (1.00)

b

REFERENCE
EIH, GPNT, Vol VII, Chapter 10.1-48,49,59,60

ANSWER 1.02 (1.00)

b

REFERENCE
Steam Tables

ANSWER 1.03 (1.00)

c

REFERENCE
EIH, GPNT, Vol VII, Chapter 1).4-11: Thermodynamics LP, pp 75-78

ANSWER 1.04 (1.00)

c

REFERENCE
EIH, GPNT, Vol. II, Chapter 3.E: Nuclear Power Reactor Instrumentation Systems Handbook, Harrer & Beckerly, p 44.

ANSWER 1.05 (2.00)

a. By observing the Full-in and Full-out travel lights (the operator could determine if geometric distortion had occured. Inability to conduct full detector movement would indicate that internal misconfiguration had occured). (1.0)

b. By observing the neutron level while moving the nuclear instrumentation. A significantly HIGHER (approximately 300 times) count rate would be seen for the UNVOIDED areas of the core as opposed to the VOIDED. (1.0)

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH.L-RQ-540 (M.8)

ANSWER 1.06 (2.50)

a. Pressure decrease is from the reduced head losses associated with the steam flow (flow through the SRV requires less driving force). (0.5)

b. Indicated total steam flow is reduced since less steam is "seen" by the flow restrictors. The SRV is upstream of the flow sensors. - OR - EHC reduces flow in response to pressure decrease. Less flow is "seen" by the flow restrictors. (0.5)

c. Turbine steam flow is reduced by the EHC system proportionate to the SRV release (interactive with pressure control). (0.5)

d. Level increase is experienced in the annulus as the pressure reduction causes void formations in the core. (0.5)

e. (Level reduction is controlled by the FWCS). Level is stabilized at a point where the level error matches the steam flow/feed flow mismatch signal. (0.5)

REFERENCE
EIH. GPNT. Vol VII. Chapter 10.4

ANSWER 1.07 (1.00)

d

REFERENCE
EIH. L-RQ-605 (15)

ANSWER 1.08 (2.00)

a. (2) - Starting Pump 2 (0.5)
b. Curve B (0.5)
c. INCREASE (0.5)
d. Curve C (0.5)

REFERENCE
Pump Laws

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 1.09 (1.50)

F1. b
F2. c
F3. a
L1. c
L2. a
L3. b (.25 each)

REFERENCE
EIH, GPNT, Vol VII, Chapter 10.2-23

ANSWER 1.10 (1.00)

d

REFERENCE
EIH, L-RQ-667 (3), L-RQ-654

ANSWER 1.11 (1.00)

b - OR - d

REFERENCE
EIH, GPNT, Vol VII, Chapter 10.1-83-86

ANSWER 1.12 (1.00)

a

REFERENCE
EIH, L-RQ-675

ANSWER 1.13 (1.00)

b

REFERENCE
EIH, L-RQ-667 (10)

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 1.14 1.00 (~~1.00~~)

~~a. (3)~~ Deleted

b. (1)

REFERENCE
EIH, L-RQ-672 (15); U2 TS 3.2.3

ANSWER 1.15 (1.00)

d

REFERENCE
EIH, L-RQ-602 (9)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 2.01 (3.00)

INITIAL RESPONSE:

a. TCV's - Remain at 100% Open (0.25)
b. BPV's - Open (16.5%) (0.25)
c. Power - Decreases (0.25)
d. Pressure - Decreases (0.25)

REASON: Above caused by PCU calling for 115% steam flow. ((950-915) x 3.3) (0.5)

FINAL STATUS

a. TCV's - At 100% Position (0.25)
b. BPV's - Shut (0.25)
c. Power - Lower (slightly) (0.25)
d. Pressure - Lower (slightly) (0.25)

REASON: Above caused by the decrease in pressure and power causing BPV's to shut -- PCU cycling to new equilibrium state ((945 - 915) x 3.3) (0.5)

REFERENCE
EOI, GPNT, Vol VII, Chapter 9.4

ANSWER 2.02 (1.00)

b

REFERENCE
EOI, GPNT, Vol V, Chapter 2.5-7 & Chapter 4.2-11,14

ANSWER 2.03 (1.00)

a

REFERENCE
EOI, L-RQ-742 (6)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 2.04 (1.00)

b

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1

ANSWER 2.05 (2.00)

a. RBCCW pressure is lower than both its load and heat sink pressures. (0.5) This is to ensure that any leakage from the heat sink or the potentially contaminated loads is contained in the RBCCW system. (0.5)

b. Recirculation MG Set Coolers
Reactor Water Sample Cooler
Recirculation Pump Motor Cooler
Drywell Pneumatic System Coolers (2 @ 0.5 each)

REFERENCE
EIH, GPNT, Vol. VI, Chapter 6.6-2; L-RO-736 (4)

ANSWER 2.06 (1.00)

b

REFERENCE
EIH, L-RO-725 (Fig. 5.3.1); L-RO-740 (7.24); GPNT, Vol.VI, Chapter 8.1

ANSWER 2.07 (1.00)

d

REFERENCE
EIH, HNP-[illegible]-1001;

ANSWER 2.08 (1.00)

a

REFERENCE
EIH, GPNT, Vol. VI, Chapter 9.3-2; Vol. VII, Chapter 9.4-19, 20

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 2.09 (1.00)

Heaters Trip
Fan Trips
Isolation Valves (Dampers) Close (2 req'd @ 0.5 each)

REFERENCE
EIH, GPNT, Vol. V, Chapter 3.3-7, 9, 10; L-RQ-748 (4,6)

ANSWER 2.10 (1.00)

b

REFERENCE
EIH, L-RQ-752, DCR 80-111; L-RQ-734

ANSWER 2.11 (1.00)

a

REFERENCE
EIH, GPNT, Vol V, Chapter 5.1.II.8

ANSWER 2.12 (2.00)

a. To prevent a loss of reactor water inventory to the Torus (0.8) through the Minimum Flow Valve (0.2)

b. SDC PCIS Valves (F008 & F009) - Auto Close
All running RHR Pumps - Trip
Head Spray Valve (F023) - Auto Closes (2 req'd @ 0.5 each)

REFERENCE
EIH, GPNT, Vol V, Chapter 4.4-15,17; GPNT, Vol VI, Chapter 8.3.c.3; HNP-2-1114, p6

ANSWER 2.13 (1.00)

b

REFERENCE
EIH, L-RQ-733, p11, Fig 4

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 2.14 (1.00)

b

REFERENCE
EIH, GPNT, Vol VI, Chapter 5.3; DCP 83-87

ANSWER 2.15 (1.00)

b

REFERENCE
EIH, L-RQ-704 (6)

ANSWER 2.16 (1.00)

INCREASE (0.5) The vacuum breaker provides a direct path to the DRYWELL. (0.5)

REFERENCE
EIH, GPNT, Vol V, Chapter 3.1; NUREG/BR-005/Vol 3, No 4, Power Reactor Events, Jan 84, p 5 (Hatch occurance 8/25/82)

3. INSTRUMENTS AND CONTROLS

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 3.01 (1.00)

~~d~~ Deleted.

REFERENCE
EIH, GPNT, Vol. VII, Chapter 9.2.3-1,2

ANSWER 3.02 (1.00)

d

REFERENCE
EIH, GPNT, Vol. V, Chapter 2.3-5,20, Chapter 4.2.1-14,15

ANSWER 3.03 (3.00)

	(a)	(b)	(c)	
ROD GROUP	03	03	04	
INSERT ERROR	22-51	22-51	18-03	
INSERT ERROR	46-55	46-55	46-55	
WITHDRAW ERROR	34-27	Blank	Blank	(.25 each)

REFERENCE
EIH, GPNT, Vol. VII, Chapter 9.2.2

ANSWER 3.04 (1.00)

d

REFERENCE
EIH, GPNT, Vol. VII, Chapter 9.2.1-4,5,11,13

3. INSTRUMENTS AND CONTROLS

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 3.05 (2.00)

RED - Solenoid control valve has energized (0.33);
De-energized (0.33)

GREEEN - Power available to the solenoid control valve (0.33)
Energized (0.33)

AMBER - Pressure in tailpipe (>85 psig) (0.33)
Energized (0.33)

REFERENCE
EIH, GPNT, Vol. VI, Chapter 5.1.II.B.2

ANSWER 3.06 (2.00)

a. 2 upscale Hi Hi Hi radiation trips
1 upscale Hi Hi Hi radiation trip and 1 downscale trip
2 downscale trips - 1 from each channel (0.5 each)

b. Off-gas System Outlet and Drain valves, OR
Discharge valve to the stack, cooler condenser and moisture
separator drain valves, and holdup line drain valve. (0.5)

REFERENCE
EIH, GPNT, Vol. VI, Chapter 6.8-21; Vol. VII, Chapter 9.7-1-7; HNP-2-2067

ANSWER 3.07 (1.00)

D

REFERENCE
EIH, GPNT, Vol. V, Chapter 3.1-Fig 3.1(3); L-RQ-704, Fig 9.9(9)

ANSWER 3.08 (1.00)

A

REFERENCE
EIH, L-RQ-750; DCR 81-175; GPNT, Vol V, Chapter 4.5; GPNT, Vol VII,
Chapter 8.1

3. INSTRUMENTS AND CONTROLS

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 3.09 (1.00)

c

REFERENCE
EIH, GPNT, Vol VI, Chapter 7.2; EIH Simulator

ANSWER 3.10 (1.00)

c

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1-9; GPNT, Vol VI, Chapter 5.5-10;
GPNT, Vol VII, Chapters 9.2.2-11 and 9.2.3-5

ANSWER 3.11 (1.00)

c

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1-23

ANSWER 3.12 (2.00)

a. 1.85 psig (.25) in Drywell (.25) and/or Lo Lo Level (.25)
of - 55 inches (.25)

b. (1) WILL
(2) WILL
(3) WILL NOT
(4) WILL (.25 each)

REFERENCE
EIH, GPNT, VOL VI, Chapter 8.1

ANSWER 3.13 (1.00)

c

REFERENCE
EIH, L-RO-752; DCR 79-443; HNP-1-1500

3. INSTRUMENTS AND CONTROLS

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 3.14 (1.00)

b - OR - d

REFERENCE
EIH, GFNT, Vol. V, Chapter 4.1-26; L-RQ-714 (14)

ANSWER 3.15 (1.00)

d

REFERENCE
EIH, L-RQ-719 (6,9); L-RQ-720 (10)

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 4.01 (1.00)

d

REFERENCE
EIH, HNP-2-1902

ANSWER 4.02 (1.00)

c

REFERENCE
EIH, HNP-2-1940, p1

ANSWER 4.03 (1.50)

a. 3 (0.5)
b. 4 (0.5)
c. 2 (0.5)

REFERENCE
EIH, HNP-8008, pp 4, 7, 8

ANSWER 4.04 (.50)

Every 30 minutes (1/2 credit for more conservative response)

REFERENCE
GET Handbook, p 25

ANSWER 4.05 (1.00)

CAUTION - Equipment damaging conditions exist (0.5)

WARNING - Personnel injury hazards exist (0.5)

REFERENCE
EIH, HNP-9, p 25

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 4.06 (1.00)

b

REFERENCE
EIH, HNP-501, pp 8.15

ANSWER 4.07 (2.00)

a) 1. RPV level cannot be maintained (0.5)
2. Suppression Pool water temperature cannot be maintained below 110 deg F (0.5)

b) 1. Five (5), or more adjacent control rods not inserted below the 06 position (0.5)
2. Thirty (30), or more total control rods not inserted below the 06 position. (0.5)

REFERENCE
EIH, HNP-2-1909

ANSWER 4.08 (1.00)

d

REFERENCE
EIH, HNP-2-1910

ANSWER 4.09 (1.00)

b

REFERENCE
EIH, HNP-2-1902

ANSWER 4.10 (1.00)

a) + 570 ° from Vessel Zero -OR- + 53° from Instrument Zero (0.5)

b) (a flow path for) Natural Circulation (0.5)

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, HNP-2-1932

ANSWER 4.11 (1.00)

c

REFERENCE
EIH, HNP-2-1934,p1

ANSWER 4.12 (2.00)

d (.25); f, c, b (.75); g (.25); h (.25); e (.25); a (.25)

REFERENCE
EIH, HNP-2-1001, pp 18, 19, 20, 22, 23, 28, 29

ANSWER 4.13 (1.00)

a

REFERENCE
EIH, HNP-2-4207, p2

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 4.14 (2.00)

"B" is normally selected because a failure in the "A/C" side, causing the transmitters to sense a LOW level, would cause the following:

A turbine trip on High Level (58") would not occur (0.5)

If "A" transmitter were selected, a false signal would be sent out to the controllers to increase level (0.5)

Level would continue to increase until the operator terminated the transient

With "B" selected, a failure of the "A" transmitter would not result in level change since the "B" transmitter has not failed. (But still do not have 2 out of 3 trip available) (0.5)

Failure of "B" transmitter with "B" selected would cause water level change, but the 2 out of 3 trip would still provide protection. (0.5)

REFERENCE
EIH, L-R0-726; GPNT, Vol VI, Chapter 5.3

ANSWER 4.15 (1.00)

To preclude establishing excessive stresses in the jet pumps due to flow reversals - OR - to prevent excessive radial bearing loads (on the recirc pumps)

REFERENCE
EIH, HNP-2-1437, 05; GPNT, Vol V, Chapter 4.1

ANSWER 4.16 (1.00)

Maximum licensed thermal power may be exceeded in the instances of THERMAL SPIKES.(0.5) Verification is accomplished by use of OD-3 Printouts from the Process Computer.(0.5)

REFERENCE
EIH, HNP-2-1005, pp 1,2

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 4.17 (1.00)

B

REFERENCE
EIH, HNP-2-1930

QUESTION	VALUE	REFERENCE
01.01	1.00	KEB0000065
01.02	1.00	KEB0000066
01.03	1.00	KEB0000067
01.04	1.00	KEB0000068
01.05	2.00	KEB0000069
01.06	2.50	KEB0000070
01.07	1.00	KEB0000151
01.08	2.00	KEB0000152
01.09	1.50	KEB0000153
01.10	1.00	KEB0000154
01.11	1.00	KEB0000155
01.12	1.00	KEB0000156
01.13	1.00	KEB0000157
01.14	2.00	KEB0000158
01.15	1.00	KEB0000159
	20.00	
02.01	3.00	KEB0000071
02.02	1.00	KEB0000072
02.03	1.00	KEB0000073
02.04	1.00	KEB0000074
02.05	2.00	KEB0000075
02.06	1.00	KEB0000076
02.07	1.00	KEB0000077
02.08	1.00	KEB0000093
02.09	1.00	KEB0000094
02.10	1.00	KEB0000160
02.11	1.00	KEB0000161
02.12	2.00	KEB0000162
02.13	1.00	KEB0000163
02.14	1.00	KEB0000164
02.15	1.00	KEB0000165
02.16	1.00	KEB0000166
	20.00	
03.01	1.00	KEB0000080
03.02	1.00	KEB0000081
03.03	3.00	KEB0000082
03.04	1.00	KEB0000083
03.05	2.00	KEB0000084
03.06	2.00	KEB0000085
03.07	1.00	KEB0000150
03.08	1.00	KEB0000167
03.09	1.00	KEB0000168
03.10	1.00	KEB0000169
03.11	1.00	KEB0000170
03.12	2.00	KEB0000171
03.13	1.00	KEB0000172

QUESTION	VALUE	REFERENCE
03.14	1.00	KEB0000173
03.15	1.00	KEB0000174
	20.00	
04.01	1.00	KEB0000086
04.02	1.00	KEB0000087
04.03	1.50	KEB0000088
04.04	.50	KEB0000089
04.05	1.00	KEB0000090
04.06	1.00	KEB0000091
04.07	2.00	KEB0000175
04.08	1.00	KEB0000176
04.09	1.00	KEB0000177
04.10	1.00	KEB0000178
04.11	1.00	KEB0000179
04.12	2.00	KEB0000180
04.13	1.00	KEB0000181
04.14	2.00	KEB0000182
04.15	1.00	KEB0000183
04.16	1.00	KEB0000184
04.17	1.00	KEB0000185
	20.00	
	20.00	
	80.00	

SRV OPEN/CLOSE

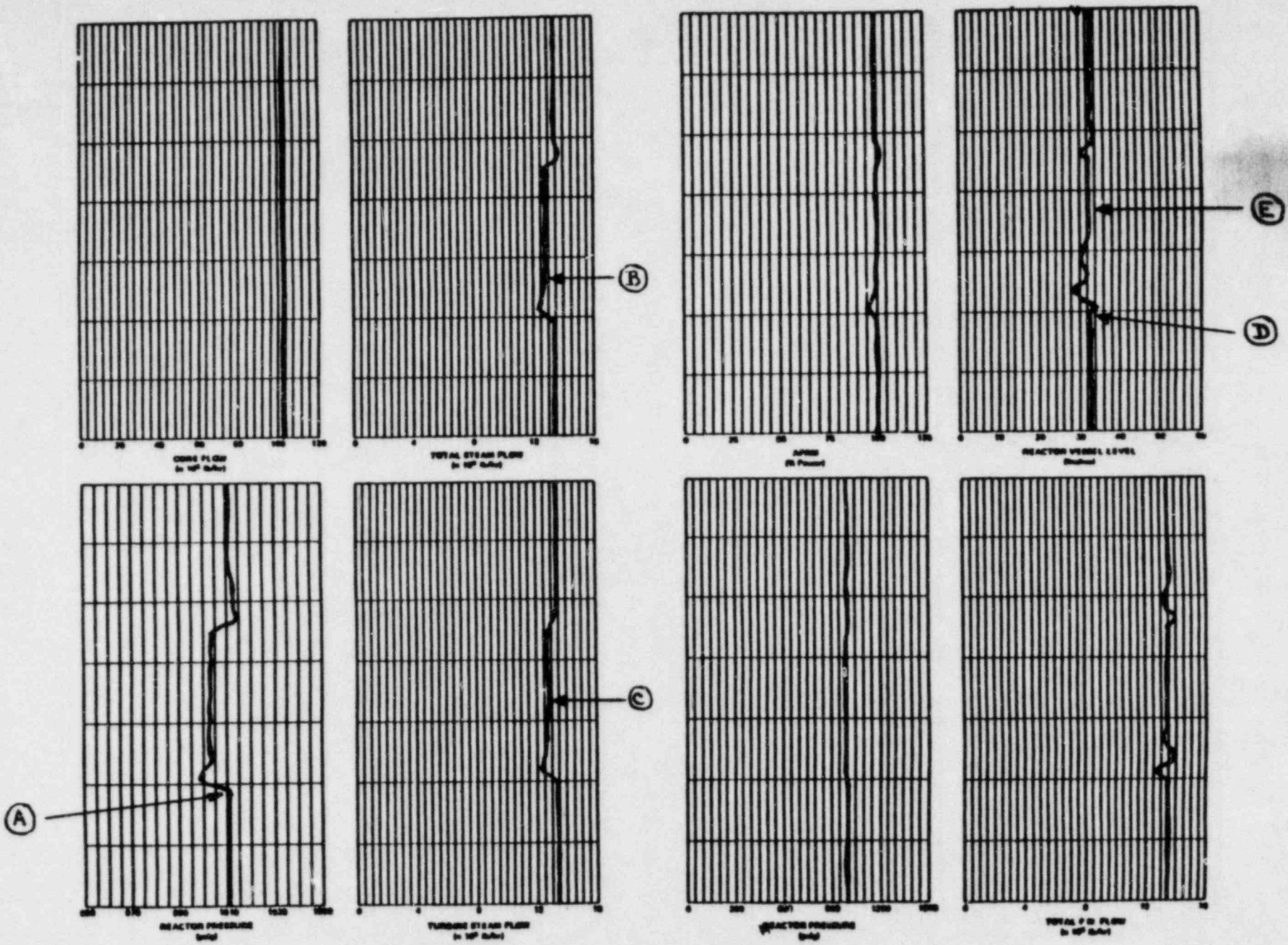
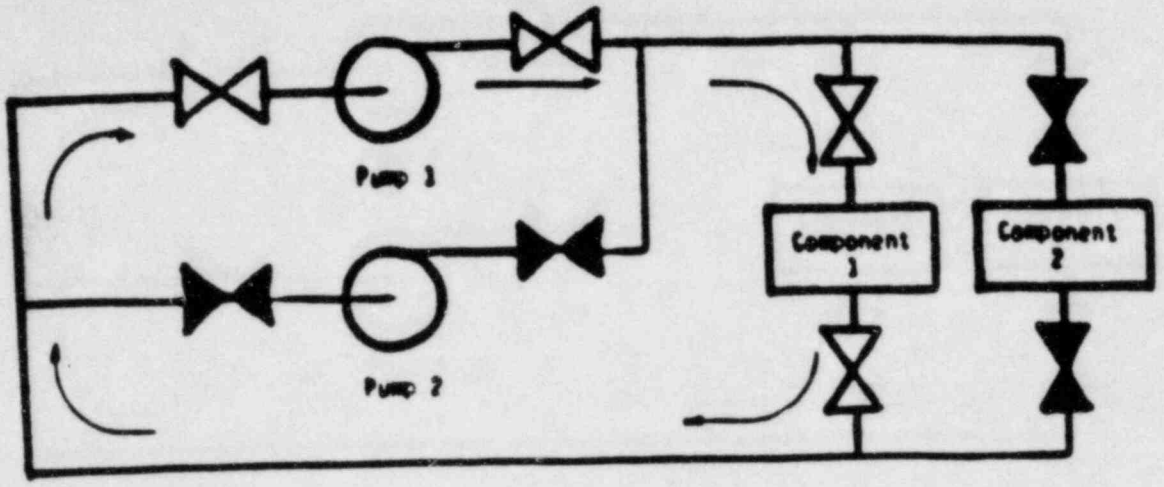
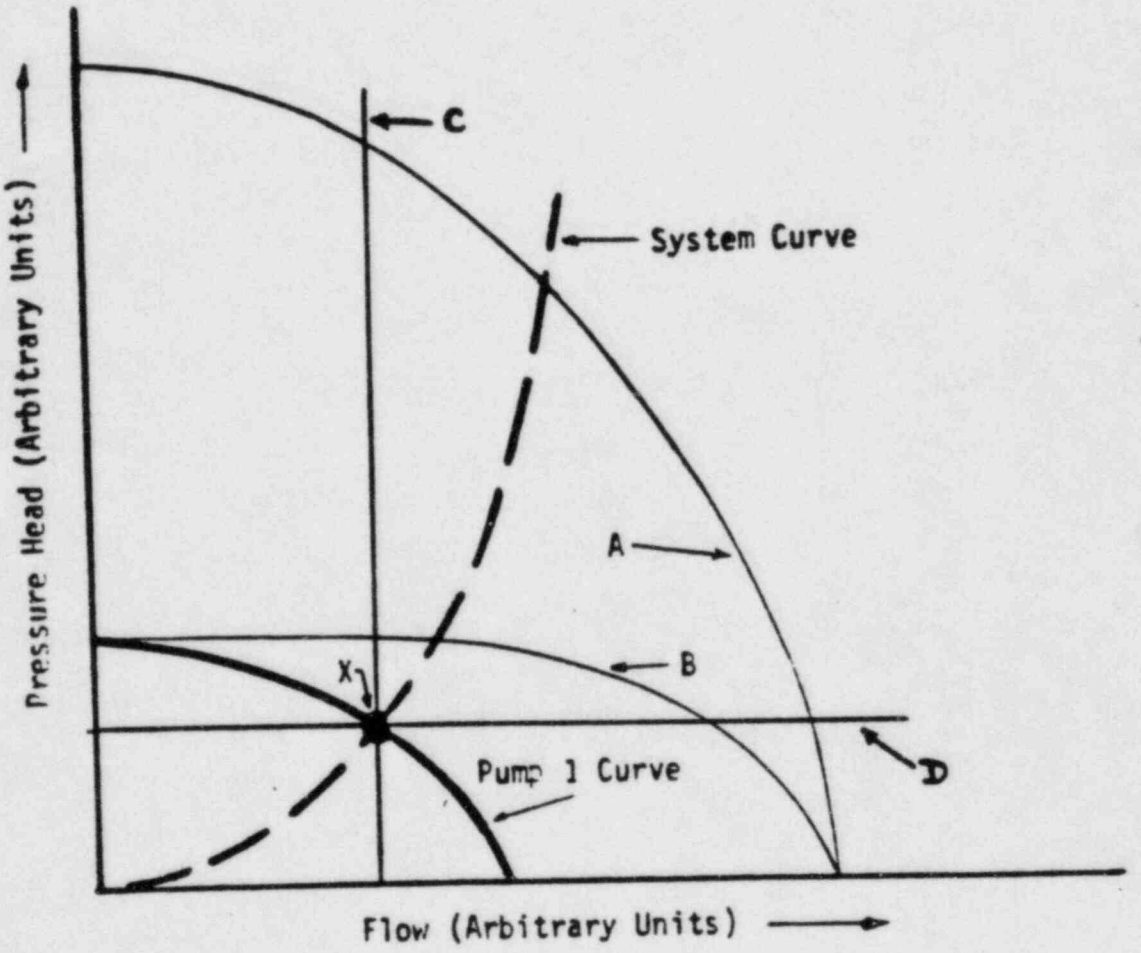


FIGURE FOR 1.06

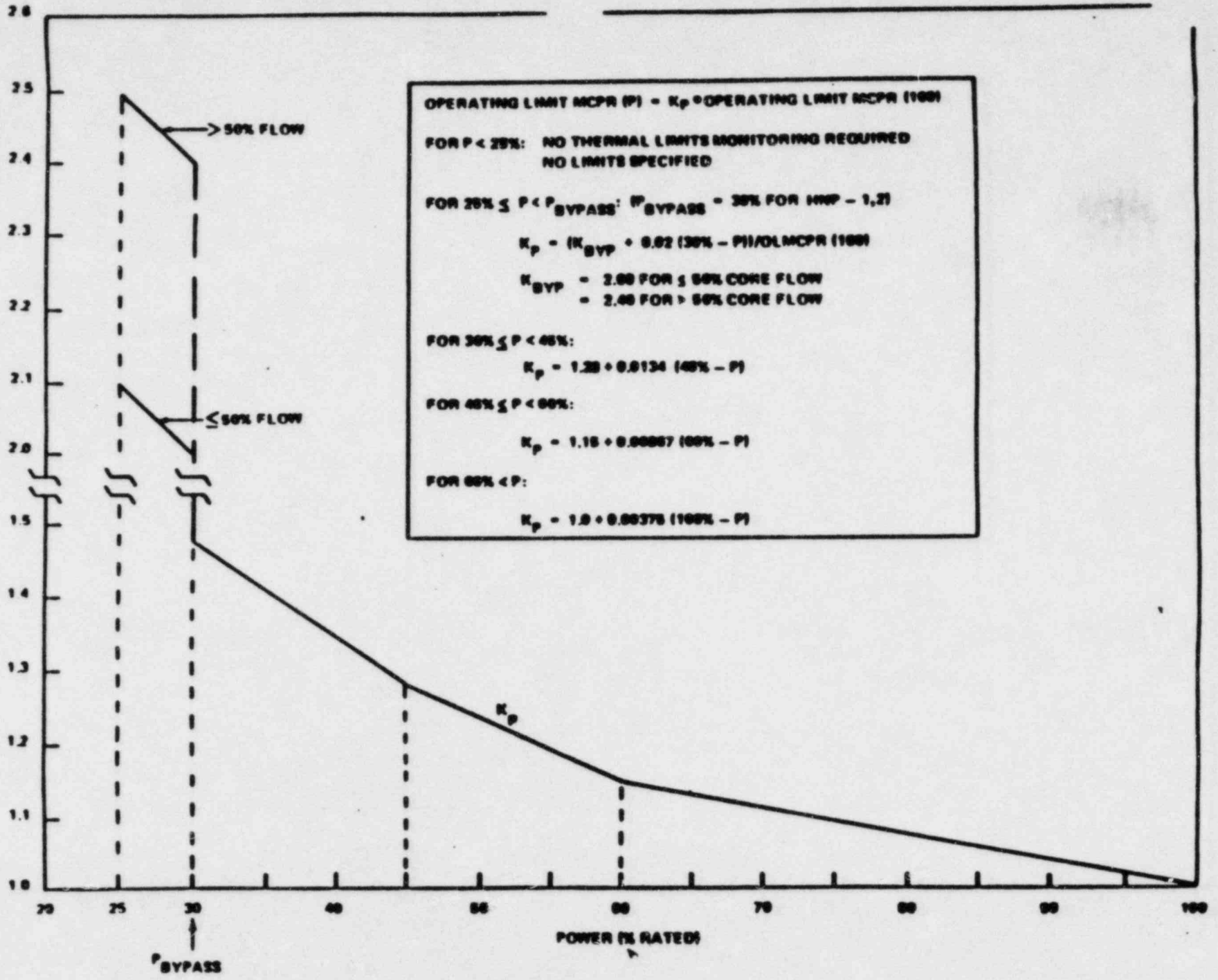


SYSTEM



SYSTEM HEAD VS. FLOW PLOT

FIGURE FOR 1.08

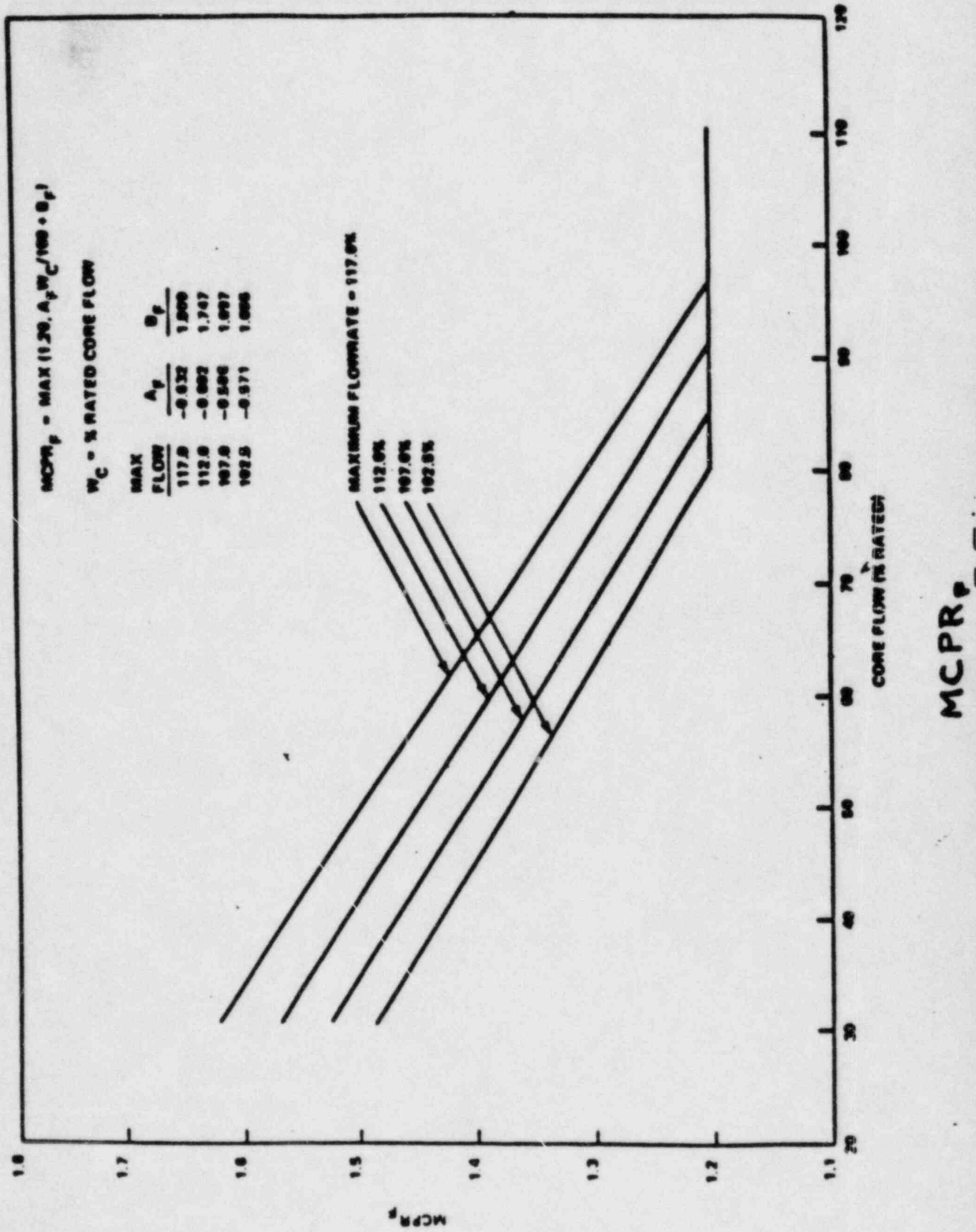


GENERAL ELECTRIC COMPANY PROPRIETARY INFORMATION

FIGURE FOR 1.14

K_p

FIGURE 5.U



GENERAL ELECTRIC COMPANY PROPRIETARY INFORMATION

FIGURE FOR 1.14

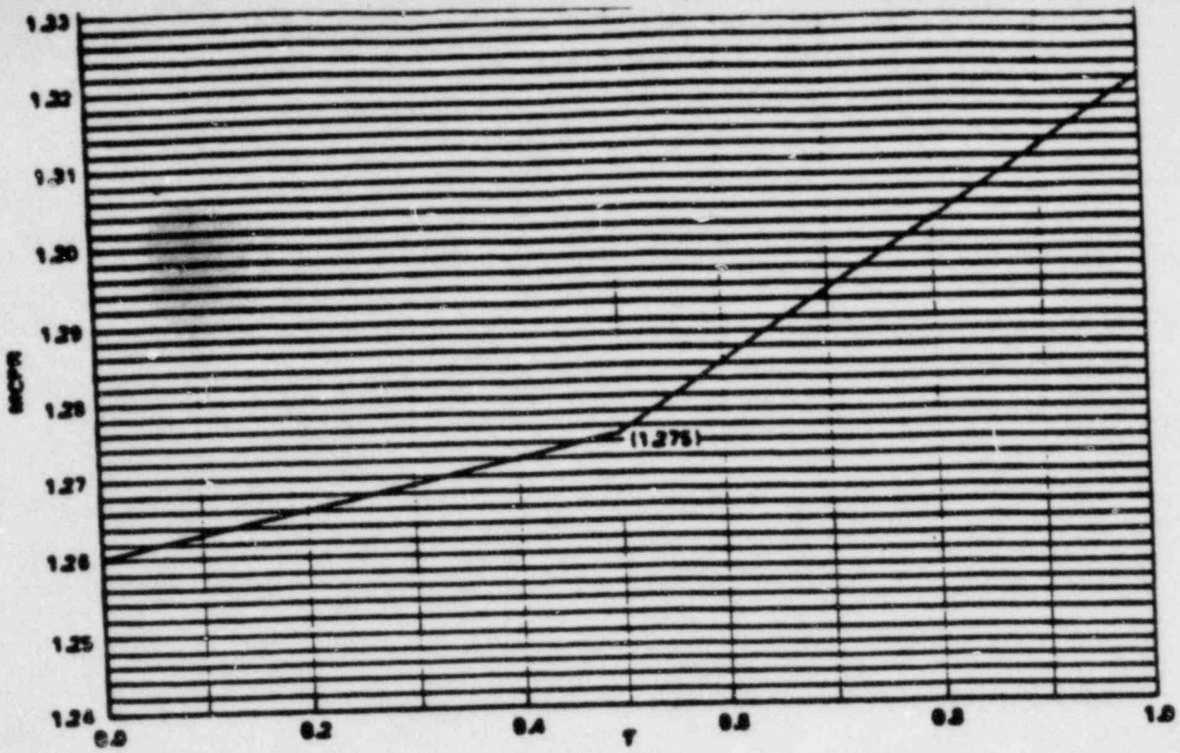
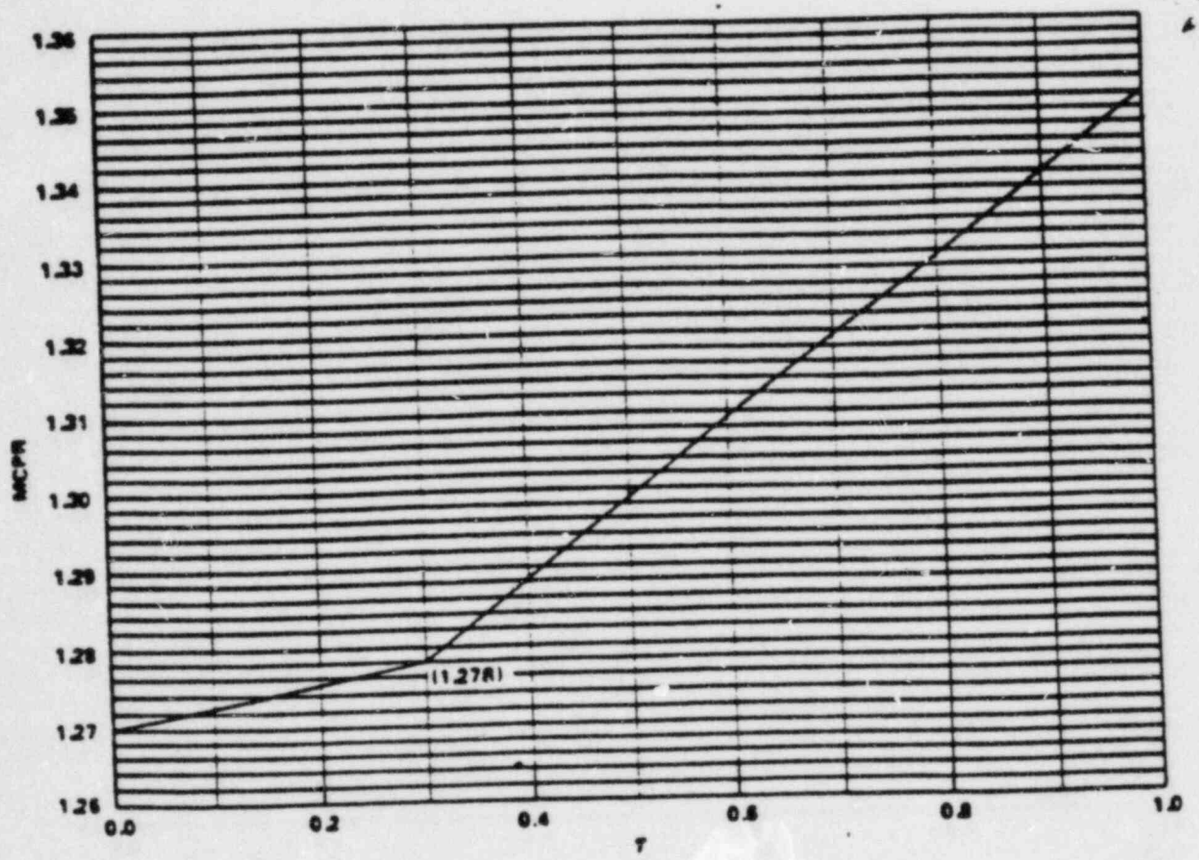


FIGURE 3.2.3-1
MCPR LIMIT FOR 8X8R FUEL
AT RATED FLOW AND RATED POWER



MCPR LIMIT [illegible] R FUEL
AT RATED FLOW [illegible] ED POWER
FIGURE 5.6

HATCH-2

FIGURE FOR 1.14

ANSWER SHEET for Question 2.01

INITIAL RESPONSE:

a. TCV position _____

b. BPV position _____

c. Power _____

d. Pressure _____

Reason: _____

_____

_____

FINAL STATUS:

a. TCV position _____

b. BPV position _____

c. Power _____

d. Pressure _____

Reason: _____

_____

_____

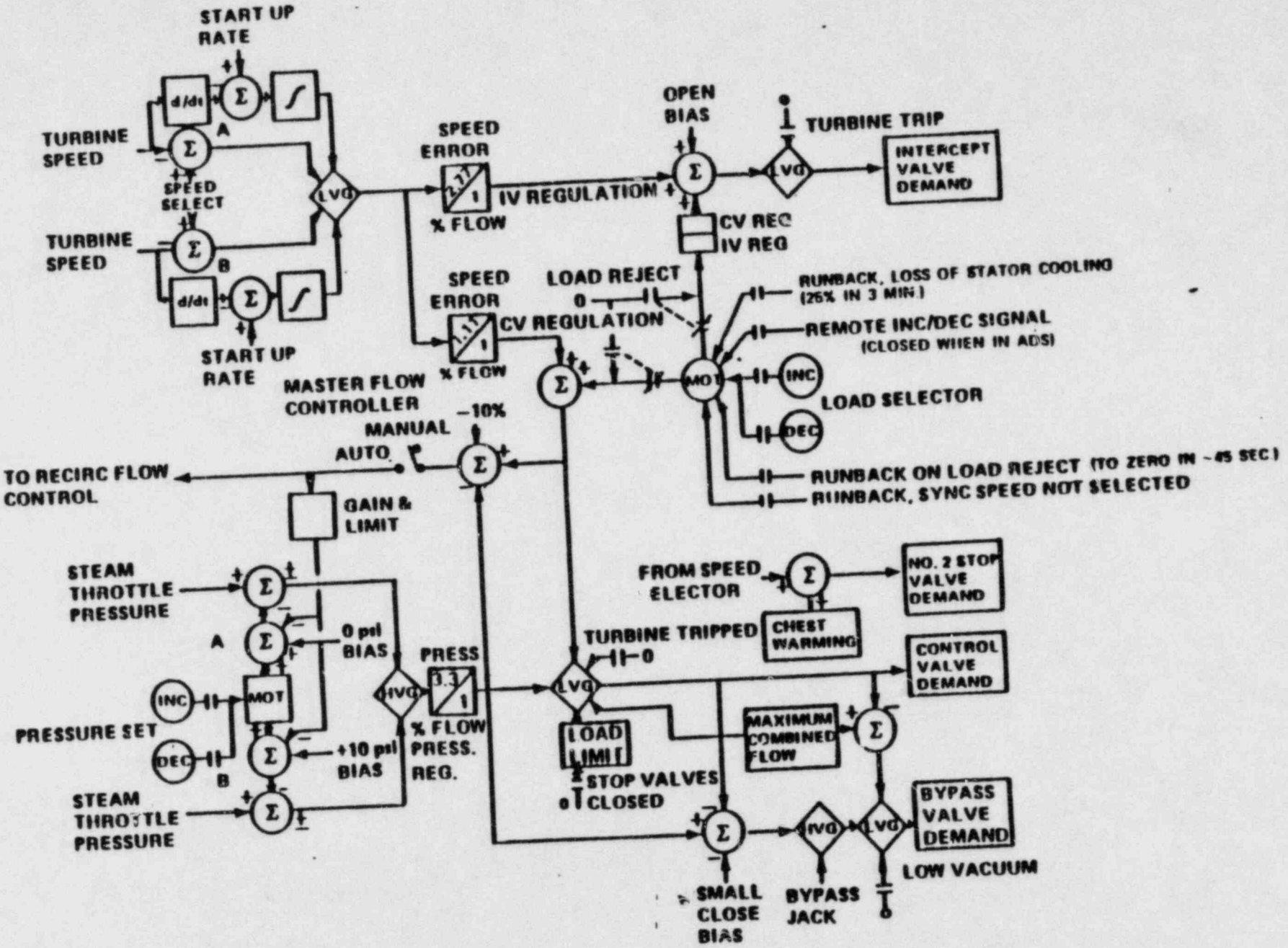


Figure 9.4(7) EHC Logic

Figure 9.9(3) ATTS Master Trip Unit

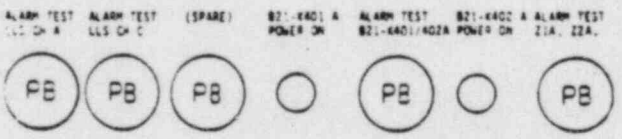


Figure 9.9(6) ATTS Panel Lights and Push Buttons

FIGURE FOR 2.15

E. REACTOR LEVEL READING CORRECTION FOR YARWAY INSTRUMENTS

1. Obtain Drywell Temperature Readings for the 185' Elevation. Temperature Indicator 2T47-R620 gives this reading for the north side and 2T47-R621 gives this reading for the south side.

2. Refer to Figure 1 and obtain the correction factor for each temperature reading.

3. _____* the correction factor found using the North Drywel Temperature Reading from the level indication shown on Leve Indicator 2B21-R604A.

4. _____* the correction factor found using the South Drywel Temperature Reading from the level indication shown on Leve Indicator 2B21-R604B.

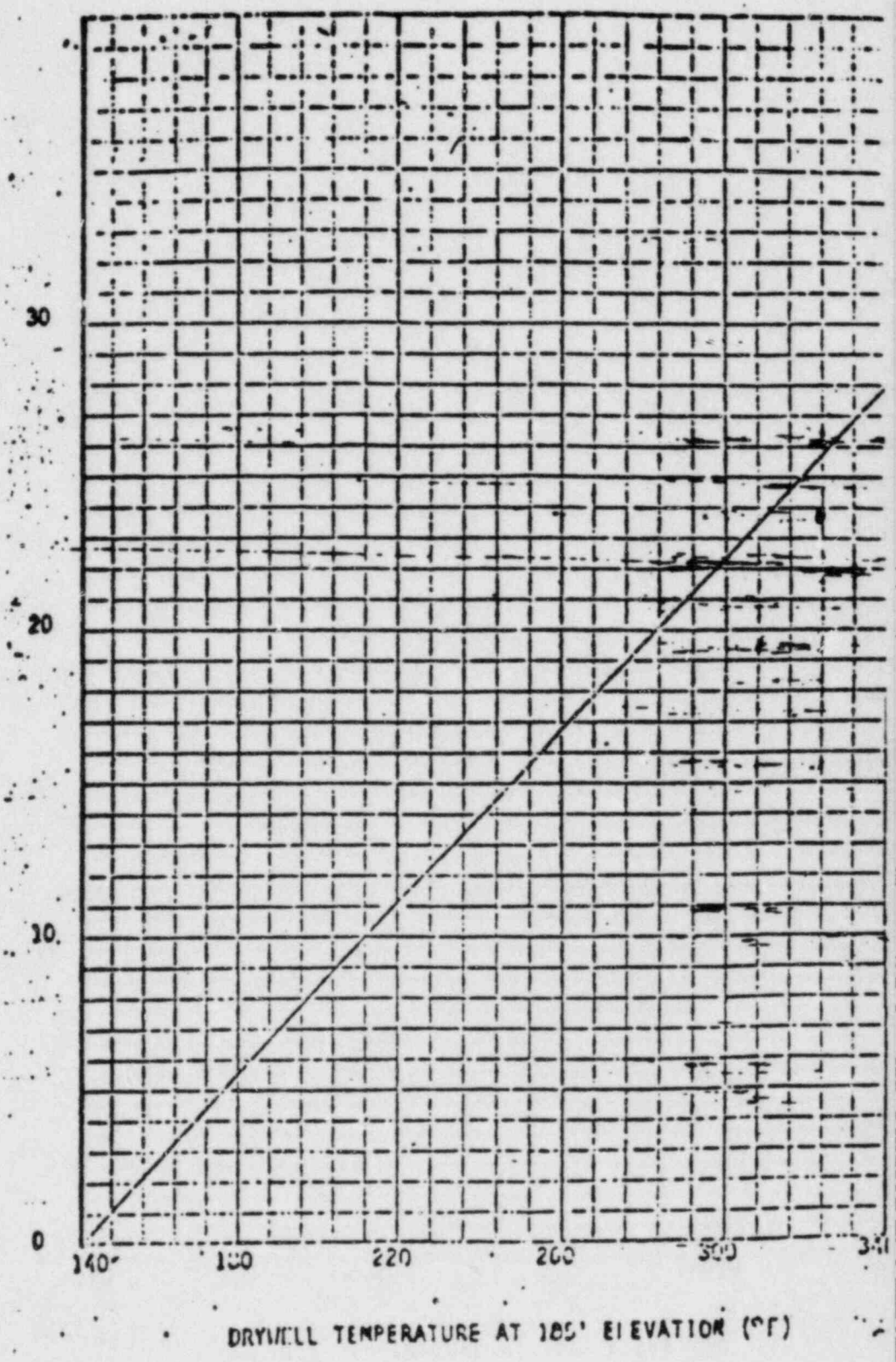
5. The average of these two corrected level readings will give a good estimate of the Actual Reactor Water Level.

* The ADDITION or SUBTRACTION of the correction factor is left to you, based upon the known sensing line flashing to steam.

FIGURE FOR 4.09

Georgia Power

FIGURE 4.09



INCHES TO IN
LEVEL READING
FROM 2821 B604A&B

reference only

FIGURE FOR 4.09

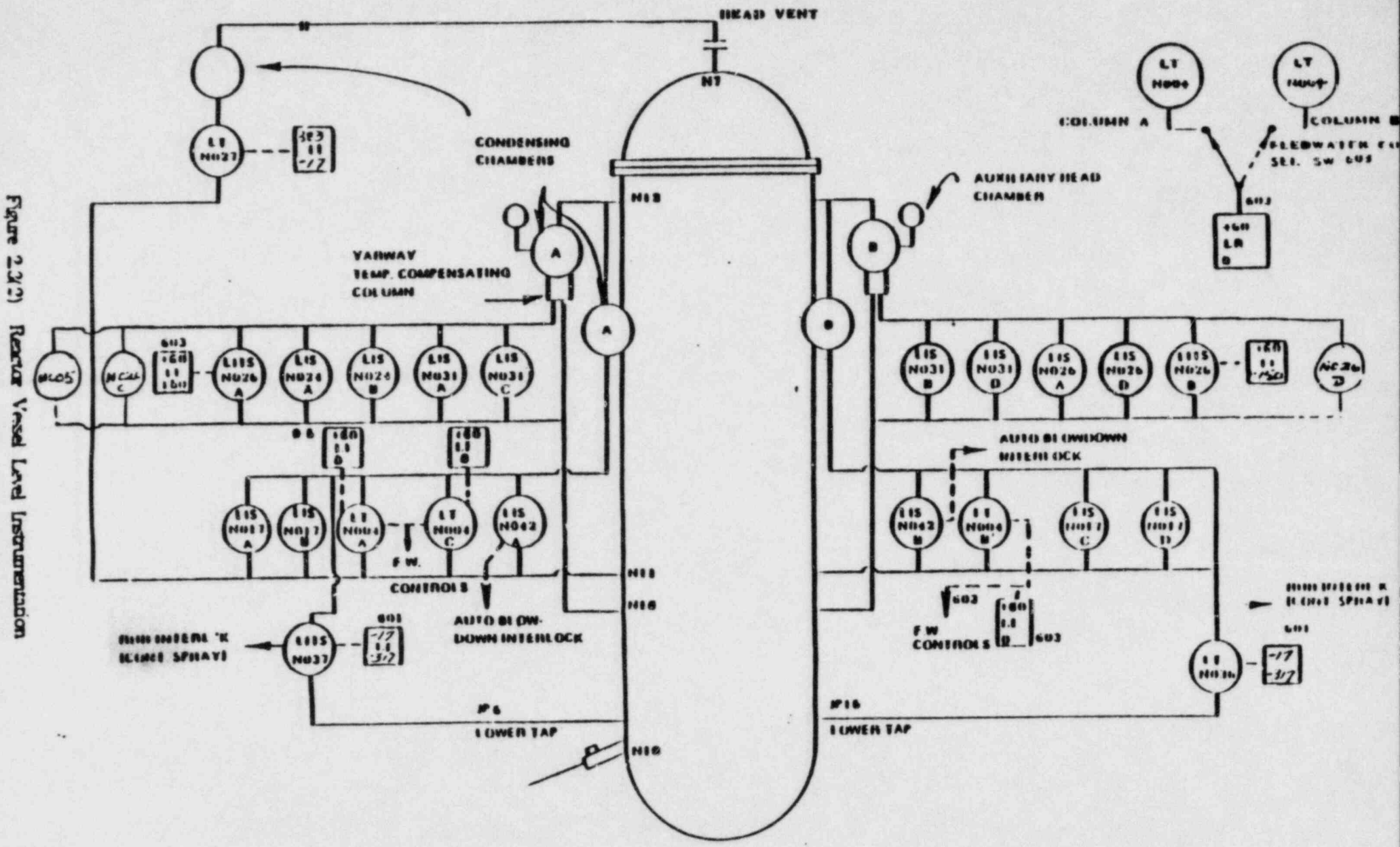


Figure 2.2(1) Reactor Vessel Level Instrumentation

FIGURE FOR 4.09

Table 3. Superheated Steam

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 200	250	300	350	400	450	500	600	700	800	900	1000	1100	1200
1 (101.74)	Sh			98.26	148.26	198.26	248.26	298.26	348.26	398.26	498.26	598.26	698.26	798.26	898.26	998.26	1098.26
	v	0.01614	333.6	392.5	422.4	452.3	482.1	511.9	541.7	571.5	631.1	690.7	750.3	809.8	869.4	929.0	988.6
	h	69.73	1105.8	1150.2	1172.9	1195.7	1218.7	1241.8	1265.1	1288.6	1336.1	1384.5	1433.7	1483.8	1534.9	1586.8	1639.7
	s	0.1326	1.9781	2.0509	2.0841	2.1152	2.1445	2.1722	2.1985	2.2237	2.2708	2.3144	2.3551	2.3934	2.4296	2.4640	2.4969
5 (162.24)	Sh			37.76	87.76	137.76	187.76	237.76	287.76	337.76	437.76	537.76	637.76	737.76	837.76	937.76	1037.76
	v	0.01641	73.53	78.14	84.21	90.24	96.25	102.24	108.23	114.21	126.15	138.08	150.01	161.94	173.86	185.78	197.70
	h	130.20	1131.1	1148.6	1171.7	1194.8	1218.0	1241.3	1264.7	1288.2	1335.9	1384.3	1433.6	1483.7	1534.7	1586.7	1639.6
	s	0.2349	1.8443	1.8716	1.9054	1.9369	1.9664	1.9943	2.0208	2.0460	2.0932	2.1369	2.1776	2.2159	2.2521	2.2866	2.3194
10 (193.21)	Sh			6.79	56.79	106.79	156.79	206.79	256.79	306.79	406.79	506.79	606.79	706.79	806.79	906.79	1006.79
	v	0.01659	38.42	38.84	41.93	44.98	48.02	51.03	54.04	57.04	63.03	69.00	74.98	80.94	86.91	92.87	98.84
	h	161.26	1143.3	1146.6	1170.2	1193.7	1217.1	1240.6	1264.1	1287.8	1335.5	1384.0	1433.4	1483.5	1534.6	1586.6	1639.5
	s	0.2836	1.7879	1.7928	1.8273	1.8593	1.8892	1.9173	1.9439	1.9692	2.0166	2.0603	2.1011	2.1394	2.1757	2.2101	2.2430
14.696 (212.00)	Sh				38.00	88.00	138.00	188.00	238.00	288.00	388.00	488.00	588.00	688.00	788.00	888.00	988.00
	v	0167	26.799		28.42	30.52	32.60	34.67	36.72	38.77	42.86	46.93	51.00	55.06	59.13	63.19	67.25
	h	180.17	1150.5		1168.8	1192.6	1216.3	1239.9	1263.6	1287.4	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4
	s	3121	1.7568		1.7833	1.8158	1.8459	1.8743	1.9010	1.9265	1.9739	2.0177	2.0585	2.0969	2.1332	2.1676	2.2005
15 (213.03)	Sh				36.97	86.97	136.97	186.97	236.97	286.97	386.97	486.97	586.97	686.97	786.97	886.97	986.97
	v	0.01673	25.290		27.837	29.899	31.939	33.963	35.977	37.985	41.986	45.978	49.964	53.946	57.926	61.905	65.882
	h	181.21	1150.9		1168.7	1192.5	1216.2	1239.9	1263.6	1287.3	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4
	s	0.3137	1.7552		1.7809	1.8134	1.8437	1.8720	1.8988	1.9242	1.9717	2.0155	2.0563	2.0946	2.1309	2.1653	2.1987
20 (227.96)	Sh				22.04	72.04	122.04	172.04	222.04	272.04	372.04	472.04	572.04	672.04	772.04	872.04	972.04
	v	0.01683	20.087		20.788	22.356	23.900	25.428	26.946	28.457	31.466	34.465	37.458	40.447	43.435	46.420	49.405
	h	196.27	1156.3		1167.1	1191.4	1215.4	1239.2	1263.0	1286.9	1334.9	1383.5	1432.9	1483.2	1534.3	1586.3	1639.3
	s	0.3358	1.7320		1.7475	1.7805	1.8111	1.8397	1.8666	1.8921	1.9397	1.9836	2.0244	2.0628	2.0991	2.1336	2.1665
25 (240.07)	Sh				9.93	59.93	109.93	159.93	209.93	259.93	359.93	459.93	559.93	659.93	759.93	859.93	959.93
	v	0.01693	16.301		16.558	17.829	19.076	20.307	21.527	22.740	25.153	27.557	29.954	32.348	34.740	37.130	39.518
	h	208.52	1160.6		1165.6	1190.2	1214.5	1238.5	1262.5	1286.4	1334.6	1383.3	1432.7	1483.0	1534.2	1586.2	1639.2
	s	0.3535	1.7141		1.7212	1.7547	1.7856	1.8145	1.8415	1.8672	1.9149	1.9588	1.9997	2.0381	2.0744	2.1089	2.1418
30 (250.34)	Sh					49.66	99.66	149.66	199.66	249.66	349.66	449.66	549.66	649.66	749.66	849.66	949.66
	v	0.01701	13.744			14.810	15.859	16.892	17.914	18.929	20.945	22.951	24.952	26.949	28.943	30.936	32.927
	h	218.93	1164.1			1189.0	1213.6	1237.8	1261.9	1286.0	1334.2	1383.0	1432.5	1482.8	1534.0	1586.1	1639.0
	s	0.3682	1.6995			1.7334	1.7647	1.7937	1.8210	1.8467	1.8946	1.9386	1.9795	2.0179	2.0543	2.0888	2.1217
35 (259.29)	Sh					40.71	90.71	140.71	190.71	240.71	340.71	440.71	540.71	640.71	740.71	840.71	940.71
	v	0.01708	11.896			12.654	13.562	14.453	15.334	16.207	17.939	19.662	21.379	23.092	24.803	26.512	28.220
	h	228.03	1167.1			1187.8	1212.7	1237.1	1261.3	1285.5	1333.9	1382.8	1432.3	1482.7	1533.9	1586.0	1638.9
	s	0.3809	1.6872			1.7152	1.7468	1.7761	1.8035	1.8294	1.8774	1.9214	1.9624	2.0009	2.0372	2.0717	2.1046
40 (267.25)	Sh					32.75	82.75	132.75	182.75	232.75	332.75	432.75	532.75	632.75	732.75	832.75	932.75
	v	0.01715	10.497			11.036	11.838	12.624	13.398	14.165	15.685	17.195	18.699	20.199	21.697	23.194	24.689
	h	236.14	1169.8			1186.6	1211.7	1236.4	1260.8	1285.0	1333.6	1382.5	1432.1	1482.5	1533.7	1585.8	1638.8
	s	0.3921	1.6765			1.6992	1.7312	1.7608	1.7883	1.8143	1.8624	1.9065	1.9476	1.9860	2.0224	2.0569	2.0899
45 (274.44)	Sh					25.56	75.56	125.56	175.56	225.56	325.56	425.56	525.56	625.56	725.56	825.56	925.56
	v	0.01721	9.399			9.777	10.497	11.201	11.892	12.577	13.932	15.276	16.614	17.950	19.282	20.613	21.943
	h	243.49	1172.1			1185.4	1210.4	1235.7	1260.2	1284.6	1333.3	1382.3	1431.9	1482.3	1533.6	1585.7	1638.7
	s	0.4021	1.6671			1.6849	1.7173	1.7471	1.7748	1.8010	1.8492	1.8934	1.9345	1.9728	2.0093	2.0439	2.0768
50 (281.02)	Sh					18.98	68.98	118.98	168.98	218.98	318.98	418.98	518.98	618.98	718.98	818.98	918.98
	v	0.01727	8.514			8.769	9.424	10.067	10.688	11.306	12.529	13.741	14.947	16.150	17.350	18.549	19.746
	h	250.21	1174.1			1184.1	1209.9	1234.9	1259.6	1284.1	1332.9	1382.0	1431.7	1482.2	1533.4	1585.6	1638.6
	s	0.4112	1.6586			1.6720	1.7048	1.7349	1.7628	1.7890	1.8374	1.8816	1.9227	1.9613	1.9977	2.0322	2.0652
55 (287.07)	Sh					12.93	62.93	112.93	162.93	212.93	312.93	412.93	512.93	612.93	712.93	812.93	912.93
	v	0.01733				7.945	8.546	9.130	9.702	10.267	11.381	12.485	13.583	14.677	15.769	16.859	17.948
	h	256.43				1182.9	1208.9	1234.2	1259.1	1283.6	1332.6	1381.8	1431.5	1482.0	1533.3	1585.5	1638.5
	s	0.4196				1.6601	1.6933	1.7237	1.7518	1.7781	1.8266	1.8710	1.9121	1.9507	1.987	2.022	2.055
60 (292.71)	Sh					7.29	57.29	107.29	157.29	207.29	307.29	407.29	507.29	607.29	707.29	807.29	907.29
	v	0.01738	7.174			7.257	7.815	8.354	8.881	9.400	10.425	11.438	12.446	13.450	14.452	15.452	16.450
	h	262.21	1177.6			1181.6	1208.0	1233.5	1258.5	1283.2	1332.3	1381.5	1431.3	1481.8	1533.2	1585.3	1638.4
	s	0.4273	1.6440			1.6492	1.6934	1.7134	1.7417	1.7681	1.8168	1.8612	1.9024	1.9410	1.9774	2.0120	2.0450
65 (297.98)	Sh					2.02	52.02	102.02	152.02	202.02	302.02	402.02	502.02	602.02	702.02	802.02	902.02
	v	0.01743	6.653			6.675	7.195	7.697	8.186	8.667	9.615	10.552	11.484	12.412	13.337	14.261	15.183
	h	267.63	1179.1			1180.3	1207.0	1232.7	1257.9	1282.7	1331.9	1381.3	1431.1	1481.6	1533.0	1585.2	1638.3
	s	0.4344	1.6375			1.6390	1.6731	1.7040	1.7324	1.7590	1.8077	1.8522	1.8935	1.9321	1.9685	2.0031	2.0361
70 (302.93)	Sh						47.07	97.07	147.07	197.07	297.07	397.07	497.07	597.07	697.07	797.07	897.07
	v	0.01748	6.205				6.664	7.133	7.590	8.039	8.922	9.793	10.659	11.522	12.382	13.240	14.097
	h	272.74	1180.6				1206.0	1232.0	1257.3	1282.2	1331.6	1381.0	1430.9	1481.5	1532.9	1585.1	1638.2
	s	0.4411	1.6316				1.6640	1.6951	1.7237	1.7504	1.7993	1.8439	1.8852	1.9238	1.9603	1.9949	2.0279
75 (307.61)	Sh						42.39	92.39	142.39	192.39	292.39	392.39	[illegible]	592.39	692.39	792.39	892.39
	v	0.01753	5.814				6.204	6.645	7.074	7.494	8.320	9.135	[illegible]	10.750	11.553	12.355	13.155
	h	277.56	1181.9				1205.0	1231.2	1256.7	1281.7	1331.3	1380.7	1430.7	1481.3	1532.7	1585.0	1638.1
	s	0.4474	1.6260				1.6554	1.6868	1.7156	1.7424	1.7915	1.8361	1.8774	1.9161	1.9526	1.9872	2.0202

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam — *Continued*

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400
	Sh			37.96	87.96	137.96	187.96	237.96	287.96	387.96	487.96	587.96	687.96	787.96	887.96	987.96	1087.96
80	v	0.01757	5.471	5.801	6.218	6.622	7.018	7.408	7.794	8.560	9.319	10.075	10.829	11.581	12.331	13.081	13.829
(312.04)	h	282.15	1183.1	1204.0	1230.5	1256.1	1281.3	1306.2	1330.9	1380.5	1430.5	1481.1	1532.6	1584.9	1638.0	1692.0	1746.8
	s	0.4534	1.6208	1.6473	1.6790	1.7080	1.7349	1.7602	1.7842	1.8289	1.8702	1.9089	1.9454	1.9800	2.013-	2.0446	2.0750
	Sh			33.74	83.74	133.74	183.74	233.74	283.74	383.74	483.74	583.74	683.74	783.74	883.74	983.74	1083.74
85	v	0.01762	5.167	5.445	5.840	6.223	6.597	6.966	7.330	8.052	8.768	9.480	10.190	10.898	11.604	12.310	13.014
(316.26)	h	286.52	1184.2	1203.0	1229.7	1255.5	1280.8	1305.8	1330.6	1380.2	1430.3	1481.0	1532.4	1584.7	1637.9	1691.9	1746.8
	s	0.4590	1.6159	1.6396	1.6716	1.7008	1.7279	1.7532	1.7772	1.8220	1.8634	1.9021	1.9386	1.9733	2.0063	2.0379	2.0682
	Sh			29.72	79.72	129.72	179.72	229.72	279.72	379.72	479.72	579.72	679.72	779.72	879.72	979.72	1079.72
90	v	0.01766	4.895	5.128	5.505	5.869	6.223	6.572	6.917	7.600	8.277	8.950	9.621	10.290	10.958	11.625	12.290
(320.28)	h	290.69	1185.3	1202.0	1228.9	1254.9	1280.3	1305.4	1330.2	1380.0	1430.1	1480.8	1532.3	1584.6	1637.8	1691.8	1746.7
	s	0.4643	1.6113	1.6323	1.6646	1.6940	1.7212	1.7467	1.7707	1.8156	1.8570	1.8957	1.9323	1.9669	2.0000	2.0316	2.0619
	Sh			25.87	75.87	125.87	175.87	225.87	275.87	375.87	475.87	575.87	675.87	775.87	875.87	975.87	1075.87
95	v	0.01770	4.651	4.845	5.205	5.553	5.889	6.221	6.548	7.196	7.838	8.477	9.113	9.747	10.380	11.012	11.644
(324.13)	h	294.70	1186.2	1200.9	1228.1	1254.3	1279.8	1305.0	1329.9	1379.7	1429.9	1480.6	1532.1	1584.5	1637.7	1691.7	1746.6
	s	0.4694	1.6069	1.6253	1.6580	1.6876	1.7149	1.7404	1.7645	1.8094	1.8509	1.8897	1.9262	1.9609	1.9940	2.0256	2.0559
	Sh			22.18	72.18	122.18	172.18	222.18	272.18	372.18	472.18	572.18	672.18	772.18	872.18	972.18	1072.18
100	v	0.01774	4.431	4.590	4.935	5.266	5.588	5.904	6.216	6.833	7.443	8.050	8.655	9.258	9.860	10.460	11.060
(327.82)	h	298.54	1187.2	1199.9	1227.4	1253.7	1279.3	1304.6	1329.6	1379.5	1429.7	1480.4	1532.0	1584.4	1637.6	1691.6	1746.5
	s	0.4743	1.6027	1.6187	1.6516	1.6814	1.7088	1.7344	1.7586	1.8036	1.8451	1.8839	1.9205	1.9552	1.9883	2.0199	2.0502
	Sh			18.63	68.63	118.63	168.63	218.63	268.63	368.63	468.63	568.63	668.63	768.63	868.63	968.63	1068.63
105	v	0.01778	4.231	4.359	4.690	5.007	5.315	5.617	5.915	6.504	7.086	7.665	8.241	8.816	9.389	9.961	10.532
(331.37)	h	302.24	1188.0	1198.8	1226.6	1253.1	1278.8	1304.2	1329.2	1379.2	1429.4	1480.3	1531.8	1584.2	1637.5	1691.5	1746.4
	s	0.4790	1.5988	1.6122	1.6455	1.6755	1.7031	1.7288	1.7530	1.7981	1.8396	1.8785	1.9151	1.9498	1.9828	2.0145	2.0448
	Sh			15.21	65.21	115.21	165.21	215.21	265.21	365.21	465.21	565.21	665.21	765.21	865.21	965.21	1065.21
110	v	0.01782	4.048	4.149	4.468	4.772	5.068	5.357	5.642	6.205	6.761	7.314	7.865	8.413	8.961	9.507	10.053
(334.79)	h	305.80	1188.9	1197.7	1225.8	1252.5	1278.3	1303.8	1328.9	1379.0	1429.2	1480.1	1531.7	1584.1	1637.4	1691.4	1746.4
	s	0.4834	1.5950	1.6061	1.6396	1.6698	1.6975	1.7233	1.7476	1.7928	1.8344	1.8732	1.9099	1.9446	1.9777	2.0093	2.0397
	Sh			11.92	61.92	111.92	161.92	211.92	261.92	361.92	461.92	561.92	661.92	761.92	861.92	961.92	1061.92
115	v	0.01785	3.881	3.957	4.265	4.558	4.841	5.119	5.392	5.932	6.465	6.994	7.521	8.046	8.570	9.093	9.615
(338.08)	h	309.25	1189.6	1196.7	1225.0	1251.8	1277.9	1303.3	1328.6	1378.7	1429.0	1479.9	1531.6	1584.0	1637.2	1691.4	1746.3
	s	0.4877	1.5913	1.6001	1.6340	1.6644	1.6922	1.7181	1.7425	1.7877	1.8294	1.8682	1.9049	1.9396	1.9727	2.0044	2.0347
	Sh			8.73	58.73	108.73	158.73	208.73	258.73	358.73	458.73	558.73	658.73	758.73	858.73	958.73	1058.73
120	v	0.01789	3.7275	3.7815	4.0786	4.3610	4.6341	4.9009	5.1637	5.6813	6.1928	6.7006	7.2060	7.7096	8.2119	8.7130	9.2134
(341.27)	h	312.58	1190.4	1195.6	1224.1	1251.2	1277.4	1302.9	1328.2	1378.4	1428.8	1479.8	1531.4	1583.9	1637.1	1691.3	1746.2
	s	0.4919	1.5879	1.5943	1.6286	1.6592	1.6872	1.7132	1.7376	1.7829	1.8246	1.8635	1.9001	1.9349	1.9680	1.9996	2.0300
	Sh			2.67	52.67	102.67	152.67	202.67	252.67	352.67	452.67	552.67	652.67	752.67	852.67	952.67	1052.67
130	v	0.01796	3.4544	3.4699	3.7489	4.0129	4.2672	4.5151	4.7589	5.2384	5.7118	6.1814	6.6486	7.1140	7.5781	8.0411	8.5033
(347.33)	h	318.95	1191.7	1193.4	1222.5	1249.9	1276.4	1302.1	1327.5	1377.9	1428.4	1479.4	1531.1	1583.6	1636.9	1691.1	1746.1
	s	0.4998	1.5813	1.5833	1.6182	1.6493	1.6775	1.7037	1.7283	1.7737	1.8155	1.8545	1.8911	1.9259	1.9591	1.9907	2.0211
	Sh				46.96	96.96	146.96	196.96	246.96	346.96	446.96	546.96	646.96	746.96	846.96	946.96	1046.96
140	v	0.01803	3.2190		3.4661	3.7143	3.9526	4.1844	4.4119	4.8588	5.2995	5.7364	6.1709	6.6036	7.0349	7.4652	7.8946
(353.04)	h	324.96	1193.0		1220.8	1248.7	1275.3	1301.3	1326.8	1377.4	1428.0	1479.1	1530.8	1583.4	1636.7	1690.9	1745.9
	s	0.5071	1.5752		1.6085	1.6400	1.6686	1.6949	1.7196	1.7652	1.8071	1.8461	1.8828	1.9176	1.9508	1.9825	2.0129
	Sh				41.57	91.57	141.57	191.57	241.57	341.57	441.57	541.57	641.57	741.57	841.57	941.57	1041.57
150	v	0.01809	3.0149		3.2708	3.4998	3.7199	3.9478	4.1312	4.5298	4.9421	5.3507	5.7568	6.1617	6.5654	6.9681	7.3701
(358.43)	h	330.65	1193.7		1219.4	1247.4	1274.1	1300.5	1326.1	1376.9	1427.6	1478.7	1530.5	1583.1	1636.5	1690.7	1745.7
	s	0.5121	1.5696		1.5991	1.6313	1.6607	1.6877	1.7115	1.7573	1.7997	1.8383	1.8751	1.9099	1.9431	1.9748	2.0053
	Sh				36.45	86.45	136.45	186.45	236.45	336.45	436.45	536.45	636.45	736.45	836.45	936.45	1036.45
160	v	0.01815	2.8336		3.0060	3.2288	3.4413	3.6469	3.8480	4.2470	4.6295	5.0132	5.3945	5.7741	6.1527	6.5303	6.9055
(363.55)	h	336.07	1195.1		1217.4	1246.0	1273.3	1299.6	1325.4	1376.4	1427.2	1478.4	1530.3	1582.9	1636.3	1690.5	1745.6
	s	0.5206	1.5641		1.5906	1.6231	1.6527	1.6790	1.7039	1.7499	1.7919	1.8310	1.8678	1.9027	1.9359	1.9676	1.9980
	Sh				31.58	81.58	131.58	181.58	231.58	331.58	431.58	531.58	631.58	731.58	831.58	931.58	1031.58
170	v	0.01821	2.6738		2.8162	3.0288	3.2306	3.4255	3.6158	3.9879	4.3536	4.7155	5.0749	5.4325	5.7888	6.1440	6.4983
(368.42)	h	341.24	1196.0		1215.6	1244.7	1272.2	1298.8	1324.7	1375.8	1426.8	1478.0	1530.0	1582.6	1636.1	1690.4	1745.4
	s	0.5269	1.5591		1.5823	1.6152	1.6447	1.6717	1.6968	1.7428	1.7850	1.8241	1.8610	1.8959	1.9291	1.9608	1.9913
	Sh				26.92	76.92	126.92	176.92	226.92	326.92	426.92	526.92	626.92	726.92	826.92	926.92	1026.92
180	v	0.01827	2.5312		2.6474	2.8508	3.0433	3.2286	3.4093	3.7621	4.1084	4.4508	4.7907	5.1289	5.4657	5.8014	6.1363
(373.08)	h	346.19	1196.9		1213.8	1243.4	1271.2	1297.9	1324.0	1375.3	1426.3	1477.7	1529.7	1582.4	1635.9	1690.2	1745.3
	s	0.5328	1.5543		1.5743	1.6078	1.6376	1.6647	1.6900	1.7362	1.7784	1.8176	1.8545	1.8894	1.9227	1.9545	1.9849
	Sh				22.47	72.47	122.47	172.47	222.47	322.47	422.47	522.47	622.47	722.47	822.47	922.47	1022.47
190	v	0.01833	2.4030		2.4961	2.6915	2.8756	3.0525	3.2246	3.5601	3.8889	4.2140	4.5365	4.8572	5.1766	5.4949	5.8174
(377.53)	h	350.94	1197.6		1212.0	1242.0	1270.1	1297.1	1323.3	1374.8	1425.9	1477.4	1529.4	1582.1	1635.7	1690.0	1745.1
	s	0.5384	1.5498		1.5667	1.6006	1.6307	1.6581	1.6835	1.7299	1.7722	1.8115	1.8484	1.8834	1.9166	1.9484	1.9789
	Sh				18.20	68.20	118.20	168.20	218.20	318.20	418.20	518.20	618.20	718.20	818.20	918.20	1018.20
200	v	0.01839	2.2873		2.3598	2.5480	2.7247	2.8939	3.0583	3.3783	3.6915	4.0008	4.3077	4.6128	4.9165	5.2191	5.5209
(381.80)	h	355.51	1198.3		1210.1	1240.6	1269.0	1296.2	1322.6	1374.3	1425.5	1477.0	1529.1	1581.9	1635.4	1689.8	1745.0
	s	0.5438	1.5454		1.5593	1.5938	1.6242	1.6518	1.6773	1.7239	1.7663	1.8057	1.8426	1.8776	1.9109	1.9427	1.9732

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400	1500
	Sh			14.09	64.09	114.09	164.09	214.09	314.09	414.09	514.09	614.09	714.09	814.09	914.09	1014.09	1114.09
210	v	0.01844	2.1822	2.2364	2.4181	2.5880	2.7504	2.9078	3.2137	3.5128	3.8080	4.1007	4.3915	4.6811	4.9695	5.2571	5.5440
(385.91)	h	359.91	1199.0	1208.02	1239.2	1268.0	1295.3	1321.9	1373.7	1425.1	1476.7	1528.8	1581.6	1635.2	1689.6	1744.8	1800.8
	s	0.5490	1.5413	1.5522	1.5872	1.6180	1.6458	1.6715	1.7182	1.7607	1.8001	1.8371	1.8721	1.9054	1.9372	1.9677	1.9970
	Sh			10.12	60.12	110.12	160.12	210.12	310.12	410.12	510.12	610.12	710.12	810.12	910.12	1010.12	1110.12
220	v	0.01850	2.0863	2.1240	2.2999	2.4638	2.6199	2.7710	3.0642	3.3504	3.6327	3.9125	4.1905	4.4671	4.7426	5.0173	5.2913
(389.88)	h	364.17	1199.6	1206.3	1237.8	1266.9	1294.5	1321.2	1373.2	1424.7	1476.3	1528.5	1581.4	1635.0	1689.4	1744.7	1800.6
	s	0.5540	1.5374	1.5453	1.5808	1.6120	1.6400	1.6658	1.7128	1.7553	1.7948	1.8318	1.8668	1.9002	1.9320	1.9625	1.9919
	Sh			6.30	56.30	106.30	156.30	206.30	306.30	406.30	506.30	606.30	706.30	806.30	906.30	1006.30	1106.30
230	v	0.01855	1.9985	2.0212	2.1919	2.3503	2.5008	2.6461	2.9276	3.2020	3.4726	3.7406	4.0068	4.2717	4.5355	4.7984	5.0606
(393.70)	h	368.28	1200.1	1204.4	1236.3	1265.7	1293.6	1320.4	1372.7	1424.2	1476.0	1528.2	1581.1	1634.8	1689.3	1744.5	1800.5
	s	0.5588	1.5336	1.5385	1.5747	1.6062	1.6344	1.6604	1.7075	1.7502	1.7897	1.8268	1.8618	1.8957	1.9270	1.9576	1.9869
	Sh			2.61	52.61	102.61	152.61	202.61	302.61	402.61	502.61	602.61	702.61	802.61	902.61	1002.61	1102.61
240	v	0.01860	1.9177	1.9268	2.0928	2.2462	2.3915	2.5316	2.8024	3.0661	3.3259	3.5831	3.8385	4.0926	4.3456	4.5977	4.8492
(397.39)	h	372.27	1200.6	1202.4	1234.9	1264.6	1292.7	1319.7	1372.1	1423.8	1475.6	1527.9	1580.9	1634.6	1689.1	1744.3	1800.4
	s	0.5634	1.5299	1.5320	1.5687	1.6006	1.6291	1.6552	1.7025	1.7452	1.7848	1.8219	1.8570	1.8904	1.9223	1.9528	1.9822
	Sh				49.03	99.03	149.03	199.03	299.03	399.03	499.03	599.03	699.03	799.03	899.03	999.03	1099.03
250	v	0.01865	1.8432		2.0016	2.1504	2.2909	2.4262	2.6872	2.9410	3.1909	3.4382	3.6837	3.9278	4.1709	4.4131	4.6546
(400.97)	h	376.14	1201.1		1233.4	1263.5	1291.8	1319.0	1371.6	1423.4	1475.3	1527.6	1580.6	1634.4	1688.9	1744.2	1800.2
	s	0.5679	1.5264		1.5629	1.5951	1.6239	1.6502	1.6976	1.7405	1.7801	1.8173	1.8524	1.8858	1.9177	1.9482	1.9776
	Sh				45.56	95.56	145.56	195.56	295.56	395.56	495.56	595.56	695.56	795.56	895.56	995.56	1095.56
260	v	0.01870	1.7742		1.9173	2.0619	2.1981	2.3289	2.5808	2.8256	3.0663	3.3044	3.5408	3.7758	4.0097	4.2427	4.4750
(404.44)	h	379.90	1201.5		1231.9	1262.4	1290.9	1318.2	1371.1	1423.0	1474.9	1527.3	1580.4	1634.2	1688.7	1744.0	1800.1
	s	0.5722	1.5230		1.5573	1.5899	1.6189	1.6453	1.6930	1.7359	1.7756	1.8128	1.8480	1.8814	1.9133	1.9439	1.9732
	Sh				42.20	92.20	142.20	192.20	292.20	392.20	492.20	592.20	692.20	792.20	892.20	992.20	1092.20
270	v	0.01875	1.7101		1.8391	1.9799	2.1121	2.2388	2.4824	2.7186	2.9509	3.1806	3.4084	3.6349	3.8603	4.0849	4.3087
(407.80)	h	383.56	1201.9		1230.4	1261.2	1290.0	1317.5	1370.5	1422.6	1474.6	1527.1	1580.1	1634.0	1688.5	1743.9	1800.0
	s	0.5764	1.5197		1.5518	1.5848	1.6140	1.6406	1.6885	1.7315	1.7713	1.8085	1.8437	1.8771	1.9090	1.9396	1.9690
	Sh				38.93	88.93	138.93	188.93	288.93	388.93	488.93	588.93	688.93	788.93	888.93	988.93	1088.93
280	v	0.01880	1.6505		1.7665	1.9037	2.0322	2.1551	2.3909	2.6194	2.8437	3.0655	3.2855	3.5042	3.7217	3.9384	4.1543
(411.07)	h	387.12	1202.3		1228.8	1260.0	1289.1	1316.8	1370.0	1422.1	1474.2	1526.8	1579.9	1633.8	1688.4	1743.7	1799.8
	s	0.5805	1.5166		1.5464	1.5798	1.6093	1.6361	1.6841	1.7273	1.7671	1.8043	1.8395	1.8730	1.9050	1.9356	1.9649
	Sh				35.75	85.75	135.75	185.75	285.75	385.75	485.75	585.75	685.75	785.75	885.75	985.75	1085.75
290	v	0.01885	1.5948		1.6988	1.8327	1.9578	2.0772	2.3058	2.5269	2.7440	2.9585	3.1711	3.3824	3.5926	3.8019	4.0106
(414.75)	h	390.60	1202.6		1227.3	1258.9	1288.1	1316.0	1369.5	1421.7	1473.9	1526.5	1579.6	1633.5	1688.2	1743.6	1799.7
	s	0.5844	1.5135		1.5412	1.5750	1.6048	1.6317	1.6799	1.7232	1.7630	1.8003	1.8356	1.8690	1.9010	1.9316	1.9610
	Sh				32.65	82.65	132.65	182.65	282.65	382.65	482.65	582.65	682.65	782.65	882.65	982.65	1082.65
300	v	0.01889	1.5427		1.6356	1.7665	1.8883	2.0044	2.2263	2.4407	2.6509	2.8585	3.0643	3.2688	3.4721	3.6746	3.8764
(417.35)	h	393.99	1202.9		1225.7	1257.7	1287.2	1315.2	1368.9	1421.3	1473.6	1526.2	1579.4	1633.3	1688.0	1743.4	1799.6
	s	0.5882	1.5105		1.5351	1.5703	1.6003	1.6274	1.6758	1.7192	1.7591	1.7964	1.8317	1.8652	1.8972	1.9278	1.9572
	Sh				29.64	79.64	129.64	179.64	279.64	379.64	479.64	579.64	679.64	779.64	879.64	979.64	1079.64
310	v	0.01894	1.4939		1.5763	1.7044	1.8233	1.9363	2.1520	2.3600	2.5638	2.7650	2.9644	3.1625	3.3594	3.5555	3.7509
(420.36)	h	397.30	1203.2		1224.1	1256.5	1286.3	1314.5	1368.4	1420.9	1473.2	1525.9	1579.2	1633.1	1687.8	1743.3	1799.4
	s	0.5920	1.5076		1.5311	1.5657	1.5960	1.6233	1.6719	1.7153	1.7553	1.7927	1.8280	1.8615	1.8935	1.9241	1.9536
	Sh				26.69	76.69	126.69	176.69	276.69	376.69	476.69	576.69	676.69	776.69	876.69	976.69	1076.69
320	v	0.01899	1.4480		1.5207	1.6462	1.7623	1.8725	2.0823	2.2843	2.4821	2.6774	2.8708	3.0628	3.2538	3.4438	3.6332
(423.31)	h	400.53	1203.4		1222.5	1255.2	1285.3	1313.7	1367.8	1420.5	1472.9	1525.6	1578.9	1632.9	1687.6	1743.1	1799.3
	s	0.5956	1.5048		1.5261	1.5612	1.5918	1.6192	1.6680	1.7116	1.7516	1.7890	1.8243	1.8579	1.8899	1.9206	1.9500
	Sh				23.82	73.82	123.82	173.82	273.82	373.82	473.82	573.82	673.82	773.82	873.82	973.82	1073.82
330	v	0.01903	1.4048		1.4684	1.5915	1.7050	1.8125	2.0168	2.2132	2.4054	2.5950	2.7828	2.9692	3.1545	3.3389	3.5227
(426.18)	h	403.70	1203.6		1220.9	1254.0	1284.4	1313.0	1367.3	1420.0	1472.5	1525.3	1578.7	1632.7	1687.5	1742.9	1799.2
	s	0.5991	1.5021		1.5213	1.5568	1.5876	1.6153	1.6643	1.7079	1.7480	1.7855	1.8208	1.8544	1.8864	1.9171	1.9466
	Sh				21.01	71.01	121.01	171.01	271.01	371.01	471.01	571.01	671.01	771.01	871.01	971.01	1071.01
340	v	0.01908	1.3640		1.4191	1.5399	1.6511	1.7561	1.9552	2.1463	2.3333	2.5175	2.7000	2.8811	3.0611	3.2402	3.4186
(428.99)	h	406.80	1203.8		1219.2	1252.8	1283.4	1312.2	1366.7	1419.6	1472.2	1525.0	1578.4	1632.5	1687.3	1742.8	1799.0
	s	0.6026	1.4994		1.5165	1.5525	1.5836	1.6114	1.6606	1.7044	1.7445	1.7820	1.8174	1.8510	1.8831	1.9138	1.9432
	Sh				18.27	68.27	118.27	168.27	268.27	368.27	468.27	568.27	668.27	768.27	868.27	968.27	1068.27
350	v	0.01912	1.3255		1.3725	1.4913	1.6002	1.7028	1.8970	2.0832	2.2652	2.4445	2.6219	2.7980	2.9730	3.1471	3.3205
(431.73)	h	409.83	1204.0		1217.5	1251.5	1282.4	1311.4	1366.2	1419.2	1471.8	1524.7	1578.2	1632.3	1687.1	1742.6	1798.9
	s	0.6059	1.4968		1.5119	1.5483	1.5797	1.6077	1.6571	1.7009	1.7411	1.7787	1.8141	1.8477	1.8798	1.9105	1.9400
	Sh				15.59	65.59	115.59	165.59	265.59	365.59	465.59	565.59	665.59	765.59	865.59	965.59	1065.59
360	v	0.01917	1.2891		1.3285	1.4454	1.5521	1.6525	1.8421	2.0237	2.2009	2.3755	2.5482	2.7196	2.8898	3.0592	3.2279
(434.41)	h	412.81	1204.1		1215.8	1250.3	1281.5	1310.6	1365.6	1418.7	1471.5	1524.4	1577.9	1632.1	1686.9	1742.5	1798.8
	s	0.6092	1.4943		1.5073	1.5441	1.5758	1.6040	1.6536	1.6976	1.7379	1.7754	1.8109	1.8445	1.8766	1.9073	1.9368
	Sh				10.39	60.39	110.39	160.39	260.39	360.39	460.39	560.39	660.39	760.39	860.39	960.39	1060.39
380	v	0.01925	1.2218		1.2472	1.3606	1.4635	1.5598	1.7410	1.9139	2.0825	2.2484	2.4124	2.5750	2.7366	2.8973	3.0572
(439.61)	h	418.59	1204.4		1212.4	1247.7	1279.5	1309.0	1364.5	1417.9	1470.8	1523.8	1577.4	1631.6	1686.5	1742.2	1798.5
	s	0.6156	1.4894		1.4982	1.5360	1.5683	1.5969	1.6470	1.6911	1.7315	1.7692	1.8047	1.8384	1.8705	1.9012	1.9307

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press Lb/Sq In (Sat. Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 450	500	550	600	650	700	800	900	1000	1100	1200	1300	1400	1500
	Sh			5 40	55 40	105 40	155 40	205 40	255 40	355 40	455 40	555 40	655 40	755 40	855 40	955 40	1055 40
400	v	0.01934	1 1610	1 1738	1 2841	1 3836	1 4763	1 5646	1 6499	1 8151	1 9759	2 1339	2 2901	2 4450	2 5987	2 7515	2 9037
(444.60)	h	424 17	1204 6	1208 8	1245 1	1277 5	1307 4	1335 9	1363 4	1417 0	1470 1	1523 3	1576 9	1631 2	1686 2	1741 9	1798 2
	s	0 6217	1 4847	1 4894	1 5282	1 5611	1 5901	1 6163	1 6406	1 6850	1 7255	1 7637	1 7988	1 8325	1 8647	1 8955	1 9250
	Sh			60	50 60	100 60	150 60	200 60	250 60	350 60	450 60	550 60	650 60	750 60	850 60	950 60	1050 60
420	v	0.01942	1 1057	1 1071	1 2148	1 3113	1 4007	1 4856	1 5676	1 7258	1 8795	2 0304	2 1795	2 3273	2 4739	2 6196	2 7647
(449.40)	h	429 56	1204 7	1205 2	1242 4	1275 4	1305 8	1334 5	1362 3	1416 2	1469 4	1522 7	1576 4	1630 8	1685 8	1741 6	1798 0
	s	0 6276	1 4802	1 4808	1 5206	1 5542	1 5835	1 6100	1 6345	1 6791	1 7197	1 7575	1 7937	1 8269	1 8591	1 8899	1 9195
	Sh				45 97	95 97	145 97	195 97	245 97	345 97	445 97	545 97	645 97	745 97	845 97	945 97	1045 97
440	v	0 01950	1 0554		1 1517	1 2454	1 3319	1 4138	1 4926	1 6445	1 7918	1 9363	2 0790	2 2203	2 3605	2 4998	2 6384
(454 03)	h	434 77	1204 8		1239 7	1273 4	1304 2	1333 2	1361 1	1415 3	1468 7	1522 1	1575 9	1630 4	1685 5	1741 2	1797 7
	s	0 6332	1 4759		1 5132	1 5474	1 5772	1 6040	1 6286	1 6734	1 7142	1 7521	1 7878	1 8216	1 8538	1 8847	1 9143
	Sh				41 50	91 50	141 50	191 50	241 50	341 50	441 50	541 50	641 50	741 50	841 50	941 50	1041 50
460	v	0 01959	1 0092		1 0939	1 1857	1 2691	1 3485	1 4242	1 5703	1 7117	1 8504	1 9872	2 1226	2 2569	2 3903	2 5230
(458 50)	h	439 83	1204 8		1236 9	1271 3	1302 5	1331 8	1360 0	1414 4	1468 0	1521 5	1575 4	1629 9	1685 1	1740 9	1797 4
	s	0 6387	1 4718		1 5060	1 5409	1 5711	1 5987	1 6230	1 6680	1 7089	1 7469	1 7826	1 8165	1 8488	1 8797	1 9093
	Sh				37 18	87 18	137 18	187 18	237 18	337 18	437 18	537 18	637 18	737 18	837 18	937 18	1037 18
480	v	0 01967	0 9668		1 0409	1 1300	1 2115	1 2881	1 3615	1 5023	1 6384	1 7716	1 9030	2 0330	2 1619	2 2900	2 4173
(462 82)	h	444 75	1204 8		1234 1	1269 1	1300 8	1330 5	1358 8	1413 6	1467 3	1520 9	1574 9	1629 5	1684 7	1740 6	1797 2
	s	0 6439	1 4677		1 4990	1 5346	1 5652	1 5925	1 6176	1 6628	1 7038	1 7419	1 7777	1 8116	1 8439	1 8748	1 9045
	Sh				32 99	82 99	132 99	182 99	232 99	332 99	432 99	532 99	632 99	732 99	832 99	932 99	1032 99
500	v	0 01975	0 9276		0 9919	1 0791	1 1584	1 2327	1 3037	1 4397	1 5708	1 6992	1 8256	1 9507	2 0746	2 1977	2 3200
(467 01)	h	449 52	1204 7		1231 2	1267 0	1299 1	1329 1	1357 7	1412 7	1466 6	1520 3	1574 4	1629 1	1684 4	1740 3	1796 9
	s	0 6490	1 4639		1 4921	1 5284	1 5595	1 5871	1 6123	1 6578	1 6990	1 7371	1 7730	1 8069	1 8393	1 8702	1 8998
	Sh				28 93	78 93	128 93	178 93	228 93	328 93	428 93	528 93	628 93	728 93	828 93	928 93	1028 93
520	v	0 01982	0 8914		0 9466	1 0371	1 1094	1 1816	1 2504	1 3819	1 5085	1 6323	1 7542	1 8746	1 9940	2 1125	2 2302
(471 07)	h	454 18	1204 5		1228 3	1264 8	1297 4	1327 7	1356 5	1411 8	1465 9	1519 7	1573 9	1628 7	1684 0	1740 0	1796 7
	s	0 6540	1 4601		1 4853	1 5223	1 5539	1 5818	1 6072	1 6530	1 6943	1 7325	1 7684	1 8024	1 8348	1 8657	1 8954
	Sh				24 99	74 99	124 99	174 99	224 99	324 99	424 99	524 99	624 99	724 99	824 99	924 99	1024 99
540	v	0 01990	0 8577		0 9045	0 9884	1 0640	1 1342	1 2010	1 3284	1 4508	1 5704	1 6880	1 8047	1 9193	2 0336	2 1471
(475 01)	h	458 71	1204 4		1225 3	1262 5	1295 7	1326 3	1355 3	1410 9	1465 1	1519 1	1573 4	1628 2	1683 6	1739 7	1796 4
	s	0 6587	1 4565		1 4786	1 5164	1 5485	1 5767	1 6023	1 6483	1 6897	1 7280	1 7640	1 7981	1 8305	1 8615	1 8911

	Sh				21 16	71 16	121 16	171 16	221 16	321 16	421 16	521 16	621 16	721 16	821 16	921 16	1021 16
560	v	0 01998	0 8264		0 8653	0 9479	1 0217	1 0902	1 1552	1 2787	1 3972	1 5129	1 6266	1 7388	1 8500	1 9603	2 0699
(478 84)	h	463 14	1204 2		1222 2	1260 3	1293 9	1324 9	1354 2	1410 0	1464 4	1518 6	1572 9	1627 8	1683 3	1739 4	1796 1
	s	0 6634	1 4529		1 4720	1 5106	1 5431	1 5717	1 5975	1 6438	1 6853	1 7237	1 7598	1 7939	1 8263	1 8573	1 8870
	Sh				17 43	67 43	117 43	167 43	217 43	317 43	417 43	517 43	617 43	717 43	817 43	917 43	1017 43
580	v	0 02006	0 7971		0 8287	0 9100	0 9824	1 0492	1 1125	1 2324	1 3473	1 4593	1 5693	1 6780	1 7855	1 8921	1 9980
(482 57)	h	467 47	1203 9		1219 1	1258 0	1292 1	1322 4	1353 0	1409 2	1463 7	1518 0	1572 4	1627 4	1682 9	1739 1	1795 9
	s	0 6679	1 4495		1 4654	1 5049	1 5380	1 5668	1 5929	1 6394	1 6811	1 7196	1 7556	1 7898	1 8223	1 8533	1 8831
	Sh				13 80	63 80	113 80	163 80	213 80	313 80	413 80	513 80	613 80	713 80	813 80	913 80	1013 80
600	v	0 02013	0 7697		0 7944	0 8746	0 9456	1 0109	1 0726	1 1897	1 3008	1 4093	1 5160	1 6211	1 7252	1 8284	1 9309
(486 20)	h	471 70	1203 7		1215 9	1256 7	1290 9	1321 9	1352 8	1408 7	1463 6	1517 4	1571 9	1627 0	1682 6	1738 8	1795 6
	s	0 6723	1 4461		1 4550	1 4997	1 5326	1 5621	1 5884	1 6361	1 6769	1 7155	1 7517	1 7855	1 8184	1 8494	1 8791
	Sh				5 11	55 11	105 11	155 11	205 11	305 11	405 11	505 11	605 11	705 11	805 11	905 11	1005 11
650	v	0 02037	0 7084		0 7173	0 7964	0 8634	0 9254	0 9838	1 0959	1 1969	1 2979	1 3969	1 4944	1 5904	1 6864	1 7813
(494 89)	h	481 89	1202 8		1207 6	1249 8	1285 7	1318 2	1348 7	1406 0	1461 2	1515 9	1570 7	1625 9	1681 6	1738 0	1794 9
	s	1 6828	1 4381		1 4430	1 4858	1 5207	1 5507	1 5775	1 6249	1 6671	1 7059	1 7422	1 7765	1 8092	1 8403	1 8701
	Sh					48 92	98 92	148 92	198 92	298 92	398 92	498 92	598 92	698 92	798 92	898 92	998 92
700	v	0 02050	0 6556			0 7271	0 7928	0 8520	0 9072	1 0103	1 1078	1 2023	1 2948	1 3858	1 4757	1 5647	1 6530
(503 08)	h	491 60	1201 8			1240 4	1281 0	1314 6	1345 6	1403 7	1459 4	1514 4	1569 4	1624 8	1680 7	1737 2	1794 3
	s	0 6928	1 4304			1 4726	1 5090	1 5399	1 5673	1 6154	1 6580	1 6970	1 7335	1 7679	1 8006	1 8318	1 8617
	Sh					39 16	89 16	139 16	189 16	289 16	389 16	489 16	589 16	689 16	789 16	889 16	989 16
750	v	0 02069	0 6095			0 6676	0 7313	0 7882	0 8409	0 9386	1 0306	1 1195	1 2063	1 2916	1 3759	1 4593	1 5419
(510 84)	h	500 89	1200 7			1236 9	1276 1	1310 7	1342 5	1401 5	1457 6	1512 9	1568 2	1623 8	1679 8	1736 4	1793 6
	s	0 7022	1 4232			1 4598	1 4977	1 5296	1 5577	1 6065	1 6494	1 6886	1 7252	1 7598	1 7926	1 8239	1 8538
	Sh					31 79	81 79	131 79	181 79	281 79	381 79	481 79	581 79	681 79	781 79	881 79	981 79
800	v	0 02087	0 5690			0 6151	0 6774	0 7323	0 7828	0 8759	0 9631	1 0470	1 1289	1 2093	1 2885	1 3669	1 4446
(518 21)	h	509 81	1199 4			1230 1	1271 1	1306 8	1339 3	1399 1	1455 8	1511 4	1566 9	1622 7	1678 9	1735 7	1792 9
	s	0 7111	1 4163			1 4472	1 4869	1 5198	1 5484	1 5980	1 6413	1 6807	1 7175	1 7522	1 7851	1 8164	1 8464
	Sh					24 76	74 76	124 76	174 76	274 76	374 76	474 76	574 76	674 76	774 76	874 76	974 76
850	v	0 02105	0 5330			0 5683	0 6296	0 6829	0 7315	0 8205	0 9034	0 9830	1 0606	1 1366	1 2115	1 2855	1 3588
(525 24)	h	518 40	1198 0			1223 0	1265 9	1302 8	1336 0	1396 8	1454 0	1510 0	1565 7	1621 6	1678 0	1734 9	1792 3
	s	0 7197	1 4096			1 4347	1 4763	1 5102	1 5396	1 5899	1 6336	1 6733	1 7102	1 7450	1 7780	1 8094	1 8395
	Sh					18 05	68 05	118 05	168 05	268 05	368 05	468 05	568 05	668 05	768 05	868 05	968 05
900	v	0 02123	0 5009			0 5263	0 5869	0 6388	0 6858	0 7713	0 8504	0 9262	0 9998	1 0720	1 1430	1 2131	1 2825
(531 95)	h	526 70	1196 4			1215 5	1260 6	1298 6	1332 7	1394 4	1452 2	1508 5	1564 4	1620 6	1677 1	1734 1	1791 6
	s	0 7279	1 4032			1 4223	1 4659	1 5010	1 5311	1 5822	1 6263	1 6662	1 7033	1 7382	1 7713	1 8028	1 8329

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam—*Continued*

Abs Press Lb/Sq In (Sat Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 550	600	650	700	750	800	850	900	1000	1100	1200	1300	1400	1500
	Sh			11.61	61.61	111.61	161.61	211.61	261.61	311.61	361.61	461.61	561.61	661.61	761.61	861.61	961.61
900	v	0.02141	0.4721	0.4883	0.5485	0.5993	0.6449	0.6871	0.7272	0.7656	0.8030	0.8753	0.9455	1.0142	1.0817	1.1484	1.2143
(526.39)	h	534.74	1194.7	1207.6	1255.1	1294.4	1329.3	1361.5	1392.0	1421.5	1450.3	1507.0	1563.2	1619.5	1676.2	1733.3	1791.0
	s	0.7358	1.3970	1.4098	1.4557	1.4921	1.5228	1.5500	1.5748	1.5977	1.6193	1.6595	1.6967	1.7317	1.7649	1.7965	1.8267
	Sh			5.42	55.42	105.42	155.42	205.42	255.42	305.42	355.42	455.42	555.42	655.42	755.42	855.42	955.42
1000	v	0.02159	0.4460	0.4535	0.5137	0.5636	0.6080	0.6489	0.6875	0.7245	0.7603	0.8295	0.8966	0.9622	1.0266	1.0901	1.1529
(544.58)	h	542.55	1192.9	1199.3	1249.3	1290.1	1325.9	1358.7	1389.6	1419.4	1448.5	1505.4	1561.9	1618.4	1675.3	1732.5	1790.3
	s	0.7434	1.3910	1.3973	1.4457	1.4833	1.5149	1.5426	1.5677	1.5908	1.6126	1.6530	1.6905	1.7256	1.7589	1.7905	1.8207
	Sh				49.47	99.47	149.47	199.47	249.47	299.47	349.47	449.47	549.47	649.47	749.47	849.47	949.47
1050	v	0.02177	0.4227		0.4821	0.5312	0.5745	0.6142	0.6515	0.6872	0.7216	0.7881	0.8524	0.9151	0.9767	1.0373	1.0973
(550.53)	h	550.15	1191.0		1243.4	1285.7	1322.4	1355.8	1387.2	1417.3	1446.6	1503.9	1560.7	1617.4	1674.4	1731.8	1789.6
	s	0.7507	1.3851		1.4358	1.4748	1.5072	1.5354	1.5608	1.5842	1.6062	1.6469	1.6845	1.7197	1.7531	1.7848	1.8151
	Sh				43.72	93.72	143.72	193.72	243.72	293.72	343.72	443.72	543.72	643.72	743.72	843.72	943.72
1100	v	0.02195	0.4006		0.4531	0.5017	0.5440	0.5826	0.6188	0.6533	0.6865	0.7505	0.8121	0.8723	0.9313	0.9894	1.0468
(556.28)	h	557.55	1189.1		1237.3	1281.2	1318.8	1352.9	1384.7	1415.2	1444.7	1502.4	1559.4	1616.3	1673.5	1731.0	1789.0
	s	0.7578	1.3794		1.4259	1.4664	1.4996	1.5284	1.5542	1.5779	1.6000	1.6410	1.6787	1.7141	1.7475	1.7793	1.8097
	Sh				39.18	89.18	139.18	189.18	239.18	289.18	339.18	439.18	539.18	639.18	739.18	839.18	939.18
1150	v	0.02214	0.3807		0.4263	0.4746	0.5162	0.5538	0.5889	0.6223	0.6544	0.7161	0.7754	0.8332	0.8899	0.9456	1.0007
(561.82)	h	564.76	1187.0		1230.9	1276.6	1315.2	1349.9	1382.2	1413.0	1442.8	1500.9	1558.1	1615.2	1672.6	1730.2	1788.3
	s	0.7647	1.3738		1.4160	1.4582	1.4923	1.5216	1.5478	1.5717	1.5941	1.6353	1.6732	1.7087	1.7422	1.7741	1.8045
	Sh				32.81	82.81	132.81	182.81	232.81	282.81	332.81	432.81	532.81	632.81	732.81	832.81	932.81
1200	v	0.02232	0.3624		0.4016	0.4497	0.4905	0.5277	0.5615	0.5939	0.6250	0.6845	0.7418	0.7974	0.8519	0.9055	0.9584
(567.19)	h	571.85	1184.8		1224.2	1271.8	1311.5	1346.9	1379.7	1410.8	1440.9	1499.4	1556.9	1614.2	1671.6	1729.4	1787.6
	s	0.7714	1.3683		1.4061	1.4501	1.4851	1.5150	1.5415	1.5658	1.5883	1.6298	1.6679	1.7035	1.7371	1.7691	1.7996
	Sh				22.58	72.58	122.58	172.58	222.58	272.58	322.58	422.58	522.58	622.58	722.58	822.58	922.58
1300	v	0.02269	0.3299		0.3570	0.4052	0.4451	0.4804	0.5129	0.5436	0.5729	0.6287	0.6822	0.7341	0.7847	0.8345	0.8836
(577.42)	h	585.58	1180.2		1209.9	1261.9	1303.9	1340.8	1374.6	1406.4	1437.1	1496.3	1554.3	1612.0	1669.8	1727.9	1786.3
	s	0.7843	1.3577		1.3860	1.4340	1.4711	1.5022	1.5296	1.5544	1.5773	1.6194	1.6578	1.6937	1.7275	1.7596	1.7902
	Sh				12.93	62.93	112.93	162.93	212.93	262.93	312.93	412.93	512.93	612.93	712.93	812.93	912.93
1400	v	0.02307	0.3018		0.3176	0.3667	0.4059	0.4400	0.4712	0.5004	0.5282	0.5809	0.6311	0.6798	0.7272	0.7737	0.8195
(587.07)	h	598.83	1175.3		1194.1	1251.4	1296.1	1334.5	1369.3	1402.0	1433.2	1493.2	1551.8	1609.9	1668.0	1726.3	1785.0
	s	0.7966	1.3474		1.3652	1.4181	1.4575	1.4900	1.5182	1.5436	1.5670	1.6096	1.6484	1.6845	1.7185	1.7508	1.7815
	Sh				3.80	53.80	103.80	153.80	203.80	253.80	303.80	403.80	503.80	603.80	703.80	803.80	903.80
1500	v	0.02346	0.2772		0.2870	0.3328	0.3717	0.4049	0.4350	0.4629	0.4894	0.5394	0.5869	0.6327	0.6773	0.7210	0.7639
(596.20)	h	611.68	1170.1		1176.3	1240.2	1287.9	1328.0	1364.0	1397.4	1429.2	1490.1	1549.2	1607.7	1666.2	1724.8	1783.7
	s	0.8085	1.3373		1.3431	1.4022	1.4443	1.4782	1.5073	1.5333	1.5572	1.6004	1.6395	1.6759	1.7101	1.7425	1.7734
	Sh					45.13	95.13	145.13	195.13	245.13	295.13	395.13	495.13	595.13	695.13	795.13	895.13
1600	v	0.02387	0.2555			0.3026	0.3415	0.3741	0.4032	0.4301	0.4555	0.5031	0.5482	0.5915	0.6336	0.6748	0.7153
(604.87)	h	624.20	1164.5			1228.3	1279.4	1321.4	1358.5	1392.8	1425.2	1485.9	1546.6	1605.6	1664.3	1723.2	1782.3
	s	0.8199	1.3274			1.3861	1.4312	1.4667	1.4968	1.5235	1.5478	1.5916	1.6312	1.6678	1.7022	1.7347	1.7657
	Sh					36.87	86.87	136.87	186.87	236.87	286.87	386.87	486.87	586.87	686.87	786.87	886.87
1700	v	0.02428	0.2361			0.2754	0.3147	0.3468	0.3751	0.4011	0.4255	0.4711	0.5140	0.5552	0.5951	0.6341	0.6724
(613.13)	h	636.45	1158.6			1215.3	1270.5	1314.5	1352.9	1388.1	1421.2	1483.8	1544.0	1603.4	1662.5	1721.7	1781.0
	s	0.8309	1.3176			1.3697	1.4183	1.4555	1.4867	1.5140	1.5388	1.5833	1.6232	1.6601	1.6947	1.7274	1.7585
	Sh					28.98	78.98	128.98	178.98	228.98	278.98	378.98	478.98	578.98	678.98	778.98	878.98
1800	v	0.02472	0.2186			0.2505	0.2909	0.3223	0.3500	0.3752	0.3988	0.4426	0.4836	0.5229	0.5609	0.5980	0.6343
(621.03)	h	648.49	1151.3			1201.2	1261.1	1307.4	1347.2	1383.3	1417.1	1480.6	1541.4	1601.2	1660.7	1720.1	1779.7
	s	0.8417	1.3079			1.3526	1.4054	1.4446	1.4768	1.5049	1.5302	1.5753	1.6156	1.6528	1.6876	1.7204	1.7516
	Sh					21.44	71.44	121.44	171.44	221.44	271.44	371.44	471.44	571.44	671.44	771.44	871.44
1900	v	0.02517	0.2028			0.2274	0.2687	0.3004	0.3275	0.3521	0.3749	0.4171	0.4565	0.4940	0.5303	0.5656	0.6001
(628.56)	h	660.36	1145.6			1185.7	1251.3	1300.2	1341.4	1378.4	1412.9	1477.4	1538.8	1599.1	1658.8	1718.6	1778.4
	s	0.8522	1.2981			1.3348	1.3925	1.4338	1.4672	1.4960	1.5219	1.5677	1.6084	1.6458	1.6808	1.7138	1.7451
	Sh					14.20	64.20	114.20	164.20	214.20	264.20	364.20	464.20	564.20	664.20	764.20	864.20
2000	v	0.02565	0.1883			0.2056	0.2488	0.2805	0.3072	0.3312	0.3534	0.3942	0.4320	0.4680	0.5027	0.5365	0.5695
(635.80)	h	672.11	1138.3			1168.3	1240.9	1292.6	1335.4	1373.5	1408.7	1474.1	1536.2	1596.9	1657.0	1717.0	1777.1
	s	0.8625	1.2881			1.3154	1.3794	1.4231	1.4578	1.4874	1.5138	1.5603	1.6014	1.6391	1.6743	1.7075	1.7389
	Sh					7.24	57.24	107.24	157.24	207.24	257.24	357.24	457.24	557.24	657.24	757.24	857.24
2100	v	0.02615	0.1750			0.1847	0.2304	0.2624	0.2888	0.3123	0.3339	0.3734	0.4099	0.4445	0.4778	0.5101	0.5418
(642.76)	h	683.79	1130.5			1148.5	1229.8	1284.9	1329.3	1368.4	1404.4	1470.9	1533.6	1594.7	1655.2	1715.4	1775.7
	s	0.8727	1.2780			1.2942	1.3661	1.4125	1.4486	1.4790	1.5060	1.5532	1.5948	1.6327	1.6681	1.7014	1.7330
	Sh					5.5	50.55	100.55	150.55	200.55	250.55	350.55	450.55	550.55	650.55	750.55	850.55
2200	v	0.02669	0.1627			0.1636	0.2134	0.2458	0.2720	0.2950	0.3161	0.3545	0.3897	0.4231	0.4551	0.4862	0.5165
(649.45)	h	695.46	1122.2			1123.9	1218.0	1276.8	1323.1	1363.3	1400.0	1467.6	1530.9	1592.5	1653.3	1713.9	1774.4
	s	0.8828	1.2676			1.2691	1.3523	1.4020	1.4395	1.4708	1.4984	1.5463	1.5883	1.6266	1.6622	1.6956	1.7273
	Sh						44.11	94.11	144.11	194.11	244.11	344.11	444.11	544.11	644.11	744.11	844.11
2300	v	0.02727	0.1513				0.1975	0.2305	0.2566	0.2793	0.2999	0.3372	0.3714	0.4035	0.4344	0.4643	0.4935
(655.89)	h	707.18	1113.2				1205.3	1268.4	1316.7	1358.1	1395.7	1464.2	1528.3	1590.3	1651.5	1712.3	1773.1
	s	0.8929	1.2569				1.3381	1.3914	1.4305	1.4628	1.4910	1.5397	1.5821	1.6207	1.6565	1.6901	1.7219

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

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

FACILITY: HATCH 1&2

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 85/03/11

EXAMINER: K E BROCKMAN

APPLICANT: _____

INSTRUCTIONS TO APPLICANT:

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

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
~~20.00~~ 79.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
20.00	25.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
20.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
20.00	25.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
~~80.00~~ 79.00	100.00			TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

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

QUESTION 5.01 (1.00)

Which of the following is NOT a characteristic of Subcritical Multiplication?

a. The subcritical neutron level is directly proportional to the neutron source strength.

b. Doubling the indicated count rate by reactivity additions will reduce the margin to criticality by approximately one-half.

c. For equal reactivity additions, it takes longer for the new equilibrium count rate to be reached, as K-eff approaches unity.

d. If ten (10) notches of rod withdrawal increases the SRM count rate by 10 cps, then twenty (20) notches of rod withdrawal will increase the SRM count rate by 20 cps. ASSUME CONSTANT ROD WORTH.

QUESTION 5.02 (1.00)

The change in reactivity associated with a change in K-eff from 0.920 to 1.004 is approximately ... (CHOOSE ONE)

a. 0.091
b. 0.084
c. 0.087
d. 0.080

QUESTION 5.03 (1.00)

A "Periodic NSSS Core Performance Log" (P-1) is attached for reference. Which statement is most accurately reflected by this printout?

a. Maximum LHGR(s) in the core is 12.00 Kw/ft.
b. Maximum LHGR(s) in the core is 7.69 Kw/ft.
c. Maximum LHGR(s) in the core is 13.40 Kw/ft.
d. Maximum LHGR(s) in the core is 9.19 Kw/ft.

QUESTION 5.04 (1.00)

The condensate subcooling in a condenser operating at 1 PSIA, with a condensate temperature of 95 deg F is ... (CHOOSE ONE)

a. 6.7 deg F
b. 196.7 deg F
c. 10.7 deg F
d. 120.3 deg F

QUESTION 5.05 (2.00)

The attached figure shows a basic closed loop fluid system with its head vs. flow plot (BOLD LINES). The two pumps are identical, variable speed, radial, centrifugal pumps. Pump 1 is initially operating at one-half speed to supply flow to component 1, as shown.

a. Component 2 is placed into service, thereby increasing the system heat load. Would total power consumption be less by ...(CHOOSE ONE)
(1) Doubling the speed of Pump 1
(2) Starting Pump 2 at one-half speed (0.5)

b. Which Pump Curve - A, B, C, or D - most accurately shows BOTH PUMPS operating to supply the system flow? (0.5)

c. With only Pump 1 operating at one-half speed - If component 2 were throttled open from its initial position, would the system flow INCREASE, DECREASE, or REMAIN THE SAME? (COMPONENTS 1 & 2 ARE IDENTICAL!) (0.5)

d. Given one operating pump, that is changed to a POSITIVE DISPLACEMENT pump. Is the correct Pump Curve to reflect this Curve A, B, C, or D? (0.5)

QUESTION 5.06 (1.50)

MATCH the appropriate Thermal Limit (a-c),

a. Linear Heat Generation Rate (LHGR)
b. Average Planar Linear Heat Generation Rate (APLHGR)
c. Minimum Critical Power Ratio (MCPR)

to each FAILURE MECHANISM AND to each LIMITING CONDITION given below:

FAILURE MECHANISM	LIMITING CONDITION
F1. Clad melting caused by decay heat & stored heat following a LOCA	L1. Coolant transition boiling
F2. Clad cracking from the surface becoming vapor "blanketed"	L2. Clad plastic strain < 1%
F3. Clad cracking caused by high stress from pellet expansion	L3. Maximum clad temperature of 2200 deg F

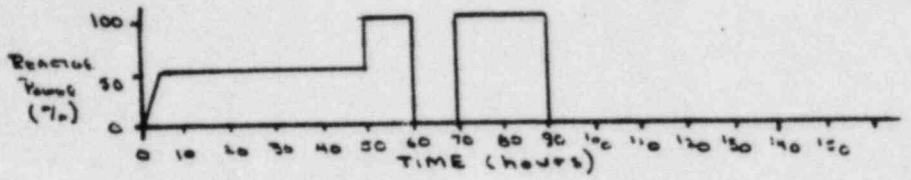
QUESTION 5.07 (1.00)

Which of the following describes the changes to the steam that occurs between the inlet and the outlet of a REAL turbine?

a. Enthalpy DECREASES, Entropy DECREASES, Quality DECREASES
b. Enthalpy INCREASES, Entropy INCREASES, Quality INCREASES
c. Enthalpy CONSTANT , Entropy DECREASES, Quality DECREASES
d. Enthalpy DECREASES, Entropy INCREASES, Quality DECREASES

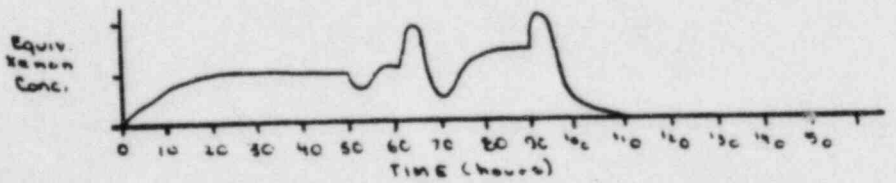
QUESTION 5.08 (1.00)

Given the following Power History:

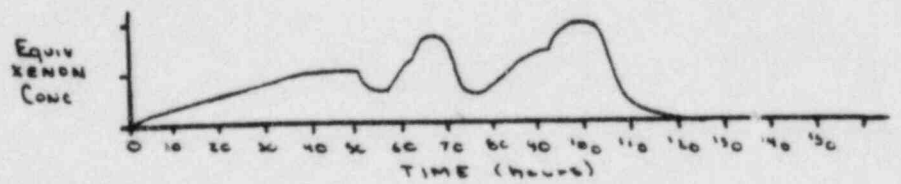


Select the most accurate curve displaying the expected XENON transient.

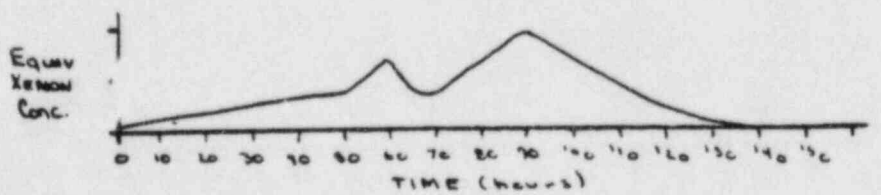
a.



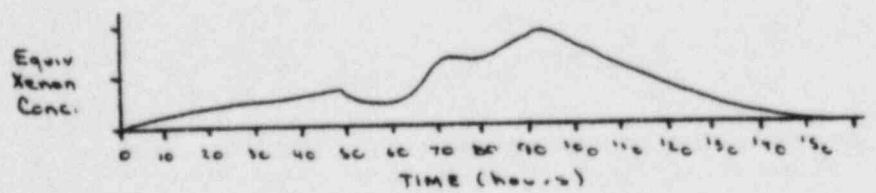
b.



c.



d.



QUESTION 5.09 (1.00)

Which of the following accurately describes a benefit of the Control Cell Core (CCC)?

a. The Capacity Factor is increased due to the elimination of rod pattern exchanges.

b. Operations are simplified since flux shaping is no longer required.

c. Thermal Limit margins are increased due to the elimination of all high power fuel bundles.

d. Fuel reliability has been improved due to the increased PCIOMR ramping rates which have been incorporated.

QUESTION 5.10 (2.50)

The attached figure represents a transient that could occur at a BWR.

Given: (1) All FW Pumps trip at time T=1.2 min
(2) No operator actions occur
(3) Recorder Speed = 1 division = 1 minute

EXPLAIN the cause(s) of the following recorder indications:

a. Core Flow DECREASE (Point A)
b. Reactor Pressure INCREASE (Point B)
c. Level INCREASE (Point C)
d. Pressure FLUCTUATION (Point D @ Time 3 - 7 minutes)
e. Reactor Power DECREASE (Point E)

QUESTION 5.11 (2.50)

The attached figure represents a transient that could occur at a BWR.

Given: (1) Both Recirculation Pumps trip at time T = 1 min
(2) No operator actions occur
(3) Recorder Speed = 1 division = 1 minute

EXPLAIN the cause(s) of the following recorder indications:

a. Core Flow DECREASE (Point A)
b. Level INCREASE (Point B)
c. FW Flow DECREASE (Point C)
d. Power INCREASE (2.2 - 3.2 minutes - Point D)
e. Why did Turbine Steam Flow stabilize at approximately 50%?

QUESTION 5.12 (1.00)

A reactor heat balance was performed (by hand) during the 00-08 shift due to the Process Computer being OOC. The GAF's were computed, but the APRM GAIN ADJUSTMENTS HAVE NOT BEEN MADE. Which of the following statements is TRUE concerning reactor power?

a. If the feedwater temperature used in the heat balance calculation was LOWER than the actual feedwater temperature, then the actual power is HIGHER than the currently calculated power.

b. If the reactor recirculation pump heat input used in the heat balance calculation was OMITTED, then the actual power is LOWER than the currently calculated power.

c. If the steam flow used in the heat balance calculation was LOWER than the actual steam flow, then the actual power is LOWER than the currently calculated power.

d. If the RWCU return temperature used in the heat balance calculation was HIGHER than the actual RWCU return temperature, then the actual power is LOWER than the currently calculated power.

QUESTION 5.13 ~~(2.00)~~ 1.00

Given: Reactor Power 60%
Core Flow 40%
T (Tau) .6
Fuel Type P8x8R
Max Flow Rate 107%
Figures 5.4, 5.5, 5.6 Enclosed

~~a. OLMCPR is ...(CHOOSE ONE)~~ (1.0)

~~(1) 1.931~~
~~(2) 1.682~~
~~(3) 1.539~~
~~(4) 1.463~~

Deleted

b. If the MCPR Printout from the Process Computer for Rod 29-17 read 1.973, which of the following would be required per Unit 2 Tech Specs?

(1) No Action Required

(2) Initiate corrective action within 15 minutes and continue the corrective action so that MCPR is within the applicable limit within 2 hours, or reduce thermal power to < 25% within the next 4 hours.

(3) Initiate corrective action within 15 minutes and continue the corrective action so that MCPR is within the applicable limit within 4 hours, or reduce thermal power to < 25% within the next 8 hours.

(4) Place the reactor in HOT SHUTDOWN within 2 hours and reduce steam dome pressure to < 785 psig and core flow to < 10% within the next 4 hours.

QUESTION 5.14 (1.00)

The fission process in a commercial reactor requires the neutrons that are 'born' by fission to be 'thermalized.' The interaction in the reactor core which is most efficient in thermalizing neutrons for fission occurs with the ...(CHOOSE ONE)

a. OXYGEN atoms in the water molecules
b. BORON atoms in the control rods
c. ZIRCONIUM atoms in the fuel cladding
d. HYDROGEN atoms in the water molecules

QUESTION 5.15 (.50)

Answer the following TRUE or FALSE:

With a reactor that is critical, low in the intermediate range, an EQUAL amount of POSITIVE or NEGATIVE reactivity insertion (e.g. 10E-4 k/k) will produce stable periods of EQUAL MAGNITUDE.

QUESTION 6.01 (1.00)

The Drywell Pneumatics System is operating in its normal line-up (Mode B). Pressure DECREASES (to approximately 100 psig). The system will automatically align such that ...(CHOOSE ONE)

a. ...the back-up Nitrogen supply line isolation valve (F001A) will OPEN and the bypass valve (F001B) will CLOSE.

b. ...the back-up Nitrogen supply line isolation valve (F001A) will OPEN and the bypass valve (F001B) will OPEN.

c. ...the Essential/Uninterruptable Instrument Air supply line isolation valves (F029 & F053) will OPEN.

d. ...the Non-essential/Interruptable Instrument Air supply line isolation valves (F036 & F038) will OPEN and the Drywell Pneumatics Compressors will TRIP and ISOLATE.

QUESTION 6.02 (1.00)

Given a Low CST Level on Unit 1 AND a High Torus Level on Unit 2. Which one of the following accurately describes the responses of the HPCI and RCIC Systems?

a. BOTH units' HPCI AND RCIC will auto-swap to Torus Suction.
b. Unit 2 HPCI AND RCIC will auto-swap to Torus Suction; Unit 1 will auto-swap for HPCI ONLY.
c. Unit 1 HPCI AND RCIC will auto-swap to Torus Suction; Unit 2 will auto-swap for HPCI ONLY.
d. BOTH units' HPCI will auto-swap to Torus Suction; RCIC does not swap.

QUESTION 6.03 (1.00)

Given: Unit 2 in control of D/G 'B'
D/G 'B' Mode Switch in TEST (Surveillance being performed)
Electrical distribution NORMAL (Full Power Lineup)

D/G 'B' is at rated speed and voltage, but not synchronized, when power is lost to 4160 volt Bus 2F. Which of the following accurately describes the system operation?

a. Bus 2F can be powered by D/G 'B' when the operator takes the Output Breaker Switch to CLOSE and has the SYNC SCOPE activated.

b. Bus 2F will be powered by D/G 'B' automatically, after 12 seconds; appropriate loads will be picked up sequentially.

c. Bus 2F can not be powered by D/G 'B' while it is in the TEST mode, given these conditions.

d. Bus 2F can be powered by D/G 'B' when the operator resets the Lockout Relay, activates the SYNC SCOPE, and takes the Output Breaker to CLOSE.

QUESTION 6.04 (1.00)

The Main Turbine first stage pressure switches provide permissives and/or control signals for several plant functions. Which of the following is NOT one of these control functions?

a. Recirculation Pump RPT breaker trip permissive
b. RSCS bypass
c. RWM LPAP
d. TSV, 10% Closure Scram bypass

QUESTION 6.05 (1.00)

The Recirculation Flow Control System contains a 44% Speed Limiter to control Recirculation pump speed under certain plant conditions. This 44% Limiter ...(CHOOSE ONE)

a. ...is first activated when total feedwater flow decreases below 20% and a reactor vessel low water level alarm is received.

b. ...is designed to prevent Recirculation pump cavitation by ensuring adequate Net Positive Suction Head.

c. ...enables the FWCS to recover reactor vessel water level upon loss of one Reactor Feedwater pump.

d. ...automatically resets when the initiating signal clears to enable the operator to restore normal recirculation flow.

QUESTION 6.06 (1.00)

The Reactor Water Cleanup System (RWCU) is being operated in the 'Hot Blowdown' mode to control reactor water level. Which one of the following limitations is NOT a valid concern to the operator while controlling blowdown flow rate to the main condenser?

a. Exceeding the maximum allowable RBCCW System temperature exiting the Non-Regenerative Heat Exchanger (NRHX).

b. Exceeding the maximum allowable RWCU system temperature exiting the NRHX.

c. Exceeding the Pressure setpoint for downstream of the Blowdown FCV.

D. Exceeding the design cooling capacity of the Regenerative Heat Exchanger (RHX).

QUESTION 6.07 (1.00)

Which one of the following accurately describes Low-Low Set (LLS) logic, as applied at Plant Hatch?

a. Lowers BOTH the opening and closing setpoints of the LLS valves.
b. Controls the operation of all relief valves, excepting E and H.
c. Is activated by a position switch which confirms any SRV opening.
d. Is applicable to Unit 2 ONLY.

QUESTION 6.08 (2.00)

Regarding the Residual Heat Removal (RHR) System while operating in the Shutdown Cooling (SDC) Mode:

a. STATE why it is necessary to prevent the RHR pump's discharge from decreasing below 400 gpm. (1.0)

b. LIST 2 ways in which the system will be effected if reactor pressure increases to above 135 psig. (1.0)

QUESTION 6.09 (2.00)

With regard to the Unit 2 HPCI System:

a. LIST the two (2) conditions (including setpoints) which will automatically initiate HPCI. (1.0)

b. For each of the situations listed below, STATE whether HPCI WILL or WILL NOT Automatically Inject into the reactor vessel. (1.0)

NOTE: ASSUME NO OPERATOR ACTIONS; ASSUME ANY FAILED COMPONENTS WERE IN THE FAILED CONDITION AT THE TIME OF THE AUTO INITIATION SIGNAL.

(1) The GLAND SEAL EXHAUSTER VACUUM PUMP fails to operate.

(2) The MINIMUM FLOW VALVE fails to auto open (stays shut) when system conditions require it to be open.

(3) After decreasing to 50 psig, HPCI Steam Line Pressure increases to 150 psig.

(4) After increasing to +60 inches, Reactor Vessel Water Level decreases to -60 inches.

QUESTION 6.10 (1.00)

The Unit 2 Vital AC Power 120/240 v Distribution Cabinet 2A is normally supplied from 600 v Bus 2D through a Battery Charger and a Static Inverter. If the Static Inverter fails ...(CHOOSE ONE)

a. ... the 125 vdc battery will maintain power to the Vital AC Cabinet for up to 6 hours.

b. ...the power supply can be manually transfered to the alternate 600 v Bus 2C / Vital AC Transformer 2A by depressing a transfer PB.

c. ...the power supply will automatically transfer to the alternate 600 v Bus 2C / Vital AC Transformer 2A.

d. ...the power supply can be manually transfered to the alternate 600 v Bus 2C / alternate Static Inverter by depressing a transfer PB.

QUESTION 6.11 (1.00)

The Unit 1 Primary Containment Atmospheric Control System can be used to vent the primary containment under normal operating conditions. To do this, the operator must manipulate the key-locked bypass switches. The direct effect of doing this, and the method by which this is done, is to ...(CHOOSE ONE)

a. ...override the HI MSL PRESSURE (> 850 psig) isolation signal by HOLDING the bypass switches in the BYPASS position.

b. ...override the HI MSL PRESSURE (> 850 psig) and the LOCA isolation signals by HOLDING the bypass switches in the BYPASS position.

c. ...override the HI MSL PRESSURE (> 850 psig) isolation signals by PLACING the bypass switches in the BYPASS position.

d. ...override the HI MSL PRESSURE (> 850 psig) and the LOCA isolation signals by PLACING the bypass switches in the BYPASS position.

QUESTION 6.12 (1.00)

Unit 1 is operating at 48% RTP using Reactor Feedwater Pumps 1A and 1B. Feedwater Line A is isolated (MOV F006A Shut). With this condition, a flowpath for RWCU ... (CHOOSE ONE)

a. ...CAN BE MAINTAINED. The RWCU connection to FW Line A is isolated by removing the spool piece between RWCU and the HPCI discharge; RWCU is operated via RCIC and FW Line B.

b. ...CAN BE MAINTAINED. The RWCU connection to FW Line A is isolated by manually valving shut the connection between RWCU and the HPCI discharge. RWCU is operated via RCIC and FW Line B.

c. ...CANNOT BE MAINTAINED. The RWCU flow to FW Line A is not isolable since the RWCU to HPCI discharge connection is not valved.

d. ...CANNOT BE MAINTAINED. RWCU only has a discharge isolation valve on its common discharge header; no FW line can be isolated without securing RWCU.

QUESTION 6.13 (1.00)

Which of the following statements correctly describes the protective trip function(s) associated with the Reactor Recirculation pumps/motor generator sets?

a. The 'EOC-RPT' trip protects the plant from overpressurization transients (e.g. MSIV Closure) by tripping the recirculation pumps, when reactor pressure exceeds 1120 psig.

b. The motor generator field breaker stays closed in most instances when the MG Set drive motor breaker trips, in order to maximize coastdown flow.

c. The two 'EOC-RPT' breakers for each recirculation pump are redundant to the MG Set drive motor breakers, and interrupt power to the MG Set during overpressurization transients.

d. The reactor recirculation pumps trip on low low reactor vessel water level, to ensure Net Positive Suction Head (NPSH) requirements are met.

QUESTION 6.14 (1.00)

A reactor startup/power ascent is in progress with the "B" IRM failed upscale and in BYPASS. The mode switch has just been taken to "Run". WHICH one of the following situations/ events will cause a reactor HALF-SCRAM?

a. APRM Flow Converter (Unit) "A" goes INOP
b. APRM "B" fails DOWNSCALE
c. One of the 11 valid LPRM inputs to APRM "B" fails DOWNSCALE
d. APRM "B" Mode Switch is taken to STANDBY

QUESTION 6.15 (1.00)

Which of the displays of the indicator lights for ATTS indicate that the system is in its normal operating mode with NO ALARM CONDITIONS present? (CHOOSE ONE)

NOTE: FIGURES 9.9(3) AND 9.9(6) PROVIDED FOR REFERENCE

	DISPLAY/COLOR			
LITE/PANEL	(a)	(b)	(c)	(d)
TRIP STATUS/MTU	ON/Green	OUT	ON/Amber	OUT
STATUS/MTU	ON/Green	ON/Green	OUT	On/Red
GROSS FAIL/MTU	ON/Green	OUT	ON/Green	OUT
POWER/P925	ON/Green	ON/Clear	ON/Red	ON/Green

QUESTION 6.16 (2.00)

EXPLAIN how reactor vessel level is controlled in the dP Mode during a reactor startup. Include the parameters which are sensed and the plant systems/components controlled.

QUESTION 6.17 (1.00)

STATE how (INCREASE, DECREASE, REMAIN THE SAME) Drywell Pressure would be expected to respond to an SRV discharge line vacuum breaker STICKING OPEN during actuation of the SRV. EXPLAIN YOUR CHOICE.

QUESTION 7.01 (2.00)

Procedure HNP-2-1909, 'Inability to Shutdown With Control Rods', states that:

> '... if at any time, either condition b(1) or b(2) exists, and either _____(a.1)____ or ____(a.2)____, and if it is obvious that the reactor cannot be shutdown and, in the judgment of the Shift Supervisor, or in his absence, a licensed operator, a hazard exists to the environs, personnel, or the plant, utilize the standby liquid control system per HNP-2-1400 ...'

a. LIST conditions (a.1) and (a.2). (1.0)

b. LIST conditions b(1) and b(2). (1.0)

QUESTION 7.02 (1.50)

Procedure HNP-8008, 'Radiation Work Permit', describes three (3) different types of RWP's which can be issued - REGULAR, ROUTINE, and BLANKET. For the following situations, STATE the most appropriate RWP to be issued.

a. Unit 1 is in an outage and the main turbine is being repaired. A controlled work area, with constant HP coverage, has been established for the round-the-clock repairs. This should last for several weeks. (0.5)

b. Unit 1 is in an outage and the main turbine requires inspection. Constant HP coverage will be maintained; the job should take approximately 18 hours. (0.5)

c. Unit 1 is in an outage. Special outage procedures will require routine (once per shift) entries into a Hi Radiation Area for component inspection. This will be required for the next three (3) months. (0.5)

QUESTION 7.03 (1.00)

You are supervising refueling activities on the Refueling Floor and hear the ARM HI RADIATION ALARM. No control rods are currently withdrawn. Per HNP-1903, "Refueling Floor High Radiation", you would contact the Control Room after ...(CHOOSE ONE)

a. ...immediately evacuating all personnel involved in fuel handling activities to the 130' Health Physics area.

b. ...reading the ARM level locally and immediately evacuating ALL personnel to the 130' Health Physics area, if the level is > 50 mR/hr.

c. ...immediately evacuating ALL personnel on the refueling floor to the 185' Change area.

d. ...immediately evacuating those personnel in the vicinity of the alarming ARM (not the entire R/F Floor) to the 185' Change Area.

QUESTION 7.04 (1.00)

You enter HNP-2-1910, "Loss of All Plant Service Water", and are unable to restore PSW operation. Subsequent operator actions require you to place Fuel Pool Cooling in operation at maximum flow. This is done to ...(CHOOSE ONE)

a. ... provide a long-term heat sink for RHRSW via the Fuel Pool Cooling Assist connection.

b. ... prepare for the high heat load from the impending reactor shutdown and required fuel unload.

c. ... provide a long term heat sink for TBCCW.

d. ... provide a short term heat sink for RBCCW.

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

QUESTION 7.05 (.50)

You enter an area posted with the following sign:

As a minimum, how often should you read your pocket dosimeter?

QUESTION 7.06 (1.00)

Unit 2 is operating at 70% RTP; you notice power start to increase with NO CHANGE in recirculation flow or rod position. You suspect a Loss of Feedwater Heating.

Which of the following actions are required/appropriate, per HNP-2-1946?

a. A 20% reduction in Recirc Flow, monitored by Recirc Flow Controller ma signal variance.

b. A 20% Power Reduction, using Recirc Flow, monitored by APRM's.

c. Insertion of Shallow Rods, to maintain proper flux shape, prior to reducing Recirc Flow.

d. Insertion of Power Rods, to maintain proper flux shape, prior to reducing Recirc Flow.

QUESTION 7.07 (1.00)

A CAUTION in HNP-2-1902, 'Pipe Break Inside Primary Containment', states that:

> 'A Pipe Break in the Drywell could result in Reactor Level Reading inaccuracies due to increased temperature. Refer to Section 'E' ... for erratic correction method before proceeding. Erratic level indication could be due to water in the sensing line flashing to steam.'

Using Section 'E', enclosed, and given the following readings:

2T47-R620	192 deg F
2T47-R621	228 deg F
2B21-604A	+26 inches
2B21-604B	+23 inches

What is the best estimate of Actual Water Level?

a. +9-1/2 inches
b. +15 inches
c. +34 inches
d. +27-1/2 inches

QUESTION 7.08 (1.00)

Which of the following conditions establishes the reactor in HOT STANDBY, as defined by HNP-2-1015, 'Maintaining Hot Standby Condition'?

PARAMETER	CONDITION (a)	(b)	(c)	(d)
Mode Switch	S & HS	S & HS	S & HS	S & HS
Coolant Temp	> 212 deg F	> 212 deg F	> 200 deg F	> 200 deg F
Rx Pressure	< 1040 psig	< 1010 psig	< 1010 psig	< 1040 psig
K-eff	1.000	< 1.000	1.000	< 1.000

QUESTION 7.09 (1.00)

Both Recirculation Pumps trip. You place the Mode Switch to SHUTDOWN but are, subsequently, UNSUCCESSFUL in restarting either Recirc Pump.

COMPLETE THE FOLLOWING: (HNP-2-1932)

> 'Subsequent to Reactor Shutdown, and without both recirculation pumps operating, maintain vessel level from (greater than) ____(a)____, to ensure ____(b)____.'

QUESTION 7.10 (1.00)

You receive the following annunciator alarm:

POWDEX SYSTEM TROUBLE

You determine that you have a Condenser tube leak, per HNP-2-1928, "Condenser Tube Leaks". Which one of the following accurately describes your Operator Actions?

a. Confirm demin effluent < 0.1 umho/cm; increase power to maintain conductivity < 2.0 umho/cm; commence a reactor shutdown if conductivity > 0.5 umho/cm.

b. Confirm demin effluent < 1.0 umho/cm; decrease power to maintain conductivity < 2.0 umho/cm; initiate fast shutdown if conductivity becomes > 2.0 umho/cm.

c. Confirm demin effluent < 1.0 umho/cm; increase power to maintain conductivity < 2.0 umho/cm; commence normal reactor shutdown if conductivity becomes > 5.0 umho/cm.

d. Confirm demin effluent < 0.1 umho/cm; decrease power to maintain conductivity < 0.2 umho/cm; initiate fast shutdown if conductivity becomes > 0.2 umho/cm.

QUESTION 7.11 (1.00)

Procedure HNP-2-1934, "Torus Water Temperature Above 95 deg F", directs:

"If any point indicates a torus temperature greater than or equal to 95 deg F, initiate torus cooling..."

Additionally,

"Operator should not initiate torus cooling unless water level is ___(1)___ and at a level greater than ___(2)___."

Which of the following are the MINIMUM requirements for (1) and (2)?

a. (1) Stable
(2) that required for Natural Circulation

b. (1) Increasing
(2) Top of Active Fuel

c. (1) Stable
(2) 2/3 Core Height

d. (1) Increasing
(2) Reactor Vessel Zero

QUESTION 7.12 (2.00)

Place the following procedural steps from HNP-2-1001 into the proper sequence, as they would be performed during an actual reactor plant startup and pressurization according to the procedure:

a. Stabilize reactor power with 1-1/2 BPV's open
b. Start a Mechanical Vacuum Pump
c. Open the Steam Seal Feed and Bypass Valves
d. Establish vessel water reject thru the RWCU System
e. Place a SJAE into service
f. Start a Steam Packing Exhauster
g. Place RCIC in Standby, per HNP-2-1125
h. Start Reactor Feedwater Pump 2A (or 2B)

QUESTION 7.13 (1.00)

Procedure HNP-2-4207, 'Transformer Fire', lists three (3) Operator Action Steps for a Startup Auxiliary Transformer fire. Which of the following is NOT a required Operator Action?

a. Confirm CARDOX system actuated.
b. Manually start the required D/G's and synchronize to the E-bus.
c. Deenergize the Transformer.
d. Evaluate the plant conditions for possible shutdown.

QUESTION 7.14 (2.00)

Procedure HNP-2-1001, 'Normal Startup', instructs the operator to:

REAC water level select switch (select level B; level A to be used only when performing maintenance or surveillance on level B).

NOTE: FIGURE 2.3(2) IS PROVIDED AS REFERENCE

EXPLAIN why level B is specified.

QUESTION 7.15 (1.00)

Procedure HNP-2-1437, 'Reactor Recirculation Pump Speed Changes', cautions the operator not to start an idle pump unless the other pump is operating at < 50% loop speed.

EXPLAIN the reason for this procedural CAUTION.

QUESTION 7.16 (1.00)

Procedure HNP-2-1005, "Power Changes", states that Unit 2's licensed maximum thermal power for steady state operations is 2436 MwT.

EXPLAIN in what instance(s) this maximum power may be exceeded and how this is verified.

QUESTION 7.17 (1.00)

Which of the following is NOT required to be immediately verified or executed by the operator in response to a "Suspected Fuel Element Failure", per HNP-2-1930?

a. Verify the Off-gas adsorber bypass valve (F043) CLOSES on an Off-gas Pre-treatment high alarm.

b. Verify the Off-gas stack inlet valve (F057) CLOSES on an Off-gas Post-treatment high-high-high alarm.

c. Lock out all the Drywell and Reactor Building Sump pumps until analysis can be performed, or the SS's approval.

d. DO NOT reject any reactor water to the Main Condenser or Radwaste without the SS's approval.

QUESTION 8.01 (1.00)

Which of the following scenarios requires application of the Power Transient fuel cladding integrity Safety Limit of the Unit 1 Technical Specifications?

a. Reactor power is at 42% RTP; the main turbine trips due to an EHC malfunction; the reactor SCRAMS on HIGH PRESSURE; the BPV's control pressure thereafter.

b. Reactor power is at 70% RTP; a steam leak to the Drywell occurs and Drywell pressure rises; the reactor SCRAMS at 1.85 psig; HPCI auto-actuation does not occur, but manual start is successful; the reactor is brought to a cold shutdown condition.

c. Reactor is in Start-Up, at 12% RTP; power is increased by rod pull; the reactor SCRAMS at 12.5% power, by APRM's; level and pressure are maintained by normal systems for the plant status.

d. The reactor is at 18% RTP; 1-1/2 BPV's are open in preparation for turbine warmup; controller failure reduces pressure to 875 psig; MSIV's close; reactor SCRAMS; level and pressure are maintained by normal systems for the plant status.

QUESTION 8.02 (1.00)

Unit 2 is operating at 90% RTP. As part of the normal surveillance program, functional tests of the MSL Radiation Detectors are performed.

(APPLICABLE TS's ARE ENCLOSED FOR REFERENCE)

Given that 2D11-K603 A tests UNSAT, which of the following is most TRUE?

(a) Establish a trip condition for the channels fed by K603A within 1 hour, and be in STARTUP with the MSIV's CLOSED within 2 hours, or be in HOT SHUTDOWN within 6 hours.

(b) Establish a trip condition for the channels fed by K603A within 1 hour, and be in STARTUP with the MSIV's CLOSED within 2 hours, or be in HOT SHUTDOWN within 6 hours and COLD SHUTDOWN within the next 30 hours.

(c) Establish a trip condition for the channels fed by K603A within 1 hour, but you may continue in Operational Condition 1.

(d) Establish a trip condition for the channels fed by K603A within 1 hour and be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the following 30 hours.

QUESTION 8.03 (.50)

STATE who can declare the unit/plant to be in an emergency condition (classification).

NOTE: Identify by Position Title and any special required qualifications.

QUESTION 8.04 (1.00)

Unit 2 Technical Specifications specify the frequency intervals for the performance of Surveillance requirements. This is accomplished by use of FREQUENCY NOTATION.

COMPLETE the following Table. (DO NOT INCLUDE GRACE PERIODS)

	NOTATION	FREQUENCY
a)	S	At least once per _____ hours.
b)	Q	At least once per _____ days.
c)	M	At least once per _____ days.
d)	---	At least once per 18 months.

QUESTION 8.05 (1.50)

Unit 2 Technical Specifications define SHUTDOWN MARGIN as...

"Shutdown Margin shall be the amount of reactivity by which the reactor is subcritical, or would be subcritical from its present condition, assuming..."

LIST the three conditions which complete the definition of SHUTDOWN MARGIN.

QUESTION 8.06 (3.00)

a. The following data was taken on Unit 2 during a single day of operation at Operational Condition 1:

		Identified Leakage	Unidentified Leakage
Shift 1:	0400	5020 gal	604 gal
	0800	4940 gal	1020 gal
Shift 2:	1200	5040 gal	900 gal
	1600	5340 gal	1032 gal
Shift 3:	2000	5840 gal	1100 gal
	2400	4640 gal	1248 gal

Indicate any TS (or other) limit(s) that was(were) exceeded. Justify your answer(s). (2.0)

b) What is the definition of "Pressure Boundary Leakage?" (1.0)

QUESTION 8.07 (1.00)

Temporary changes to operating procedures should be minimized. Under which one of the following conditions is a temporary change permitted and warranted, as the proper corrective action?

a. The addition of a CAUTION is necessary to prevent possible equipment damage.

b. A correction is required to a valve/electrical lineup.

c. The plant physical conditions assumed by a procedure are incorrect and prevent its completion as written.

d. A procedural step is determined to be unnecessary and should be deleted.

QUESTION 8.08 (1.00)

Per Administrative Procedure MNT-01-0, "Maintenance Program", EMERGENCY MAINTENANCE ...(CHOOSE ONE)

a. ... is maintenance that must be performed to maintain safe operating conditions, as determined by the Operations Supervisor On Shift

b. ... may be performed without issuance, or approval, of a Maintenance Work Order (MWO), or procedure.

c. ... must be approved by the General Manager or Deputy General Manager -AND- the OSOS or SS on duty.

d. ... may be worked on a 24 hour/day, 7 day/week schedule, upon the specific approval of the General Manager.

QUESTION 8.09 (2.00)

Answer the following TRUE or FALSE questions with regard to the control of Lifted Wires and Temporary Jumpers (HNP-504 and HNP-9).

a. A lifted wire or jumper that is required by Tech Specs, such as placing an inoperable channel in the tripped condition, does NOT require PRB approval. (0.5)

b. When lifting wires or installing jumpers not requiring a "J and LW" sheet, "J and LW" tags must still be placed on the jumpers and/or lifted wires. (0.5)

c. The final approval to activate a "J and LW" clearance sheet on a safety system that is required to be operable by Tech Specs is provided by two members of the plant staff, one of whom must be a licensed SRO. (0.5)

d. For surveillance procedures requiring the use of temporary jumpers, independent verification is ONLY required on system restoration and NOT on initial installation. (0.5)

QUESTION 8.10 (1.00)

HNP-501, 'Equipment Clearance and Tagging', provides instructions for the proper method of requesting and issuing clearances and hold tags. Which of the following accurately describes the clearance process?

a. When a maintenance project will require a clearance for more than one shift, the Shift Supervisor can release the sub-clearance to the 'Maintenance Foreman'; by name release is not required in this case.

b. Any clearance which requires the normal electrical lineup of the plant to be modified, will be issued by the Shift Supervisor in the form of written Switching Orders, per HNP-X-1646.

c. If a new MWO has identical isolation boundaries to a previously released MWO/Clearance, the new MWO may be added to the clearance.

d. When restoring a safety-related component to service, if NOT covered by procedure or surveillance requirement, INDEPENDENT VERIFICATION of the release is REQUIRED.

QUESTION 8.11 (1.00)

Procedure MNT 01-0, 'Maintenance Program', designates certain responsibilities for the Shift Supervisor in returning components/ systems to service after maintenance activities. Which of the following is NOT one of these responsibilities.?

a. The Shift Supervisor will EVALUATE the inspections and tests performed to determine if the system or component may be returned to service.

b. The Shift Supervisor will PLACE the system or component in operation and DOCUMENT its operational status by signing the MWO.

c. The Shift Supervisor will attach a copy of any LCO report generated as a result of the work activity to the MWO package, once the MWO is closed out.

d. If the operational test(s) are UNSATISFACTORY, the Shift Supervisor will return the MWO, with amplifying remarks, to the Maintenance Foreman in charge of the work activity, to allow for further corrective maintenance to be performed.

QUESTION 8.12 (1.00)

Unit 2 is in Operational Condition 1, at 75% RTP, with two outstanding deficiencies:

ADS	1 ADS Valve INOP (1 Day)
CS	CST Suction INOP (3 Days)

The Auto - swap of the HPCI suction upon receiving CST low level is determined to be UNSATISFACTORY. The suction is MANUALLY switched to the Suppression Pool, and the suction to the CST is ISOLATED.

The Shift Supervisor determines that the required action(s), per the Unit Technical Specifications is(are) ...(CHOOSE ONE)

NOTE: APPLICABLE TS's ARE ENCLOSED FOR REFERENCE

a. ...no new limitations or TS Operational Condition restrictions are initiated by this re-alignment.

b. ...be in at least HOT SHUTDOWN within 12 hours and reduce reactor steam dome pressure to less than or equal to 150 psig within the following 24 hours.

c. ...be in at least HOT SHUTDOWN within 6 hours and COLD SHUTDOWN within the following 30 hours.

d. ...be in at least HOT SHUTDOWN within 6 hours and reduce reactor steam dome pressure to less than or equal to 150 psig within the next 30 hours.

QUESTION 8.13 (1.00)

Procedure HNP-514, "Control of Locked Valves", states that ...

> "... Confirmation of valve position is required periodically ... (and) all valves will normally be checked and manipulated by Operations Department personnel ..."

What is the proper way to CONFIRM a locked valve position?

a. Turn the valve hand wheel in the OPEN direction; confirm the locking device integrity and proper installation by visual inspection.

b. Turn the valve hand wheel in the CLOSED direction; confirm the locking device integrity and proper installation by attempting to misposition the valve.

c. Turn the valve hand wheel in the DESIRED POSITION direction; confirm the locking device integrity and proper installation by visual inspection.

d. Turn the valve hand wheel in the DESIRED POSITION direction; confirm the locking device integrity and proper installation by attempting to misposition the valve.

QUESTION 8.14 (1.00)

Unit 2 is in COLD SHUTDOWN during a reactor strartup with no outstanding deficiencies. Hydrogen Recombiner A becomes INOP. It is anticipated that repairs will be complete within two (2) weeks.

The Shift Supervisor determines that the required action(s) per the Unit 2 Technical Specifications is(are) ... (CHOOSE ONE)

a. ...Operational Condition 4 must be maintained (Entry into Operational Condition 5 is acceptable)

b. ...Startup activities may continue; Operational Condition 3 may be entered, but not exceeded.

c. ...Startup activities may continue; Operational Condition 2 may be entered, but not exceeded; Oxygen concentration shall be maintained < 2 v/o.

d. ...Startup activities may continue; Operational Condition 1 and/or 2 may be entered, but the Recombiner must be returned to an OPERABLE status within 30 days.

NOTE: APPLICABLE TS's ARE ENCLOSED FOR REFERENCE

QUESTION 8.15 (2.00)

a. Unit 2 is in Operational 1 Condition with NO outstanding deficiencies. The current Surveillance Assignment printout sheet identifies a 'Latest Date' for the RCIC quarterly flow test, but the RCIC system becomes INOPERABLE before completing the surveillance. SELECT the statement which accurately describes the surveillance requirements as per HNP-831, 'Tech Spec Surveillance Program.' (1.0)

(1) The surveillance must be performed immediately AFTER returning the system (or subsystem) to an OPERABLE condition.

(2) The next regular surveillance interval shall commence UPON THE COMPLETION of the overdue surveillance.

(3) The surveillance shall NOT be documented as officially missed until the END of the 'Latest Date.'

(4) Since the RCIC system is already INOPERABLE, an LCO sheet need NOT be issued to track the missed surveillance.

b. The 'Earliest Date' block of the Surveillance Assignment printout sheet reads '00000' for a given surveillance. STATE the meaning of this reading AND for which Unit it would be applicable. (1.0)

QUESTION 8.16 (1.00)

Unit 2 has been recently shutdown and placed in COLD SHUTDOWN - Operational Condition 4. The shutdown/cooldown was necessitated by a requirement to drain and visually inspect the Suppression Pool.

The following plant conditions/requirements have been established:

CS system is aligned to the CST
Reactor Mode Switch is locked in the Shutdown Position
No maintenance affecting the reactor vessel is in progress

There is one outstanding deficiency:

D/G 2A Turbocharger is undergoing repairs (D/G INOP)

NOTE: APPLICABLE TS's ARE ENCLOSED FOR REFERENCE

The Shift Supervisor may ...(CHOOSE ONE)

a. ...commence Suppression Pool draining, since all TS LCO requirements are met.

b. ...commence Suppression Pool draining as soon as he ensures that NO POSITIVE REACTIVITY changes will occur during this condition.

c. ...commence Suppression Pool draining as soon as he ensures that NO POSITIVE REACTIVITY changes will occur AND that one LPCI subsystem is OPERABLE in this condition.

d. ...commence Suppression Pool draining only AFTER the D/G 2A Turbocharger is repaired and the D/G declared OPERABLE.

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

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.01 (1.00)

d

REFERENCE
EIH, L-RQ-605 (15)

ANSWER 5.02 (1.00)

a

REFERENCE
EIH, L-RQ-602

ANSWER 5.03 (1.00)

d

REFERENCE
General Electric, NEDE-24810 (Jun 81)

ANSWER 5.04 (1.00)

a

REFERENCE
Steam Tables

ANSWER 5.05 (2.00)

a. (2) - Starting Pump 2 (0.5)
b. Curve B (0.5)
c. INCREASE (0.5)
d. Curve C (0.5)

REFERENCE
Pump Laws

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.06 (1.50)

F1. b
F2. c
F3. a
L1. c
L2. a
L3. b (.25 each)

REFERENCE
EIH, GFNT, Vol VII, Chapter 10.2-23

ANSWER 5.07 (1.00)

d

REFERENCE
EIH, L-RQ-667 (3), L-RQ-654

ANSWER 5.08 (1.00)

b - OR - d

REFERENCE
EIH, GFNT,Vol VII, Chapter 10.1-83-86

ANSWER 5.09 (1.00)

a

REFERENCE
EIH, L-RQ-675

ANSWER 5.10 (2.50)

a. Recirculation Pump Trip (Lo Lo Level)
b. MSIV Closure (Lo Lo Lo Level) - OR - CV Closure w/BPV F.S.
c. HPCI & RCIC Injection
d. HPCI and RCIC Cooldown Effects (Steam & Colder Water)
e. Recirculation Pump Runback (#1 S.L.) (0.5 each)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, L-RQ-732

ANSWER 5.11 (2.50)

a. Natural Circulation at reduced power (Scram)
b. Decreased suction from the downcomer due to the tripped RRP's (Increased voiding in the core causing a swell in the downcomer)
c. In response to level increase
d. Loss of FW Heating (due to reduced extraction steam flow)
e. EHC established flow appropriate to control pressure (Flow equivalent to reactor power) (0.5 each)

REFERENCE
EIH, L-RQ-732

ANSWER 5.12 (1.00)

b

REFERENCE
EIH, L-RQ-667 (10)

ANSWER 5.13 (~~2~~ 1.00)

~~a. (3)~~ Deleted

b. (1)

REFERENCE
EIH, L-RQ-672 (15); U2 TS 3.2.3

ANSWER 5.14 (1.00)

d

REFERENCE
EIH, L-RQ-602 (9)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 5.15 (.50)

FALSE

REFERENCE
EIH, L-RQ-603 (4)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.01 (1.00)

b

REFERENCE
EIH, L-RQ-752, DCR 80-111; L-RQ-734

ANSWER 6.02 (1.00)

a

REFERENCE
EIH, L-RQ-752; DCR 81-175; GPNT, Vol V, Chapter 4.5; GPNT, Vol VII, Chapter 8.1

ANSWER 6.03 (1.00)

c

REFERENCE
EIH, GPNT, Vol VI, Chapter 7.2; EIH Simulator

ANSWER 6.04 (1.00)

c

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1-9; GPNT, Vol VI, Chapter 5.5-10;
GPNT, Vol VII, Chapters 9.2.2-11 and 9.2.3-5

ANSWER 6.05 (1.00)

c

REFERENCE
EIH, GPNT, Vol V, Chapter 4.1-23

ANSWER 6.06 (1.00)

d

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, GPNT, Vol V, Chapter 4.3-12

ANSWER 6.07 (1.00)

a

REFERENCE
EIH, GPNT, Vol V, Chapter 5.1.II.B

ANSWER 6.08 (2.00)

a. To prevent a loss of reactor water inventory to the Torus (0.8) through the Minimum Flow Valve (0.2)

b. SDC PCIS Valves (F008 & F009) - Auto Close
All running RHR Pumps - Trip
Head Spray Valve (F023) - Auto Closes
RHR Inboard Inj. Valve (F015) - Auto Closes (2 req'd @ 0.5 each)

REFERENCE
EIH, GPNT, Vol V, Chapter 4.4-15,17; GPNT, Vol VI, Chapter 8.3.c.3; HNP-2-1114, p6

ANSWER 6.09 (2.00)

a. 1.85 psig (.25) in Drywell (.25) and/or Lo Lo Level (.25) of - 55 inches (.25)

b. (1) WILL
(2) WILL
(3) WILL NOT
(4) WILL (.25 each)

REFERENCE
EIH, GPNT, VOL VI, Chapter 8.1

ANSWER 6.10 (1.00)

b

REFERENCE
EIH, L-RQ-733, p11, Fig 4

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.11 (1.00)

c

REFERENCE
EIH, L-RQ-752; DCR 79-442; HNP-1-1500

ANSWER 6.12 (1.00)

b

REFERENCE
EIH, GPNT, Vol VI, Chapter 5.3; DCR 83-87

ANSWER 6.13 (1.00)

b - OR - d

REFERENCE
EIH, GPNT, Vol. V, Chapter 4.1-26; L-RQ-714 (14)

ANSWER 6.14 (1.00)

d

REFERENCE
EIH, L-RQ-719 (6,9); L-RQ-720 (10)

ANSWER 6.15 (1.00)

b

REFERENCE
EIH, L-RQ-704 (6)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 6.16 (2.00)

PARAMETERS MONITORED

Vessel level is monitored and becomes the controlling signal for operation of the Startup Level Control (F111) valve. (0.5)

dP signal across the SLC Bypass Valve (F110) is monitored and becomes the controlling signal for RFPT speed. (0.5)

SYSTEM/COMPONENT CONTROL

The input to the M/A stations is a dP error signal from the dP controller. The controller senses the dP across the F110 valve, compares it to the controller set dP, in order to maintain a constant dP across the valve. (0.5)

The F111 valve opens/shuts in response to reactor vessel water level. When the valve opens, the dP decreases and the signal sent is to increase RFPT speed; valve closure is the converse. (0.5)

REFERENCE
EIH, L-RQ-726 (3,5,6)

ANSWER 6.17 (1.00)

INCREASE (0.5) The vacuum breaker provides a direct path to the DRYWELL. (0.5)

REFERENCE
EIH, GPNT, Vol V, Chapter 3.1; NUREG/BR-005/Vol 5, No 4, Power Reactor Events, Jan 84, p 5 (Hatch occurance 8/25/82)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 7.01 (2.00)

a) 1. RPV level cannot be maintained (0.5)
2. Suppression Pool water temperature cannot be maintained below 110 deg F (0.5)

b) 1. Five (5), or more adjacent control rods not inserted below the 06 position (0.5)
2. Thirty (30), or more total control rods not inserted below the 06 position. (0.5)

REFERENCE
EIH, HNP-2-1909

ANSWER 7.02 (1.50)

a) ROUTINE (0.5)
b) REGULAR (0.5)
c) BLANKET (0.5)

REFERENCE
EIH, HNP-8008, pp 1, 6, 8

ANSWER 7.03 (1.00)

c

REFERENCE
EIH, HNP-2-1903, p2

ANSWER 7.04 (1.00)

d

REFERENCE
EIH, HNP-2-1910

ANSWER 7.05 (.50)

Every five (5) minutes (1/2 credit for more conservative response)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, GET Handbook, p25

ANSWER 7.06 (1.00)

b

REFERENCE
EIH, HNP-2-1946

ANSWER 7.07 (1.00)

b

REFERENCE
EIH, HNP-2-1902

ANSWER 7.08 (1.00)

a

REFERENCE
EIH, HNP-2-1015

ANSWER 7.09 (1.00)

a) + 570 ° from Vessel Zero -OR- + 53° from Instrument Zero (0.5)

b) (a flow path for) Natural Circulation (0.5)

REFERENCE
EIH, HNP-2-1932

ANSWER 7.10 (1.00)

d

REFERENCE
EIH, HNP-2-1928

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 7.11 (1.00)

c

REFERENCE
EIH, HNP-2-1934,p1

ANSWER 7.12 (2.00)

d (.25); f, c, b (.75); g (.25); h (.25); e (.25); a (.25)

REFERENCE
EIH, HNP-2-1001, pp 18, 19, 20, 22, 23, 28, 29

ANSWER 7.13 (1.00)

a

REFERENCE
EIH, HNP-2-4207, p2

ANSWER 7.14 (2.00)

'B' is normally selected because a failure in the 'A/C' side, causing the transmitters to sense a LOW level, would cause the following:

A turbine trip on High Level (58") would not occur (0.5)

If 'A' transmitter were selected, a false signal would be sent out to the controllers to increase level (0.5)

Level would continue to increase until the operator terminated the transient

With 'B' selected, a failure of the 'A' transmitter would not result in level change since the 'B' transmitter has not failed. (But still do not have 2 out of 3 trip available) (0.5)

Failure of 'B' transmitter with 'B' selected would cause water level change, but the 2 out of 3 trip would still provide protection. (0.5)

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

REFERENCE
EIH, L-RQ-726; GPNT, Vol VI, Chapter 5.3

ANSWER 7.15 (1.00)

To preclude establishing excessive stresses in the jet pumps due to flow reversals - OR - to prevent excessive radial bearing loads (on the recirc pumps)

REFERENCE
EIH, HNP-2-1437, p5; GPNT, Vol V, Chapter 4.1

ANSWER 7.16 (1.00)

Maximum licensed thermal power may be exceeded in the instances of THERMAL SPIKES.(0.5) Verification is accomplished by use of OD-3 Printouts from the Process Computer.(0.5)

REFERENCE
EIH, HNP-2-1005, pp 1,2

ANSWER 7.17 (1.00)

a

REFERENCE
EIH, HNP-2-1930

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.01 (1.00)

a

REFERENCE
EIH, U1TS, 1.1.c

ANSWER 8.02 (1.00)

c

REFERENCE
EIH, U2 TS, 3.0.4, 3.3.1, 3.3.2

ANSWER 8.03 (.50)

SHIFT SUPERVISOR (SS) or OPERATIONS SUPERVISOR (OSOS) or ANY HIGHER RANKING LICENSED OR CERTIFIED PERSON PRESENT

REFERENCE
EIH, HNP - 4520, 4620, 4720

ANSWER 8.04 (1.00)

a) 12 hours (+ 0)
b) 92 days (+ 0)
c) 31 days (+ 0)
d) R

(.25 each)

REFERENCE
EIH, U2 TS, Table 1.1; HNP-0-ADM-0831

ANSWER 8.05 (1.50)

(1) Highest worth rod (0.25) fully withdrawn (0.25)
(2) Xenon free
(3) Cold (68 deg F)

(0.5 each)

REFERENCE
EIH, U2 TS, 1.0 'SDM'

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.06 (3.00)

a) UNIDENTIFIED LEAKAGE increased from a 2.51 gpm rate at 0400 to a 4.58 gpm rate at 2000, thus exceeding the 2 gpm increase limit within a 24 hour period. (0.67)

TOTAL LEAKAGE exceeded the 25 gpm limit over a 24 hour period (25.50 gpm) (0.66)

UNIDENTIFIED LEAKAGE exceeded the 5 gpm limit at 2400 (5.2 gpm) (0.67)

b) Pressure Boundary Leakage is leakage through a non-isolable fault (0.5) in a reactor coolant system component body, pipe wall, or vessel wall (0.5) (1.0)

REFERENCE
EIH, U2 TS, 1.0, 3.4.3.2; Confirmatory Order 7590-01, dtd 7-8-83

ANSWER 8.07 (1.00)

a - OR - c

REFERENCE
EIH, HNP - 9, p47

ANSWER 8.08 (1.00)

b

REFERENCE
EIH, MNT 01-0, p9

ANSWER 8.09 (2.00)

a) TRUE
b) TRUE
c) FALSE
d) TRUE

REFERENCE
EIH, HNP-504, pp 1-3; HNP-9, p25

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.10 (1.00)

c

REFERENCE
EIH, HNP-501, pp 1, 2, 8, 10

ANSWER 8.11 (1.00)

d

REFERENCE
EIH, MNT 01-0, p20

ANSWER 8.12 (1.00)

a

REFERENCE
EIH, U2 TS, 3.5.1, and 3.5.2

ANSWER 8.13 (1.00)

b

REFERENCE
EIH, HNP-514, p1

ANSWER 8.14 (1.00)

d

REFERENCE
EIH, U2 TS, 3.0.3, 3.0.4, 3.6.6.2

ANSWERS -- HATCH 1&2 -85/03/11-K E BROCKMAN

ANSWER 8.15 (2.00)

a. (3) (1.0)

b. '00000' indicates that there is no Negative Grace Period for this surveillance.(0.5) It would be applicable for Unit 2. (0.5) (Since Unit 1 allows plus AND minus 25% interval variance)

REFERENCE
EIH, HNP-ADM-0831

ANSWER 8.16 (1.00)

d

REFERENCE
EIH, U2 TS's, 3.5.4; Standing Order 84-35

QUESTION	VALUE	REFERENCE
05.01	1.00	KEB0000042
05.02	1.00	KEB0000043
05.03	1.00	KEB0000044
05.04	1.00	KEB0000045
05.05	2.00	KEB0000046
05.06	1.50	KEB0000047
05.07	1.00	KEB0000048
05.08	1.00	KEB0000049
05.09	1.00	KEB0000050
05.10	2.50	KEB0000051
05.11	2.50	KEB0000052
05.12	1.00	KEB0000053
05.13	2.00	KEB0000054
05.14	1.00	KEB0000055
05.15	.50	KEB0000056
	20.00	
06.01	1.00	KEB0000030
06.02	1.00	KEB0000031
06.03	1.00	KEB0000032
06.04	1.00	KEB0000033
06.05	1.00	KEB0000034
06.06	1.00	KEB0000035
06.07	1.00	KEB0000036
06.08	2.00	KEB0000037
06.09	2.00	KEB0000038
06.10	1.00	KEB0000039
06.11	1.00	KEB0000040
06.12	1.00	KEB0000041
06.13	1.00	KEB0000060
06.14	1.00	KEB0000061
06.15	1.00	KEB0000062
06.16	2.00	KEB0000063
06.17	1.00	KEB0000064
	20.00	
07.01	2.00	KEB0000016
07.02	1.50	KEB0000017
07.03	1.00	KEB0000018
07.04	1.00	KEB0000019
07.05	.50	KEB0000020
07.06	1.00	KEB0000021
07.07	1.00	KEB0000022
07.08	1.00	KEB0000023
07.09	1.00	KEB0000024
07.10	1.00	KEB0000025
07.11	1.00	KEB0000027
07.12	2.00	KEB0000028

QUESTION	VALUE	REFERENCE
07.13	1.00	KEB0000029
07.14	2.00	KEB0000057
07.15	1.00	KEB0000058
07.16	1.00	KEB0000059
07.17	1.00	KEB0000136
	20.00	
08.01	1.00	KEB0000001
08.02	1.00	KEB0000002
08.03	.50	KEB0000003
08.04	1.00	KEB0000004
08.05	1.50	KEB0000005
08.06	3.00	KEB0000008
08.07	1.00	KEB0000009
08.08	1.00	KEB0000010
08.09	2.00	KEB0000011
08.10	1.00	KEB0000012
08.11	1.00	KEB0000013
08.12	1.00	KEB0000014
08.13	1.00	KEB0000015
08.14	1.00	KEB0000092
08.15	2.00	KEB0000134
08.16	1.00	KEB0000135
	20.00	
	80.00	

DATE 21 SEP 84 TIME [illegible]:59:57 HATCH-1 SEQ. NO. 10,[illegible]

PERIODIC NSS CORE PERFORMANCE LOG

LOCATION	1	2	3	4	5	6	7	8	9	10	11	12
AXIAL REL PWR	0.68	1.12	1.15	1.12	1.10	1.09	1.08	1.05	1.02	1.03	0.89	0.48
REGION REL PWR	0.87	1.07	0.87	1.06	1.15	1.06	0.87	1.07	0.87			
RING REL PWR	0.96	1.17	1.20	1.23	1.22	1.09	0.50					
APRM GAF	0.97	0.97	0.95	0.96	0.93	0.98						

REGION	1	2	3	4	5	6	7	8	9
MFLCPR	0.696	0.704	0.696	0.715	0.670	0.715	0.696	0.704	0.696
LOC	17-14	21-14	35-14	9-28	33-[illegible]	43-26	17-40	31-40	35-40
FLOW	0.1320	0.1318	0.1320	0.1325	0.1334	0.1325	0.1320	0.1318	0.1320
PKF	1.35	1.37	1.35	1.34	1.32	1.34	1.35	1.37	1.35
MFLPD	0.686	0.670	0.686	0.671	0.6[illegible]	0.676	0.655	0.6[illegible]	0.[illegible]
LOC	17-14 4	31-14 4	35-14- 4	11-30- 4	19-30 5	41-24 4	17-40- 4	31-40- 4	35-40- 4
PKFL	1.96	1.94	1.96	1.9[illegible]	1.77	1.9[illegible]	1.9[illegible]	1.94	1.9[illegible]
MAPRAT	0.642	0.740	0.641	0.6[illegible]	0.591	0.6[illegible]	0.642	0.740	0.641
LOC	17-10 5	21-14- 4	35-10- 5	[illegible] 5	19-20- 4	43-2[illegible] 5	17-44- 5	31-40 4	35-44- 5
PKFS	1.72	1.68	1.71	1.69	1.53	1.69	1.72	1.68	1.71

CMWT	2046.
PCT PWR	84.0
PCTLFP	81.4
GMWE	698.4
CMFCP	0.715
CMFLPD	0.7[illegible]
FCAPDR	0.816
CMAPR	0.742
CMPI	1.964
CAFD	0.10[illegible]
CADA	0.124
CAVT	0.[illegible]
CAPD	41.47
[illegible]	0.000
CRSYM	2.
[illegible]	[illegible]78.
[illegible]	[illegible]1.76
[illegible]	[illegible]
SUL	37.44
DHC	17.7[illegible]
WFW	[illegible]
WD	[illegible]4.8[illegible]
WTSUB	7[illegible]
WTOPC	1.00
WT	[illegible]
PCT WTF	105.2
WTFLAG	2
ITER	1
IREF	0
IFOI	1
IXXFLE	0

FAILED SENSORS 7 12 13 14 15 22 23 24 25

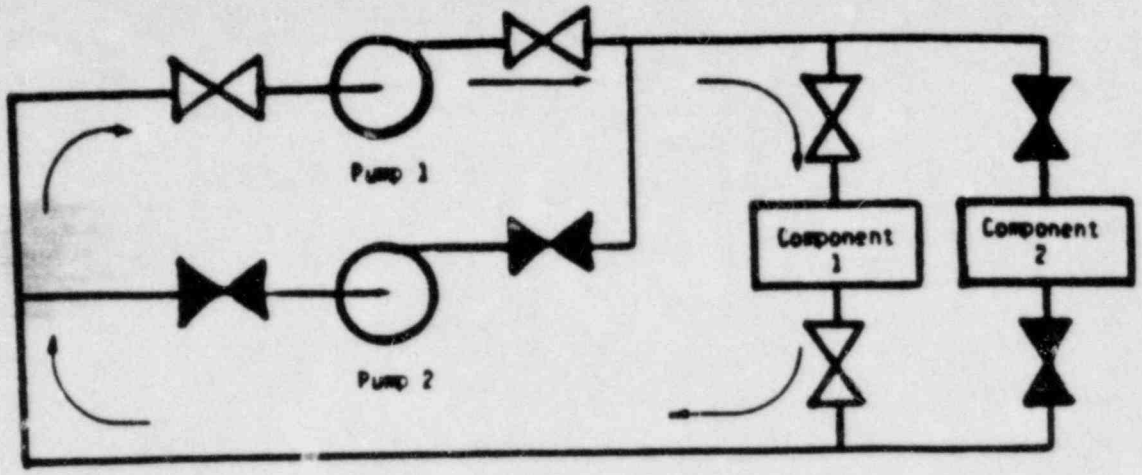
FAILED LPRM LIST PASS FAIL CODE

2813.B.2 4413.C.1 3621.D.2 4421.D.1 NONE

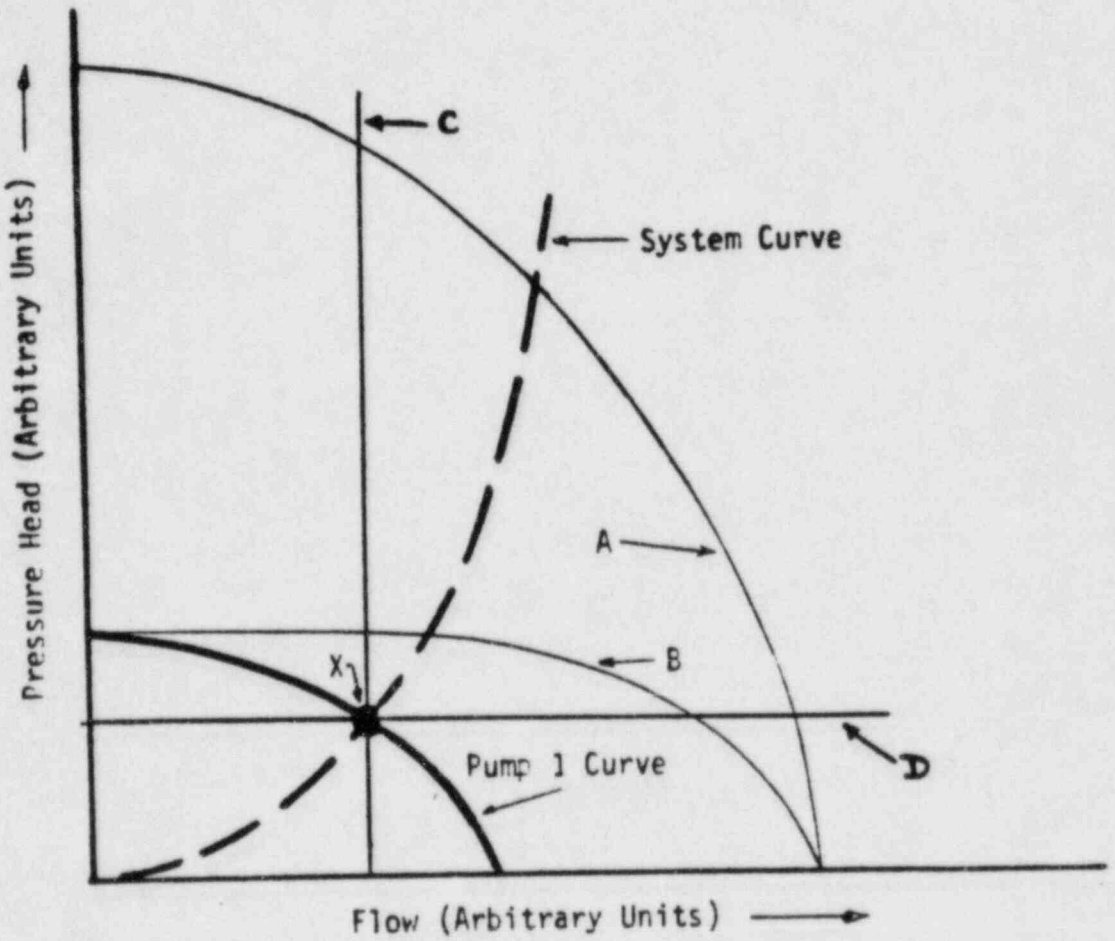
THE 12 MOST LIMITING BUNDLES

FOR MFLCPR				FOR MFLPD				FOR MAPRAT			
MFLCPR	LOC	MCPR	CPRLIM	MFLPD	LOC	MFPD	PDLIM	MAPRAT	LOC	MAPLHGR	LIMLHGR
0.715	43-26	1.805	1.290	0.686	35-40- 4	9.19	13.40	0.742	17-44- 5	7.45	11.99
0.715	9-28	1.805	1.290	0.686	17-14 4	9.19	13.40	0.742	17-10- 5	7.45	11.99
0.715	43-28	1.805	1.290	0.686	35-14- 4	9.19	13.40	0.741	35-10- 5	7.45	11.99
0.715	9-26	1.805	1.290	0.685	17-40 4	9.19	13.40	0.741	35-44- 5	7.45	11.99
0.704	31-40	1.832	1.290	0.679	31-14- 4	9.08	13.40	0.[illegible]	31-40- 4	7.43	12.00
0.704	21-40	1.832	1.290	0.677	31-40- 4	9.07	13.40	0.740	21-14 4	7.40	12.00
0.704	21-14	1.832	1.290	0.677	21-40- 4	9.07	13.40	0.740	21-40- 4	7.40	12.00
0.704	31-14	1.833	1.290	0.677	21-14- 4	9.07	13.40	0.740	31-14 4	7.40	12.00
0.703	27-44	1.835	1.290	0.676	17-44- 5	9.05	13.40	0.[illegible]	27-44- 4	7.45	11.97
0.703	27-10	1.835	1.290	0.676	19-12- 5	9.05	13.40	0.[illegible]	27-10- 4	7.45	11.97
0.703	25-44	1.835	1.290	0.676	33-42- 5	9.05	13.40	0.[illegible]	25-10- 4	7.45	11.97
0.703	25-10	1.835	1.290	0.676	19-42- 5	9.05	13.40	0.[illegible]	25-44- 4	7.45	11.97

THE NUMBER OF BUNDLES WITH MFLCPR GREATER THAN 1.0 = 0
THE NUMBER OF BUNDLES WITH MFLPD GREATER THAN 1.0 = 0
THE NUMBER OF BUNDLES WITH MAPRAT GREATER THAN 1.0 = 0



SYSTEM



SYSTEM HEAD VS. FLOW PLOT

FIGURE FOR 5.05

LOSS OF ALL FEEDWATER

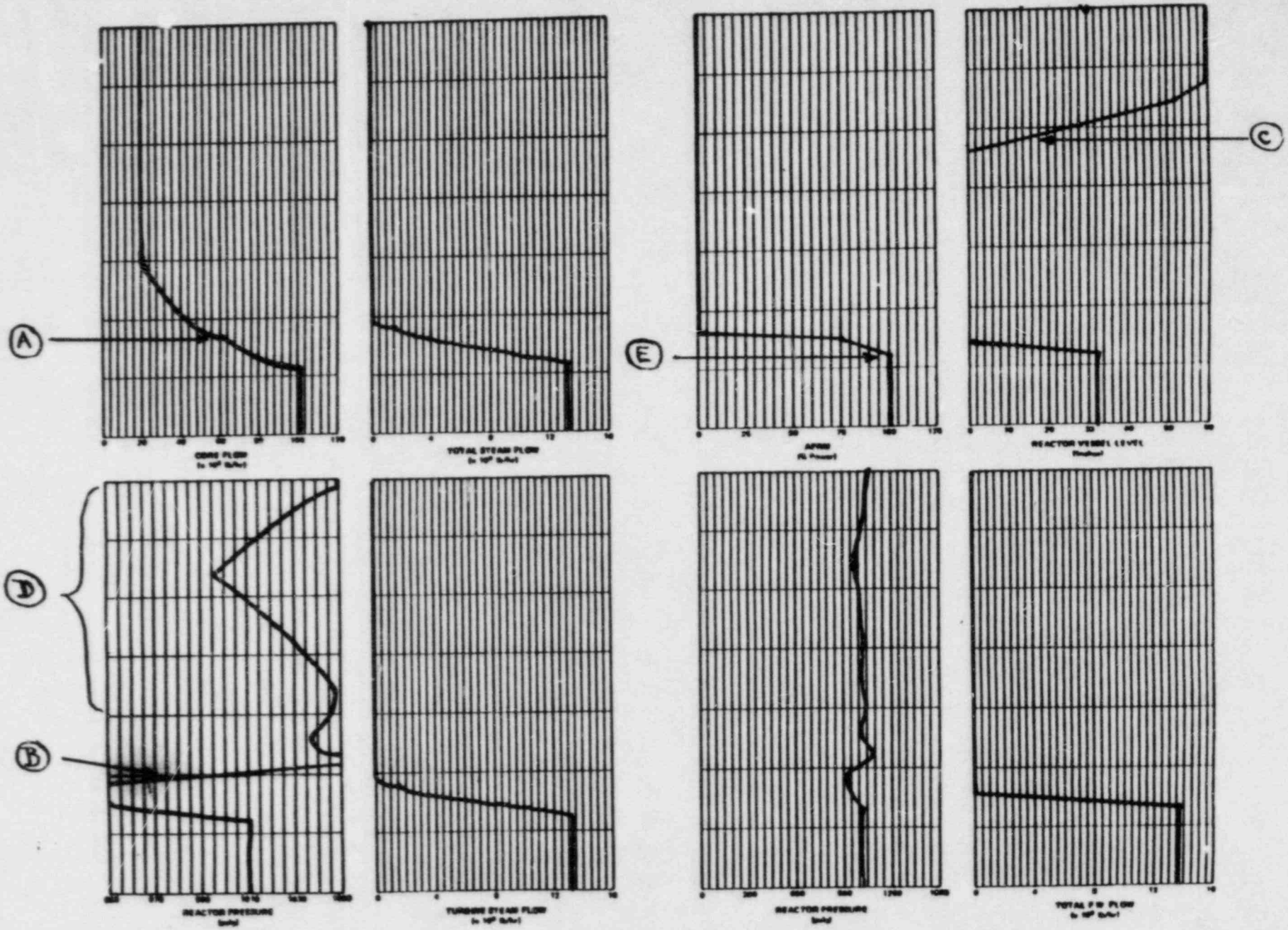


FIGURE FOR 5.10

LOSS OF BOTH RECIRC PUMPS

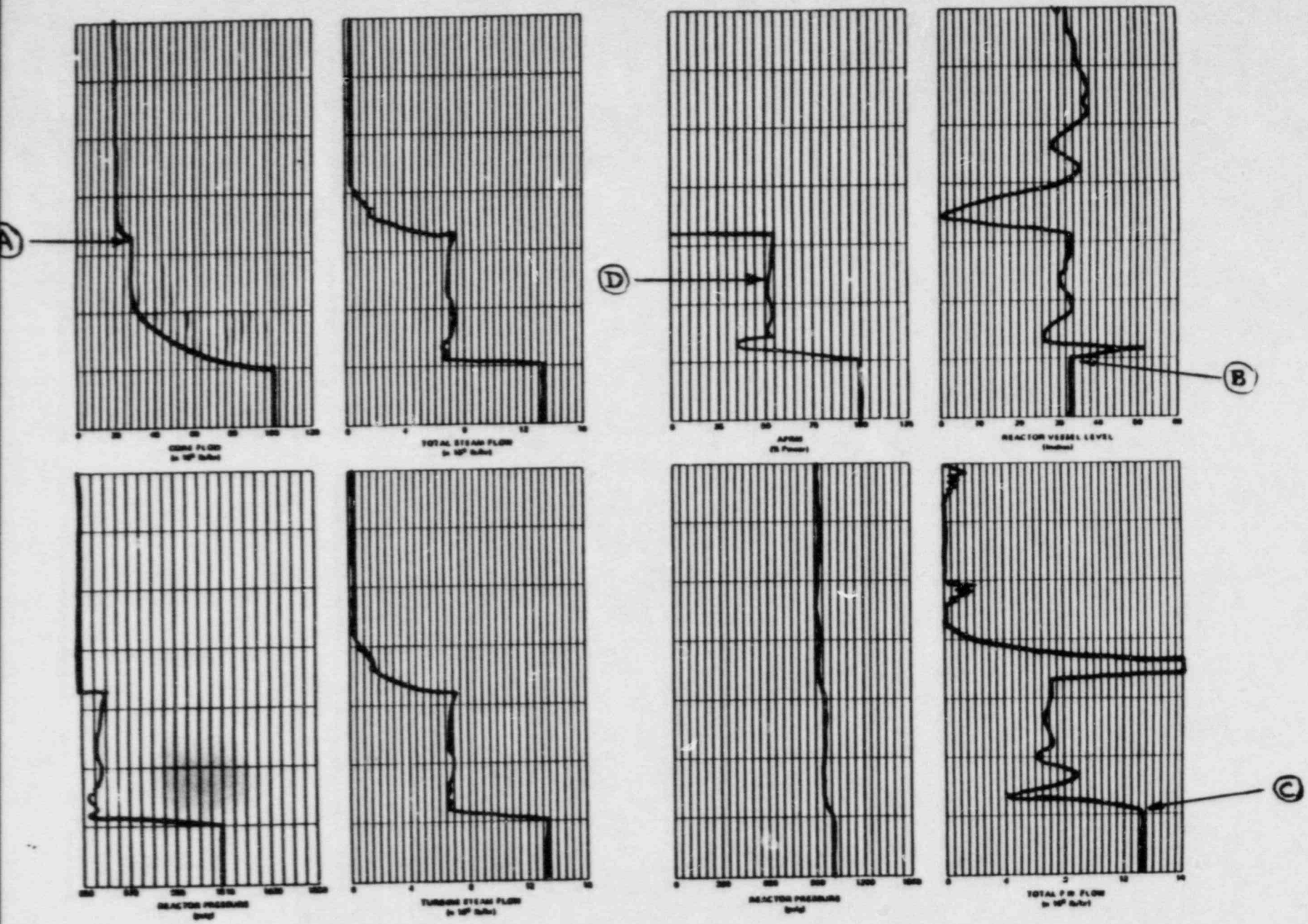


FIGURE FOR 5.11

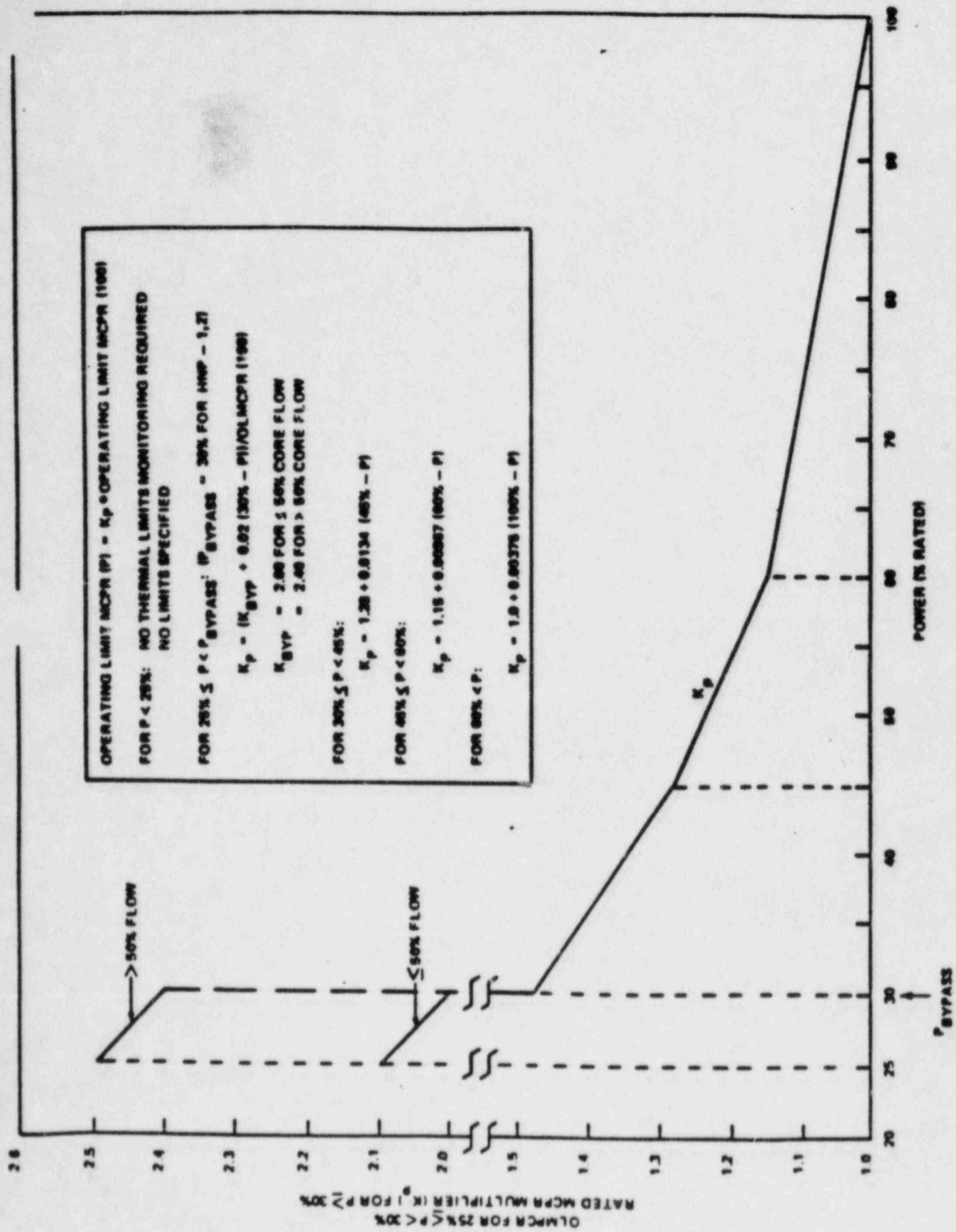
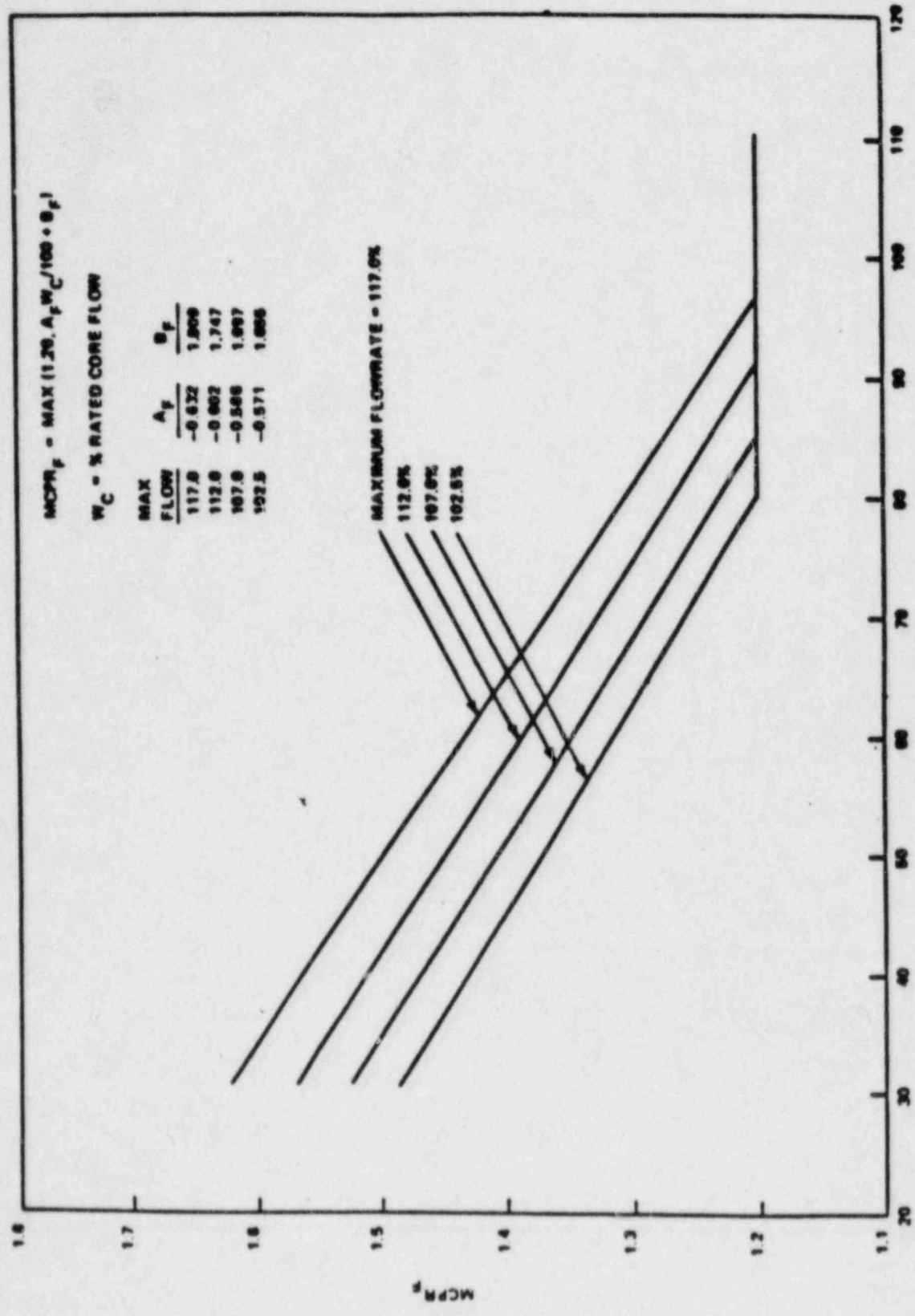


FIGURE 5.4

K_p

GENERAL ELECTRIC COMPANY PROPRIETARY INFORMATION

FIGURE FOR 5.13



MCPR$_P$
FIGURE 5.5

FIGURE FOR 5.13

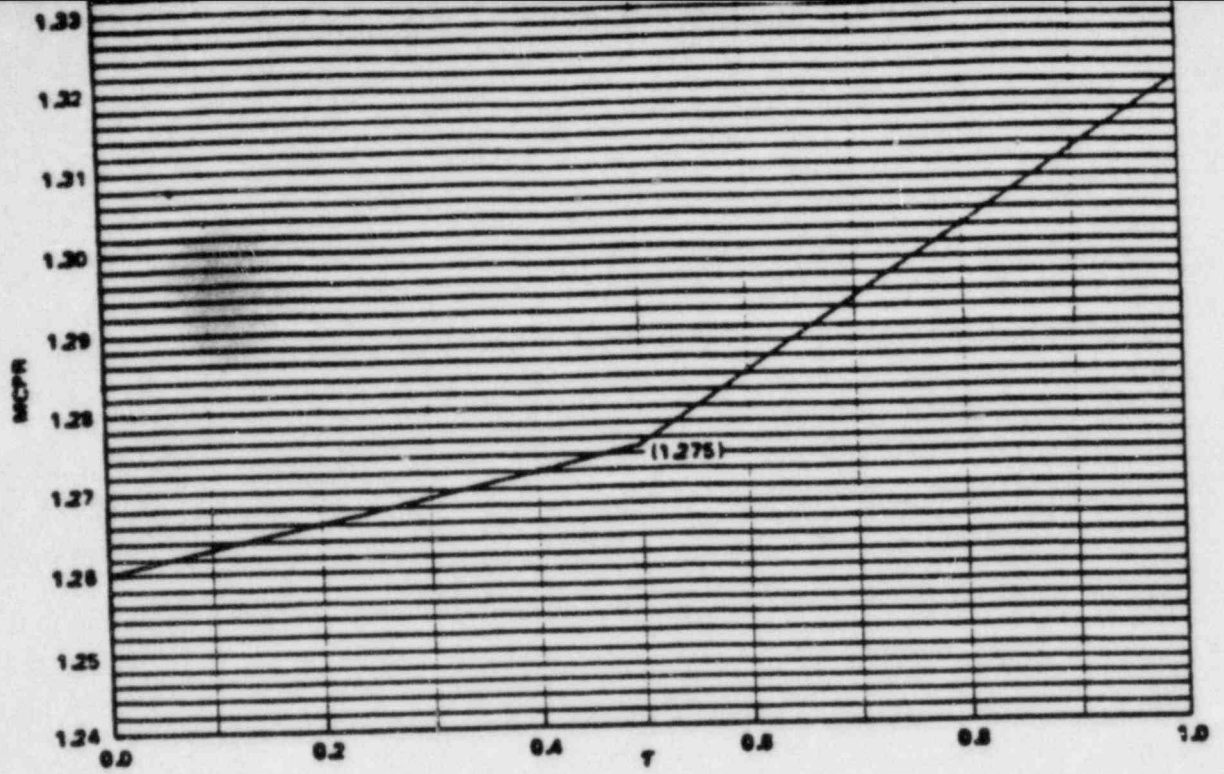
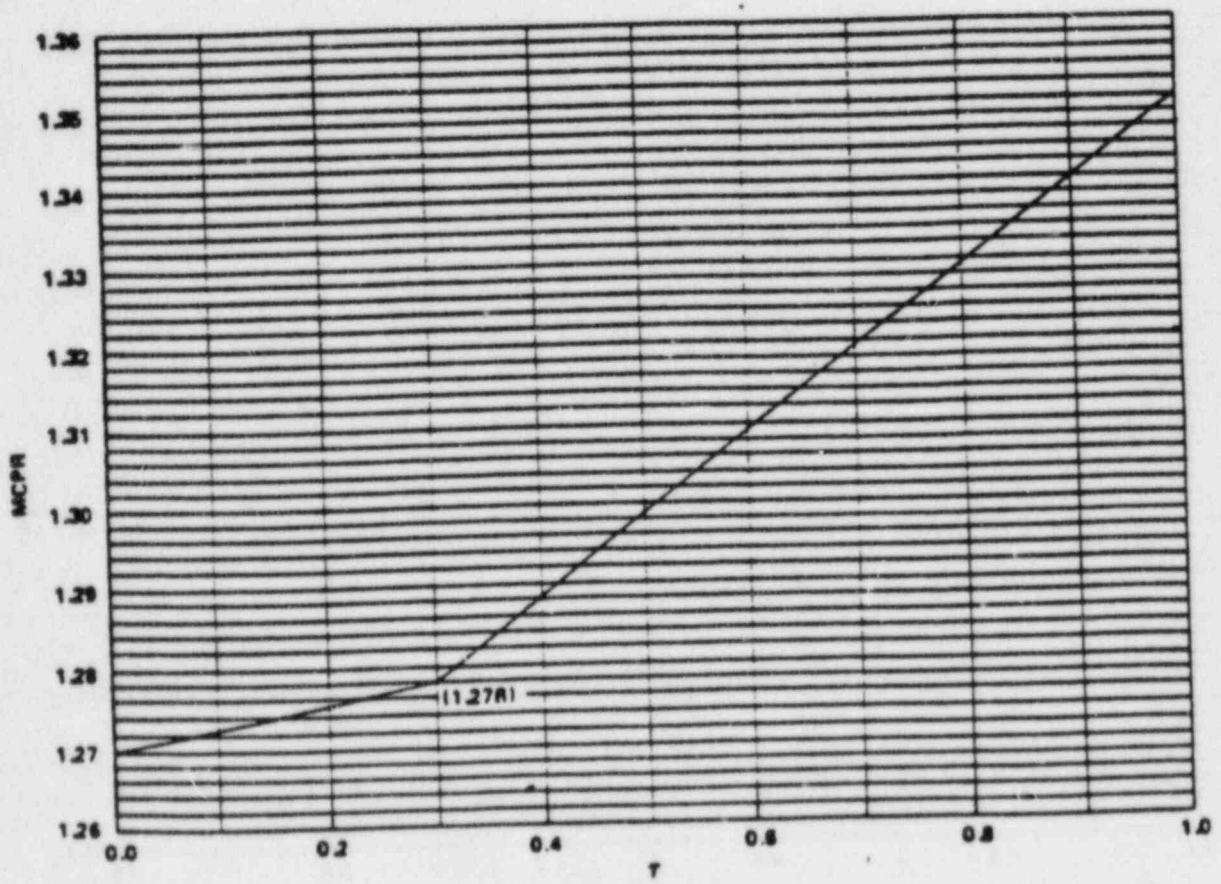


FIGURE 3.2.3-1
MCPR LIMIT FOR 8X8R FUEL
AT RATED FLOW AND RATED POWER



MCPR LIMIT FOR P8X8R FUEL
AT RATED FLOW AND RATED POWER
FIGURE 5.6

FIGURE FOR 5.13

Figure 9.9(3) ATTS Master Trip Unit

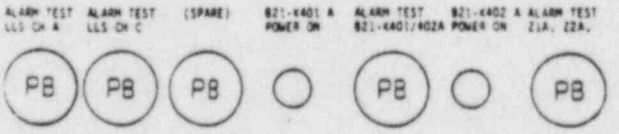


Figure 9.9(6) ATTS Panel Lights and Push Buttons

FIGURE FOR 6.15

See Table Page

E. REACTOR LEVEL READING CORRECTION FOR YARWAY INSTRUMENTS

1. Obtain Drywell Temperature Readings for the 185' Elevation. Temperature Indicator 2T47-R020 gives this reading for the north side and 2T47-R021 gives this reading for the south side.

2. Refer to Figure 1 and obtain the correction factor for each temperature reading.

3. _____* the correction factor found using the North Drywell Temperature Reading from the level indication shown on Level Indicator 2B21-R604A.

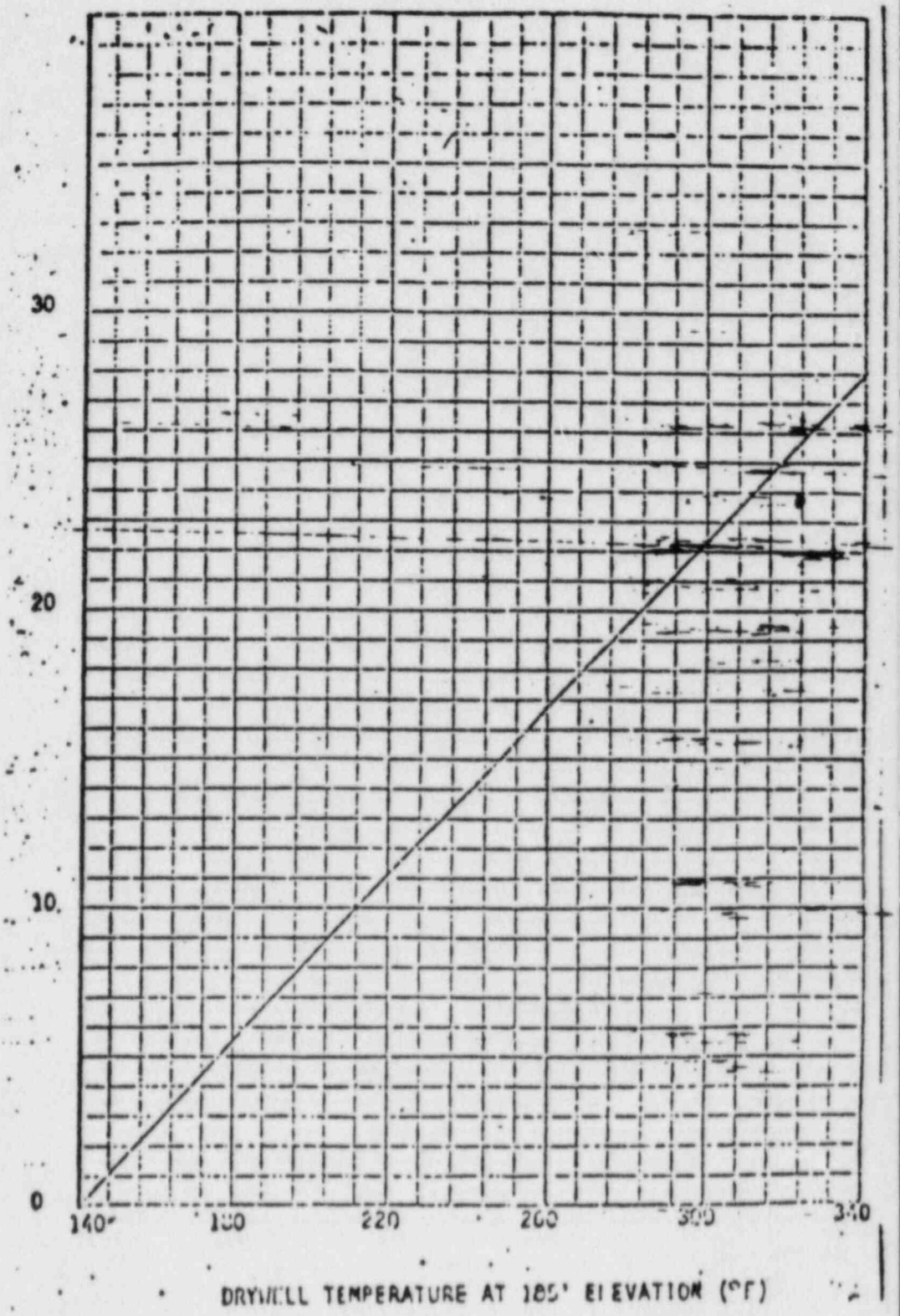
4. _____* the correction factor found using the South Drywell Temperature Reading from the level indication shown on Level Indicator 2B21-R604B.

5. The average of these two corrected level readings will give a good estimate of the actual Reactor Water Level.

* The ADDITION or SUBTRACTION of the correction factor is left to you, based upon the known sensing line flashing to steam.

FIGURE FOR 7.07

FIGURE 1



INCHES TO IN
LEVEL READING
FROM 2521 B604A&B

reference only

FIGURE FOR 7.07

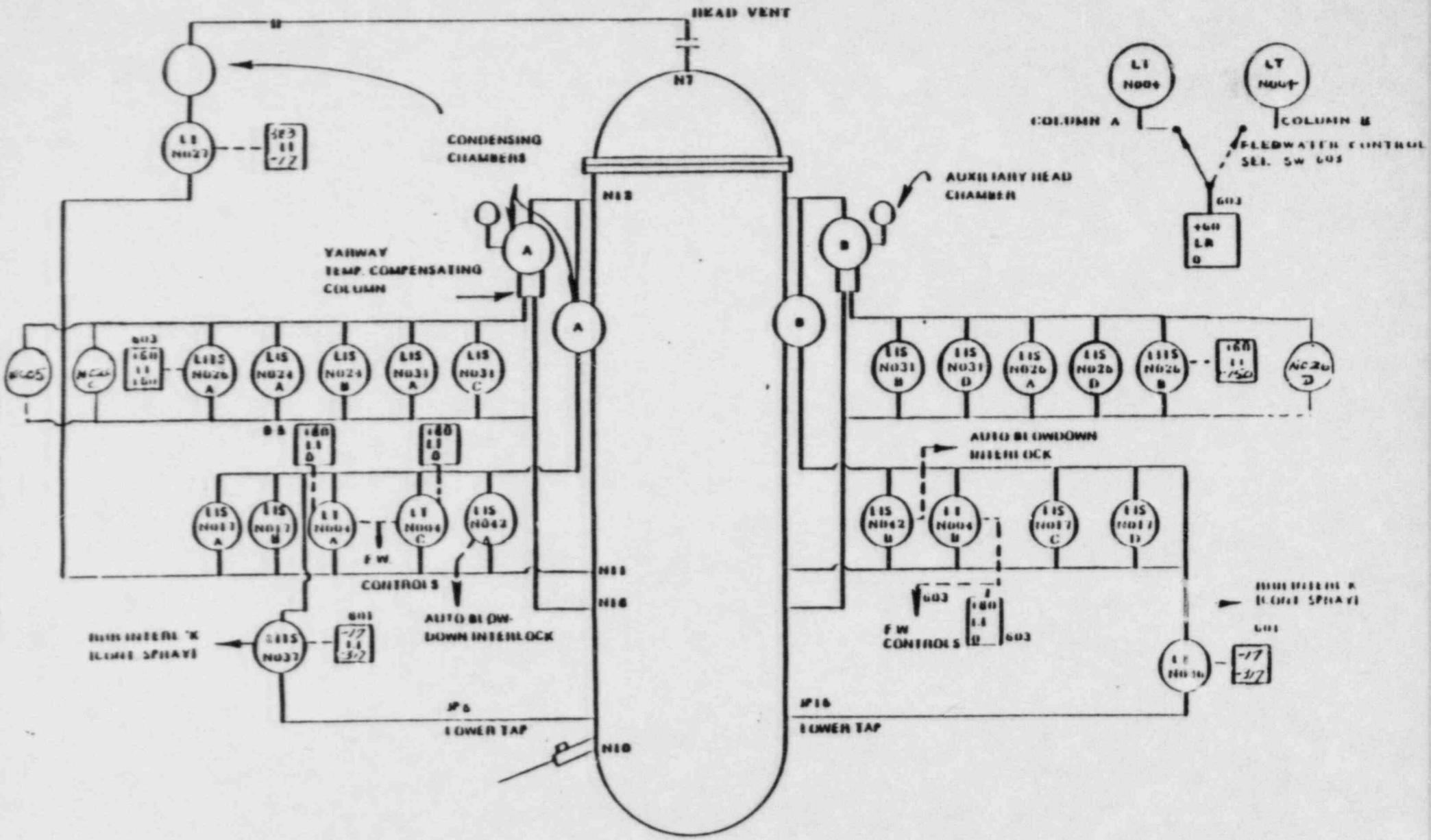


FIGURE FOR 7.07

Figure 7.07 Reactor Vessel Level Instrumentation

Unit 1 ( ) Unit 11 (✓) Plant ~~( )~~ HLS 11-2-84

STANDING ORDER

NO. 84-34

Date Issued 11-2-84

Date Deleted _____

TITLE CLARIFICATION OF OPERABILITY

APPROVED [signature] 11/2/84 [signature]

Site General Manager or Site Deputy General Manager

Manager of Operations, or Superintendent of Operations

The following clarification of the definition of operability is now in effect. Any questions concerning interpretation of the below beyond what is explicitly stated in the statement below should be referred to the General Manager or Deputy General Manager.

When a system, subsystem, train component, or device having Technical Specification operability requirements 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: (a) its corresponding normal or emergency power source is operable; and (b) all its redundant system(s), subsystem(s), train(s) component(s) and device(s) are operable, or likewise satisfy the requirements of this specification. Unless both condition(s) (a) and (b) are satisfied, enter the applicable Limiting Condition for Operation as specified by the Technical Specifications, or the unit shall be placed in at least Hot Shutdown within the next 6 hours, and in at least Cold Shutdown within the following 30 hours.

The clarification stated above is not applicable in Operational Conditions for 4 or 5 for Unit 2, ~~and Cold Shutdown or Refueling for Unit 1~~.

HLS 11-2-84

FIGURE 1
HNP-12 R10

3/4.3.1 REACTOR PROTECTION SYSTEM INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.1 As a minimum, the reactor protection system instrumentation channels shown in Table 3.3.1-1 shall be OPERABLE with the REACTOR PROTECTION SYSTEM RESPONSE TIME as shown in Table 3.3.1-2. Set points and interlocks are given in Table 2.2.1-1.

APPLICABILITY: As shown in Table 3.3.1-1.

ACTION:

a. With the requirements for the minimum number of OPERABLE channels not satisfied for one trip system, place at least one inoperable channel in the tripped condition within one hour.

b. With the requirements for the minimum number of OPERABLE channels not satisfied for both trip systems, place at least one inoperable channel in at least one trip system* in the tripped condition within one hour and take the ACTION required by Table 3.3.1-1.

c. The provisions of Specification 3.0.3 are not applicable in OPERATIONAL CONDITION 5.

SURVEILLANCE REQUIREMENTS

*If both channels are inoperable in one trip system, select at least one inoperable channel in that trip system to place in the tripped conditions, except when this could cause the Trip Function to occur.

TABLE 3.3.1-1

REACTOR PROTECTION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	APPLICABLE OPERATIONAL CONDITIONS	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(a)	ACTION
1. Intermediate Range Monitors: (2C51-K601, A, B, C, D, E, F, G, H)			
a. Neutron Flux - High	2(c), 5(b)	3	1
	3, 4	2	2
b. Inoperative	2,5(b)	3	1
	3,4	2	2
2. Average Power Range Monitor: (2C51-K605 A, B, C, D, E, F)			
a. Neutron Flux - Upscale, 15%	2, 5	2	1
b. Flow Referenced Simulated Thermal Power - Upscale	1	2	3
c. Fixed Neutron Flux - Upscale, 118%	1	2	3
d. Inoperative	1, 2, 5	2	4
e. Downscale	1	2	3
f. LPRM	1, 2, 5	(d)	NA
3. Reactor Vessel Steam Dome Pressure - High (2B21-N678 A, B, C, D)	1, 2(e)	2(j, 2B21-N045 A, B, C, D)	5
4. Reactor Vessel Water Level - Low (Level 3) (2B21-N680 A, B, C, D)	1, 2	2(j, 2B21-N681 A, B, C, D)	5
5. Main Steam Line Isolation Valve - Closure (NA)	1(f)	4	3
6. Main Steam Line Radiation - High (2D11-K603 A, B, C, D)	1, 2(e)	2	6
7. Drywell Pressure - High (2C71-N650 A, B, C, D)	1, 2(g)	2	5

HATCH-UNIT 2

3/4 3-2

Amendment No. 74, 39

TABLE 3.3.1-1 (Continued)

REACTOR PROTECTION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	APPLICABLE OPERATIONAL CONDITIONS	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(a)	ACTION
8. Scram Discharge Volume Water Level - High (2C11-N013A,B,C,D)	1, 2, 5(h)	2	4
Level - High (2C11-N060A,B,C,D)	1, 2, 5	2	4
9. Turbine Stop Valve - Closure (NA)	1(i)	4(k)	7
10. Turbine Control Valve Fast Closure, Trip Oil Pressure - Low (2C71-N005A,B,C,D)	1(i)	2(k)	7
11. Reactor Mode Switch in Shutdown Position (NA)	1, 2, 3, 4, 5	1	8
12. Manual Scram (NA)	1, 2, 3, 4, 5	1	9

TABLE 3.3.1-1 (Continued)

REACTOR PROTECTION SYSTEM INSTRUMENTATION

ACTION

ACTION 1 - In OPERATIONAL CONDITION 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or postive reactivity changes and fully insert all insertable control rods within one hour.

ACTION 2 - Lock the reactor mode switch in the Shutdown position within one hour.

ACTION 3 - Be in at least STARTUP within 2 hours.

ACTION 4 - In OPERATIONAL CONDITION 1 or 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or positive reactivity changes and fully insert all insertable control rods within one hour.

ACTION 5 - Be in at least HOT SHUTDOWN within 6 hours.

ACTION 6 - Be in STARTUP with the main steam line isolation valves closed within 2 hours or in at least HOT SHUTDOWN within 6 hours.

ACTION 7 - Initiate a reduction in THERMAL POWER within 15 minutes and be at less than 30% of RATED THERMAL POWER within 2 hours.

ACTION 8 - In OPERATIONAL CONDITION 1 or 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 3 or 4, immediately and at least once per 12 hours verify that all control rods are fully inserted.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or positive reactivity changes and fully insert all insertable control rods within one hour.

ACTION 9 - In OPERATIONAL CONDITION 1 or 2, be in at least HOT SHUTDOWN within 6 hours.

In OPERATIONAL CONDITION 3 or 4, lock the reactor mode switch in the Shutdown position within one hour.

In OPERATIONAL CONDITION 5, suspend all operations involving CORE ALTERATIONS or positive reactivity changes and fully insert all insertable control rods within one hour.

TABLE NOTATIONS

a. A channel may be placed in an inoperable status for up to 2 hours for required surveillance without placing the trip system in the tripped condition provided at least one OPERABLE channel in the same trip system is monitoring that parameter.

b. The "shorting links" shall be removed from the RPS circuitry during CORE ALTERATIONS and shutdown margin demonstrations performed in accordance with Specification 3.10.3.

c. The IRM scrams are automatically bypassed when the reactor vessel mode switch is in the Run position and all APRM channels are OPERABLE and on scale.

d. An APRM channel is inoperable if there are less than 2 LPRM inputs per level or less than eleven LPRM inputs to an APRM channel.

e. These functions are not required to be OPERABLE when the reactor pressure vessel head is unbolted or removed.

f. This function is automatically bypassed when the reactor mode switch is in other than the Run position.

g. This function is not required to be OPERABLE when PRIMARY CONTAINMENT INTEGRITY is not required; this function may be bypassed when necessary for containment inerting or de-inerting (purging).

h. With any control rod withdrawn. Not applicable to control rods removed per Specification 3.9.11.1 or 3.9.11.2.

i. These functions are bypassed when turbine first stage pressure is $\leq$250* psig, equivalent to THERMAL POWER less than 30% of RATED THERMAL POWER.

j. Also trips reactor coolant system recirculation pump MG sets.

k. Also trips reactor coolant system recirculation pump motors.

*Initial setpoint. Final setpoint to be determined during startup testing.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

LIMITING CONDITION FOR OPERATION

3.3.2 The isolation actuation instrumentation channels shown in Table 3.3.2-1 shall be OPERABLE with their trip setpoints set consistent with the values shown in the Trip Setpoint column of Table 3.3.2-2 and with ISOLATION SYSTEM RESPONSE TIME as shown in Table 3.3.2-3.

APPLICABILITY: As shown in Table 3.3.2-1.

ACTION:

a. With an isolation actuation instrumentation channel trip setpoint less conservative than the value shown in the Allowable Values column of Table 3.3.2-2, declare the channel inoperable and place the inoperable channel in the tripped condition* until the channel is restored to OPERABLE status with its trip setpoint adjusted consistent with the Trip Setpoint value.

b. With the requirements for the minimum number of OPERABLE channels not satisfied for one trip system, place at least one inoperable channel in the tripped condition* within one hour.

c. With the requirements for the minimum number of OPERABLE channels not satisfied for both trip systems, place at least one inoperable channel in at least one trip system** in the tripped condition within one hour and take the ACTION required by Table 3.3.2-1.

d. The provisions of Specification 3.0.3 are not applicable in OPERATIONAL CONDITION 5.

SURVEILLANCE REQUIREMENTS

* With a design providing only one channel per trip system, an inoperable channel need not be placed in the tripped condition where this would cause the Trip Function to occur. In these cases, the inoperable channel shall be restored to OPERABLE status within 2 hours or the ACTION required by Table 3.3.2-1 for that Trip Function shall be taken.

**If both channels are inoperable in one trip system, select at least one inoperable channel in that trip system to place in the tripped condition, except when that would cause the Trip Function to occur.

TABLE .2-1

ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
1. PRIMARY CONTAINMENT ISOLATION				
a. Reactor Vessel Water Level				
1. Low (Level 3) (2B21-N680 A, B, C, D)	2, 6, 10, 11, 12	2	1, 2, 3	20
2. Low-Low (Level 2) (2B21-N682 A, B, C, D)	5, #, *	2	1, 2, 3	20
3. Low-Low-Low (Level 1) (2B21-N681 A, B, C, D)	1	2	1, 2, 3	20
b. Drywell Pressure - High (2C71-N650 A, B, C, D)	2, 6, 7, 10, 12, #, *	2	1, 2, 3	20
c. Main Steam Line				
1. Radiation - High (2D11-K603 A, B, C, D)	1, 12, #, (d)	2	1, 2, 3	21
2. Pressure - Low (2B21-N015 A, B, C, D)	1	2	1	22
3. Flow - High (2B21-N686 A, B, C, D) (2B21-N687 A, B, C, D) (2B21-N688 A, B, C, D) (2B21-N689 A, B, C, D)	1, #	2/line	1, 2, 3	21
d. Main Steam Line Tunnel Temperature - High (2B21-N623 A, B, C, D) (2B21-N624 A, B, C, D) (2B21-N625 A, B, C, D) (2B21-N626 A, B, C, D)	1	2/line(e)	1, 2, 3	21
e. Condenser Vacuum - Low (2B21-N056 A, B, C, D)	1	2	1, 2,(f),3(f)	23
f. Turbine Building Area Temperature - High (2U61-R001, 2U61-R002, 2U61-R003, 2U61-R004)	1	2(e)	1, 2, 3	21

TABLE 3.3.2-1 (Continued)

ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
2. SECONDARY CONTAINMENT ISOLATION				
a. Reactor Building Exhaust Radiation - High (2D11-K609 A, B, C, D)	6, 10, 12, *	2	1,2,3,5 and**	24
b. Drywell Pressure - High (2C71-N650 A, B, C, D)	2, 6, 7, 10, 12, #, *	2	1, 2, 3	24
c. Reactor Vessel Water Level - Low Low (Level 2) (2B21-N682 A, B, C, D)	5, #, *	2	1, 2, 3	24
d. Refueling Floor Exhaust Radiation - High (2D11-K611 A, B, C, D)	6, 10, 12, #, *	2	1,2,3,5 and**	24
3. REACTOR WATER CLEANUP SYSTEM ISOLATION				
a. Δ Flow - High (2G31-N603 A, B)	5	1	1, 2, 3	25
b. Area Temperature - High (2G31-N662 A, D, E, H, J, M)	5	1	1, 2, 3	25
c. Area Ventilation Δ Temp. - High (2G31-N663 A, D, E, H, J, M; 2G31-N661 A, D, E, H, J, M; 2G31-N662 A, D, E, H, J, M)	5	1	1, 2, 3	25
d. SLCS Initiation (NA)	5(g)	NA	1, 2, 3	25
e. Reactor Vessel Water Level - Low Low (Level 2) (2B21-N682 A, B, C, D)	5, #, *	2	1, 2, 3	25

TABLE 3.3.2-1 (Continued)

ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION	
4. HIGH PRESSURE COOLANT INJECTION SYSTEM ISOLATION					
a. HPCI Steam Line Flow - High (2E41-N657 A,B)	3	1	1, 2, 3	26	|
b. HPCI Steam Supply Pressure - Low (2E41-N658 A,B,C,D)	3,8	2	1, 2, 3	26	|
c. HPCI Turbine Exhaust Diaphragm Pressure - High (2E41-N655 A,B,C,D)	3	2	1, 2, 3	26	|
d. HPCI Pipe Penetration Room Temperature - High (2E41-N671 A, B)	3	1	1, 2, 3	26	|
e. Suppression Pool Area Ambient Temperature-High (2E51-N666 C, D)	3	1	1, 2, 3	26	|
f. Suppression Pool Area Δ Temp.-High (2E51-N665 C, D; 2E51-N663 C, D; 2E51-N664 C, D)	3	1	1, 2, 3	26	|
g. Suppression Pool Area Temperature Timer Relays (2E41-M603 A, B)	3(i)	1	1, 2, 3	26	
h. Emergency Area Cooler Temperature-High (2E41-N670 A, B)	3	1	1, 2, 3	26	|
i. Drywell Pressure-High (2E11-N694 C, D)	8	1	1, 2, 3	26	|
j. Logic Power Monitor (2E41-K1)	NA(h)	1	1, 2, 3	27	

TABLE 3.3.2-1 (Continued)
ISOLATION ACTUATION INSTRUMENTATION

TRIP FUNCTION	VALVE GROUPS OPERATED BY SIGNAL(a)	MINIMUM NUMBER OPERABLE CHANNELS PER TRIP SYSTEM(b)(c)	APPLICABLE OPERATIONAL CONDITION	ACTION
5. REACTOR CORE ISOLATION COOLING SYSTEM ISOLATION				
a. RCIC Steam Line Flow-High (2E51-N657 A,B)	4	1	1, 2, 3	26
b. RCIC Steam Supply Pressure - Low (2E51-N658 A, B, C, D)	4, 9	2	1, 2, 3	26
c. RCIC Turbine Exhaust Diaphragm Pressure - High (2E51-N685 A, B, C, D)	4	2	1, 2, 3	26
d. Emergency Area Cooler Temperature - High (2E51-N661 A, B)	4	1	1, 2, 3	26
e. Suppression Pool Area Ambient Temperature-High (2E51-N666 A, B)	4	1	1, 2, 3	26
f. Suppression Pool Area Δ T-High (2E51-N665 A, B; 2E51-N663 A,B; 2E51-N664 A,B)	4	1	1, 2, 3	26
g. Suppression Pool Area Temperature Timer Relays (2E51-N602 A, B)	4(i)	1	1, 2, 3	26
h. Drywell Pressure - High (2E11-N694 A, B)	9	1	1, 2, 3	26
i. Logic Power Monitor (2E51-K1)	NA(h)	1	1, 2, 3	27
6. SHUTDOWN COOLING SYSTEM ISOLATION				
a. Reactor Vessel Water Level-Low (Level 3)(2B21-N680 A, B, C, D)	6, 10, 11, 2 12	2	3, 4, 5	26
b. Reactor Steam Dome Pressure-High (2B31-N679 A, D)	11	1	1, 2, 3	28

TABLE 3.3.2-1 (Continued)

ISOLATION ACTUATION INSTRUMENTATION

ACTION

ACTION 20 - Be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the next 30 hours.

ACTION 21 - Be in at least STARTUP with the main steam line isolation valves closed within 2 hours or be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within the next 30 hours.

ACTION 22 - Be in at least STARTUP within 2 hours.

ACTION 23 - Be in at least STARTUP with the Group 1 isolation valves closed within 2 hours or in at least HOT SHUTDOWN within 6 hours.

ACTION 24 - Establish SECONDARY CONTAINMENT INTEGRITY with the standby gas treatment system operating within one hour.

ACTION 25 - Isolate the reactor water cleanup system.

ACTION 26 - Close the affected system isolation valves and declare the affected system inoperable.

ACTION 27 - Verify power availability to the bus at least once per 12 hours or close the affected system isolation valves and declare the affected system inoperable.

ACTION 28 - Close the shutdown cooling supply and reactor vessel head spray isolation valves unless reactor steam dome pressure $\leq$ 145 psig.

NOTES

\# Actuates operation of the main control room environmental control system in the pressurization mode of operation.

* Actuates the standby gas treatment system.

** When handling irradiated fuel in the secondary containment.

a. See Specification 3.6.3, Table 3.6.3-1 for valves in each valve group.

b. A channel may be placed in an inoperable status for up to 2 hours for required surveillance without placing the trip system in the tripped condition provided at least one other OPERABLE channel in the same trip system is monitoring that parameter.

c. With a design providing only one channel per trip system, an inoperable channel need not be placed in the tripped condition where this would cause the Trip Function to occur. In these cases, the inoperable channel shall be restored to OPERABLE status within 2 hours or the ACTION required by Table 3.3.2-1 for that Trip Function shall be taken.

d. Trips the mechanical vacuum pumps.

e. A channel is OPERABLE if 2 of 4 instruments in that channel are OPERABLE.

f. May be bypassed with all turbine stop valves closed.

g. Closes only RWCU outlet isolation valve 2G31-F004.

h. Alarm only.

i. Adjustable up to 60 minutes.

3/4.5 EMERGENCY CORE COOLING SYSTEMS

3/4.5.1 HIGH PRESSURE COOLANT INJECTION SYSTEM

LIMITING CONDITION FOR OPERATION

3.5.1 The High Pressure Coolant Injection (HPCI) system shall be OPERABLE with:

a. One OPERABLE high pressure coolant injection pump, and

b. An OPERABLE flow path capable of taking suction from the suppression chamber and transferring the water to the reactor pressure vessel.

APPLICABILITY: CONDITIONS 1*, 2* and 3* with reactor vessel steam dome pressure > 150 psig.

ACTION:

a. With the HPCI system inoperable, POWER OPERATION may continue and the provisions of 3.0.4 do not apply*, provided the RCIC system, ADS, CSS and LPCI system are OPERABLE; restore the inoperable HPCI system to OPERABLE status within 14 days or be in at least HOT SHUTDOWN within the next 12 hours and reduce reactor steam dome pressure to ≤ 150 psig within the following 24 hours.

b. With the surveillance requirements of Specification 4.5.1 not performed at the required frequencies due to low reactor steam pressure, the provisions of Specification 4.0.4 are not applicable provided the appropriate surveillance is performed within 12 hours after reactor steam pressure is adequate to perform the tests.

c. In the event the HPCI 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 actuations cycles to date.

SURVEILLANCE REQUIREMENTS

*See Special Test Exception 3.10.5

3/4.5.2 AUTOMATIC DEPRESSURIZATION SYSTEM

LIMITING CONDITION FOR OPERATION

ad.6

3.5.2 The Automatic Depressurization System (ADS) shall be OPERABLE with at least seven OPERABLE ADS valves.

APPLICABILITY: CONDITIONS 1, 2 and 3 with reactor vessel steam dome pressure >150 psig.

ACTION:

a. With one of the above required ADS valves inoperable, POWER OPERATION may continue provided the HPCI, CSS and LPCI systems are OPERABLE; restore the inoperable ADS valve to OPERABLE status within 14 days or be in at least HOT SHUTDOWN within the next 12 hours and reduce reactor vessel steam dome pressure to $\leq$ 150 psig within the following 24 hours.

b. With two or more of the above required ADS valves inoperable, be in at least HOT SHUTDOWN within 12 hours and reduce reactor steam dome pressure to $\leq$ 150 psig within the next 24 hours.

c. With the Surveillance Requirement of Specification 4.5.2.b not performed at the required interval due to low reactor steam pressure, the provisions of Specification 4.0.4 are not applicable provided the appropriate surveillance is performed within 12 hours after reactor steam pressure is adequate to perform the tests.

SURVEILLANCE REQUIREMENTS

3/4.5.3 LOW PRESSURE CORE COOLING SYSTEMS

CORE SPRAY SYSTEM

LIMITING CONDITION FOR OPERATION

3.5.3.1 Two independent Core Spray System (CSS) subsystems shall be OPERABLE with each subsystem comprised of:

a. One OPERABLE CSS pump, and

b. An OPERABLE flow path capable of taking suction from at least one of the following OPERABLE sources and transferring the water through the spray sparger to the reactor vessel;

1. In CONDITION 1, 2 or 3, from the suppression pool.

2. In CONDITION 4 or 5*;

a) From the suppression pool, or

b) When the suppression pool is being drained, from the condensate storage tank containing at least (150,000) gallons of water.

APPLICABILITY: CONDITIONS 1, 2, 3, 4, and 5*.

ACTION:

a. In CONDITION 1, 2 or 3;

1. With one CSS subsystem inoperable, POWER OPERATION may continue provided both LPCI subsystems are OPERABLE; restore the inoperable CSS subsystem to OPERABLE status within 7 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

2. With both CSS subsystems inoperable, be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours.

3. In the event the CSS 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.

* The core spray system and the suppression chamber are not required to be OPERABLE provided that the reactor vessel head is removed and the cavity is flooded, the spent fuel pool gates are removed, and the water level is maintained within the limits of Specifications 3.9.8 and 3.9.10

LIMITING CONDITION FOR OPERATION (Continued)

ACTION (Continued)

b. In CONDITION 4 or 5*;

1. With one CSS subsystem inoperable, operation may continue provided that at least one LPCI subsystem is OPERABLE within 4 hours; otherwise, suspend all operations that have a potential for draining the reactor vessel.

2. With both CSS subsystems inoperable, operation may continue provided that at least one LPCI subsystem is OPERABLE and both LPCI subsystems are OPERABLE within 4 hours. Otherwise, suspend all operations that have a potential for draining the reactor vessel and verify that at least one LPCI subsystem is OPERABLE within 4 hours.

3. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

LOW PRESSURE COOLANT INJECTION SYSTEM

LIMITING CONDITION FOR OPERATION

3.5.3.2 Two independent Low Pressure Coolant Injection (LPCI) subsystems of the residual heat removal system (RHR) shall be OPERABLE with each subsystem comprised of:

a. Two OPERABLE RHR pumps,

b. An OPERABLE flow path capable of taking suction from the suppression chamber and transferring the water to the reactor pressure vessel.

APPLICABILITY: CONDITIONS 1, 2, 3, 4* and 5*, **.

ACTION:

a. In CONDITION 1, 2 or 3;

1. With one LPCI subsystem or one LPCI pump inoperable, POWER OPERATION may continue provided both CSS subsystems are OPERABLE; restore the inoperable LPCI subsystem or pump to OPERABLE status within 7 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

2. With both LPCI subsystems inoperable, be in at least HOT SHUTDOWN within 12 hours and either be in COLD SHUTDOWN or maintain reactor coolant temperature $\leq$ 400°F by use of alternate heat removal methods within the following 24 hours.

3. With the LPCI system cross-tie valve open or power not removed from the valve operator, be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the following 24 hours.

4. In the event the LPCI system 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.

b. In CONDITION 4* or 5*, ** with one or more LPCI subsystems inoperable, take the ACTION required by Specification 3.5.3.1. The provisions of Specification 3.0.3 are not applicable.

* Not applicable when two CSS subsystems are OPERABLE per Specification 3.5.3.1.

**Not applicable when the CSS is not required to be OPERABLE per Specification 3.5.3.1.

LIMITING CONDITION FOR OPERATION

3.5.4 The suppression chamber shall be OPERABLE with a minimum contained water volume of 653,000 gallons, equivalent to a level of 12'2", and the water level instrumentation channels alarms adjusted to actuate at a low water level ≥ 12'2", except that the suppression chamber may be drained:

a. In OPERATIONAL CONDITION 4, provided that;

1. No work is performed which has a potential for draining the reactor vessel,

2. The reactor mode switch is locked in the Shutdown position, and

3. The core spray system is OPERABLE per Specification 3.5.3.1 with an OPERABLE flow path capable of taking suction from the OPERABLE condensate storage tank and transferring the water through the spray sparger to the reactor vessel.

b. In OPERATIONAL CONDITION 5, provided that the reactor mode switch is locked in the Refuel position, and:

1. The core spray system is OPERABLE per Specification 3.5.3.1 with an OPERABLE flow path capable of taking suction from the OPERABLE condensate storage tank and transferring the water through the spray sparger to the reactor vessel, or

2. The reactor vessel head is removed and the cavity is flooded, the spent fuel pool gates are removed, and the water level is maintained within the limits of Specifications 3.9.9 and 3.9.10

APPLICABILITY: CONDITION 1, 2, 3, 4 and 5.

ACTION:

a. In CONDITION 1, 2 or 3 with the suppression chamber water level less than the above limit, restore the water level to within the limit within 1 hour or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours.

b. In CONDITION 4 or 5 with the suppression chamber drained and the conditions of Specification 3.5.4.a or 3.5.4.b, as applicable, not satisfied, suspend all operations in the reactor vessel and all positive reactivity changes. The provisions of Specification 3.0.3 are not applicable.

LIMITING CONDITION FOR OPERATION (Continued)

ACTION (Continued)

c. With one suppression chamber water level instrumentation channel inoperable, restore the inoperable channel to OPERABLE status within 30 days or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours and verify the suppression chamber water level to be $\geq$ 12'2" at least once per 12 hours.

d. With both suppression chamber water level instrumentation channels inoperable, restore at least one inoperable channel to OPERABLE status within 6 hours or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours and verify the suppression chamber water level to be $\geq$ 12'2" at least once per hour.

SURVEILLANCE REQUIREMENTS

PRIMARY CONTAINMENT HYDROGEN RECOMBINER SYSTEMS

LIMITING CONDITION FOR OPERATION

3.6.6.2 Two independent primary containment hydrogen recombiner systems shall be OPERABLE.

APPLICABILITY: CONDITIONS 1 and 2.

ACTION

a. With one hydrogen recombiner system inoperable, restore the inoperable system to OPERABLE status within 30 days or be in at least HOT SHUTDOWN within the next 12 hours. The provisions of Specification 3.0.4 are not applicable.

b. With both hydrogen recombiner systems inoperable, be in at least HOT SHUTDOWN within 12 hours.

SURVEILLANCE REQUIREMENTS

Table 3. Superheated Steam

Abs Press. Lb/Sq In. (Sat. Temp)		Sat. Water	Sat. Steam	Temperature – Degrees Fahrenheit 200	250	300	350	400	450	500	600	700	800	900	1000	1100	1200
1 (101.74)	Sh			98.26	148.26	198.26	248.26	298.26	348.26	398.26	498.26	598.26	698.26	798.26	898.26	998.26	1098.26
	v	0.01614	333.6	392.5	422.4	452.3	482.1	511.9	541.7	571.5	631.1	690.7	750.3	809.8	869.4	929.0	988.6
	h	69.73	1105.8	1150.2	1172.9	1195.7	1218.7	1241.8	1265.1	1288.6	1336.1	1384.5	1433.7	1483.8	1534.9	1586.8	1639.7
	s	0.1326	1.9781	2.0509	2.0841	2.1152	2.1445	2.1722	2.1985	2.2237	2.2708	2.3144	2.3551	2.3934	2.4296	2.4640	2.4969
5 (162.24)	Sh			37.76	87.76	137.76	187.76	237.76	287.76	337.76	437.76	537.76	637.76	737.76	837.76	937.76	1037.76
	v	0.01641	73.53	78.14	84.21	90.24	96.25	102.24	108.23	114.21	126.15	138.08	150.01	161.94	173.86	185.78	197.70
	h	130.20	1131.1	1148.6	1171.7	1194.8	1218.0	1241.3	1264.7	1288.2	1335.9	1384.3	1433.6	1483.7	1534.7	1586.7	1639.6
	s	0.2349	1.9443	1.8716	1.9054	1.9369	1.9664	1.9943	2.0208	2.0460	2.0932	2.1369	2.1776	2.2159	2.2521	2.2866	2.3194
10 (193.21)	Sh			6.79	56.79	106.79	156.79	206.79	256.79	306.79	406.79	506.79	606.79	706.79	806.79	906.79	1006.79
	v	0.01659	38.42	38.84	41.93	44.98	48.02	51.03	54.04	57.04	63.03	69.00	74.98	80.94	86.91	92.87	98.84
	h	161.26	1143.3	1146.6	1170.2	1193.7	1217.1	1240.6	1264.1	1287.8	1335.5	1384.0	1433.4	1483.5	1534.6	1586.6	1639.5
	s	0.2836	1.7879	1.7928	1.8273	1.8593	1.8892	1.9173	1.9439	1.9692	2.0166	2.0603	2.1011	2.1394	2.1757	2.2101	2.2430
14.696 (212.00)	Sh				38.00	88.00	138.00	188.00	238.00	288.00	388.00	488.00	588.00	688.00	788.00	888.00	988.00
	v	0167	26.799		28.42	30.52	32.60	34.67	36.72	38.77	42.86	46.93	51.00	55.06	59.13	63.19	67.25
	h	180.17	1150.5		1168.8	1192.6	1216.3	1239.9	1263.6	1287.4	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4
	s	3121	1.7568		1.7833	1.8158	1.8459	1.8743	1.9010	1.9265	1.9739	2.0177	2.0585	2.0969	2.1332	2.1676	2.2005
15 (213.03)	Sh				36.97	86.97	136.97	186.97	236.97	286.97	386.97	486.97	586.97	686.97	786.97	886.97	986.97
	v	0.01673	26.290		27.837	29.899	31.939	33.963	35.977	37.985	41.986	45.978	49.964	53.946	57.926	61.905	65.882
	h	181.21	1150.9		1168.7	1192.5	1216.2	1239.9	1263.6	1287.3	1335.2	1383.8	1433.2	1483.4	1534.5	1586.5	1639.4
	s	0.3137	1.7552		1.7809	1.8134	1.8437	1.8720	1.8988	1.9242	1.9717	2.0155	2.0563	2.0946	2.1309	2.1653	2.1982
20 (227.96)	Sh				22.04	72.04	122.04	172.04	222.04	272.04	372.04	472.04	572.04	672.04	772.04	872.04	972.04
	v	0.01683	20.087		20.788	22.356	23.900	25.428	26.946	28.457	31.466	34.465	37.458	40.447	43.435	46.420	49.405
	h	196.27	1156.3		1167.1	1191.4	1215.4	1239.2	1263.0	1286.9	1334.9	1383.5	1432.9	1483.2	1534.3	1586.3	1639.3
	s	0.3358	1.7320		1.7475	1.7805	1.8111	1.8397	1.8666	1.8921	1.9397	1.9836	2.0244	2.0628	2.0991	2.1336	2.1665
25 (240.07)	Sh				9.93	59.93	109.93	159.93	209.93	259.93	359.93	459.93	559.93	659.93	759.93	859.93	959.93
	v	0.01693	16.301		16.558	17.829	19.076	20.307	21.527	22.740	25.153	27.557	29.954	32.348	34.740	37.130	39.518
	h	208.52	1160.6		1165.6	1190.2	1214.5	1238.5	1262.5	1286.4	1334.6	1383.3	1432.7	1483.0	1534.2	1586.2	1639.2
	s	0.3535	1.7141		1.7212	1.7547	1.7856	1.8145	1.8415	1.8672	1.9149	1.9588	1.9997	2.0381	2.0744	2.1089	2.1418
30 (250.34)	Sh					49.66	99.66	149.66	199.66	249.66	349.66	449.66	549.66	649.66	749.66	849.66	949.66
	v	0.01701	13.744			14.810	15.[illegible]	16.892	17.914	18.929	20.945	22.951	24.952	26.949	28.943	30.936	32.927
	h	218.93	1164.1			1189.0	1213.6	1237.8	1261.9	1286.0	1334.2	1383.0	1432.5	1482.8	1534.0	1586.1	1639.0
	s	0.3682	1.6995			1.7334	1.7647	1.7937	1.8210	1.8467	1.8946	1.9386	1.9795	2.0179	2.0543	2.0888	2.1217
35 (259.29)	Sh					40.71	90.71	140.71	190.71	240.71	340.71	440.71	540.71	640.71	740.71	840.71	940.71
	v	0.01708	11.896			12.654	13.562	14.453	15.334	16.207	17.939	19.662	21.379	23.092	24.803	26.512	28.220
	h	228.03	1167.1			1187.8	1212.7	1237.1	1261.3	1285.5	1333.9	1382.8	1432.3	1482.7	1533.9	1586.0	1638.9
	s	0.3809	1.6872			1.7152	1.7468	1.7761	1.8035	1.8294	1.8774	1.9214	1.9624	2.0009	2.0372	2.0717	2.1046
40 (267.25)	Sh					32.75	82.75	132.75	182.75	232.75	332.75	432.75	532.75	632.75	732.75	832.75	932.75
	v	0.01715	10.497			11.036	11.838	12.624	13.398	14.165	15.685	17.195	18.699	20.199	21.697	23.194	24.689
	h	236.14	1169.8			1186.6	1211.7	1236.4	1260.8	1285.0	1333.6	1382.5	1432.1	1482.5	1533.7	1585.8	1638.8
	s	0.3921	1.6765			1.6992	1.7312	1.7608	1.7883	1.8143	1.8624	1.9065	1.9476	1.9860	2.0224	2.0569	2.0899
45 (274.44)	Sh					25.56	75.56	125.56	175.56	225.56	325.56	425.56	525.56	625.56	725.56	825.56	925.56
	v	0.01721	9.399			9.777	10.497	11.201	11.892	12.577	13.932	15.276	16.614	17.950	19.282	20.613	21.943
	h	243.49	1172.1			1185.4	1210.4	1235.7	1260.2	1284.6	1333.3	1382.3	1431.9	1482.3	1533.6	1585.7	1638.7
	s	0.4021	1.6671			1.6849	1.7173	1.7471	1.7748	1.8010	1.8492	1.8934	1.9345	1.9730	2.0093	2.0439	2.0768
50 (281.02)	Sh					18.98	68.98	118.98	168.98	218.98	318.98	418.98	518.98	618.98	718.98	818.98	918.98
	v	0.01727	8.514			8.769	9.424	10.062	10.688	11.306	12.529	13.741	14.947	16.150	17.350	18.549	19.746
	h	250.21	1174.1			1184.1	1209.9	1234.9	1259.6	1284.1	1332.9	1382.0	1431.7	1482.2	1533.4	1585.6	1638.6
	s	0.4112	1.6586			1.6720	1.7048	1.7345	1.7628	1.7890	1.8374	1.8816	1.9227	1.9613	1.9977	2.0322	2.0652
55 (287.07)	Sh					12.93	62.93	112.93	162.93	212.93	312.93	412.93	512.93	612.93	712.93	812.93	912.93
	v	0.01733				7.945	8.546	9.130	9.702	10.267	11.381	12.485	13.583	14.677	15.769	16.859	17.948
	h	256.43				1182.9	1208.9	1234.2	1259.1	1283.6	1332.6	1381.8	1431.5	1482.0	1533.3	1585.5	1638.5
	s	0.4196				1.6601	1.6933	1.7237	1.7518	1.7781	1.8266	1.8710	1.9121	1.9507	1.987	2.022	2.055
60 (292.71)	Sh					7.29	57.29	107.29	157.29	207.29	307.29	407.29	507.29	607.29	707.29	807.29	907.29
	v	0.01738	7.174			7.257	7.815	8.354	8.881	9.400	10.425	11.438	12.446	13.450	14.452	15.452	16.450
	h	262.21	1177.6			1181.6	1208.0	1233.5	1258.5	1283.2	1332.3	1381.5	1431.3	1481.8	1533.2	1585.3	1638.4
	s	0.4273	1.6440			1.6492	1.6934	1.7134	1.7417	1.7681	1.8168	1.8612	1.9024	1.9410	1.9774	2.0120	2.0450
65 (297.98)	Sh					2.02	52.02	102.02	152.02	202.02	302.02	402.02	502.02	602.02	702.02	802.02	902.02
	v	0.01743	6.653			6.675	7.195	7.697	8.186	8.667	9.615	10.552	11.484	12.412	13.337	14.261	15.183
	h	267.63	1179.1			1180.3	1207.0	1232.7	1257.9	1282.7	1331.9	1381.3	1431.1	1481.6	1533.0	1585.2	1638.3
	s	0.4344	1.6375			1.6390	1.6731	1.7040	1.7324	1.7590	1.8077	1.8522	1.8935	1.9321	1.9685	2.0031	2.0361
70 (302.93)	Sh						47.07	97.07	147.07	197.07	297.07	397.07	497.07	597.07	697.07	797.07	897.07
	v	0.01748	6.205				6.664	7.133	7.590	8.039	8.922	9.793	10.659	11.522	12.382	13.240	14.097
	h	272.74	1180.6				1206.0	1232.0	1257.3	1282.2	1331.6	1381.0	1430.9	1481.5	1532.9	1585.1	1638.2
	s	0.4411	1.6316				1.6640	1.6951	1.7237	1.7504	1.7993	1.8439	1.8852	1.9238	1.9603	1.9949	2.0279
75 (307.61)	Sh						42.39	92.39	142.39	192.39	292.39	392.39	492.39	592.39	692.39	792.39	892.39
	v	0.01753	5.814				6.204	6.645	7.074	7.494	8.320	9.135	9.945	10.750	11.553	12.355	13.155
	h	277.56	1181.9				1205.0	1231.2	1256.7	1281.7	1331.3	1380.7	1430.7	1481.3	1532.7	1585.0	1638.1
	s	0.4474	1.6260				1.6554	1.6868	1.7156	1.7424	1.7915	1.8361	1.8774	1.9161	1.9526	1.9872	2.0202

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam — *Continued*

Abs Press Lb/Sq In (Sat. Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 350	400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400
	Sh			37.96	87.96	137.96	187.96	237.96	287.96	387.96	487.96	587.96	687.96	787.96	887.96	987.96	1087.96
80	v	0.01757	5.471	5.801	6.218	6.622	7.018	7.408	7.794	8.560	9.319	10.075	10.829	11.581	12.331	13.081	13.829
(312.04)	h	282.15	1183.1	1204.0	1230.5	1256.1	1281.3	1306.2	1330.9	1380.5	1430.5	1481.1	1532.6	1584.9	1638.0	1692.0	1746.8
	s	0.4534	1.6208	1.6473	1.6790	1.7080	1.7349	1.7602	1.7842	1.8289	1.8702	1.9089	1.9454	1.9800	2.0131	2.0446	2.0750
	Sh			33.74	83.74	133.74	183.74	233.74	283.74	383.74	483.74	583.74	683.74	783.74	883.74	983.74	1083.74
85	v	0.01762	5.167	5.445	5.840	6.223	6.597	6.966	7.330	8.052	8.768	9.480	10.190	10.898	11.604	12.310	13.014
(316.26)	h	286.52	1184.2	1203.0	1229.7	1255.5	1280.8	1305.8	1330.6	1380.2	1430.3	1481.0	1532.4	1584.7	1637.9	1691.9	1746.8
	s	0.4590	1.6159	1.6396	1.6716	1.7008	1.7279	1.7532	1.7772	1.8220	1.8634	1.9021	1.9386	1.9733	2.0063	2.0379	2.0682
	Sh			29.72	79.72	129.72	179.72	229.72	279.72	379.72	479.72	579.72	679.72	779.72	879.72	979.72	1079.72
90	v	0.01766	4.895	5.128	5.505	5.869	6.223	6.572	6.917	7.600	8.277	8.950	9.621	10.290	10.958	11.625	12.290
(320.28)	h	290.69	1185.3	1202.0	1228.9	1254.9	1280.3	1305.4	1330.2	1380.0	1430.1	1480.8	1532.3	1584.6	1637.8	1691.8	1746.7
	s	0.4643	1.6113	1.6323	1.6646	1.6940	1.7212	1.7467	1.7707	1.8156	1.8570	1.8957	1.9323	1.9669	2.0000	2.0316	2.0619
	Sh			25.87	75.87	125.87	175.87	225.87	275.87	375.87	475.87	575.87	675.87	775.87	875.87	975.87	1075.87
95	v	0.01770	4.651	4.845	5.205	5.551	5.889	6.221	6.548	7.196	7.838	8.477	9.113	9.747	10.380	11.012	11.643
(324.13)	h	294.70	1186.2	1200.9	1228.1	1254.3	1279.8	1305.0	1329.9	1379.7	1429.9	1480.6	1532.1	1584.5	1637.7	1691.7	1746.6
	s	0.4694	1.6069	1.6253	1.6580	1.6876	1.7149	1.7404	1.7645	1.8094	1.8509	1.8897	1.9262	1.9609	1.9940	2.0256	2.0559
	Sh			22.18	72.18	122.18	172.18	222.18	272.18	372.18	472.18	572.18	672.18	772.18	872.18	972.18	1072.18
100	v	0.01774	4.431	4.590	4.935	5.266	5.588	5.904	6.216	6.833	7.443	8.050	8.655	9.258	9.860	10.460	11.060
(327.82)	h	298.54	1187.2	1199.9	1227.4	1253.7	1279.3	1304.6	1329.6	1379.5	1429.7	1480.4	1532.0	1584.4	1637.6	1691.6	1746.5
	s	0.4743	1.6027	1.6187	1.6516	1.6814	1.7088	1.7344	1.7586	1.8036	1.8451	1.8839	1.9205	1.9552	1.9883	2.0199	2.0502
	Sh			18.63	68.63	118.63	168.63	218.63	268.63	368.63	468.63	568.63	668.63	768.63	868.63	968.63	1068.63
105	v	0.01778	4.231	4.359	4.690	5.007	5.315	5.617	5.915	6.504	7.086	7.665	8.241	8.816	9.389	9.961	10.532
(331.37)	h	302.24	1188.0	1198.8	1226.6	1253.1	1278.8	1304.2	1329.2	1379.2	1429.4	1480.3	1531.8	1584.2	1637.5	1691.5	1746.4
	s	0.4790	1.5988	1.6127	1.6455	1.6755	1.7031	1.7288	1.7530	1.7981	1.8396	1.8785	1.9151	1.9498	1.9828	2.0145	2.0448
	Sh			15.21	65.21	115.21	165.21	215.21	265.21	365.21	465.21	565.21	665.21	765.21	865.21	965.21	1065.21
110	v	0.01782	4.048	4.149	4.468	4.772	5.068	5.357	5.642	6.205	6.761	7.314	7.865	8.413	8.961	9.507	10.053
(334.79)	h	305.80	1188.9	1197.7	1225.8	1252.5	1278.3	1303.8	1328.9	1379.0	1429.2	1480.1	1531.7	1584.1	1637.4	1691.4	1746.4
	s	0.4834	1.5950	1.6061	1.6396	1.6698	1.6975	1.7233	1.7476	1.7928	1.8344	1.8732	1.9099	1.9446	1.9777	2.0093	2.0397
	Sh			11.92	61.92	111.92	161.92	211.92	261.92	361.92	461.92	561.92	661.92	761.92	861.92	961.92	1061.92
115	v	0.01785	3.881	3.957	4.265	4.558	4.841	5.119	5.392	5.932	6.465	6.994	7.521	8.046	8.570	9.093	9.615
(338.08)	h	309.25	1189.6	1196.7	1225.0	1251.8	1277.9	1303.3	1328.6	1378.7	1429.0	1479.9	1531.6	1584.0	1637.2	1691.4	1746.3
	s	0.4877	1.5913	1.6001	1.6340	1.6644	1.6922	1.7181	1.7425	1.7877	1.8294	1.8682	1.9049	1.9396	1.9727	2.0044	2.0347
	Sh			8.73	58.73	108.73	158.73	208.73	258.73	358.73	458.73	558.73	658.73	758.73	858.73	958.73	1058.73
120	v	0.01789	3.7275	3.7815	4.0786	4.3610	4.6341	4.9009	5.1637	5.6813	6.1928	6.7006	7.2060	7.7096	8.2119	8.7130	9.2134
(341.27)	h	312.58	1190.4	1195.6	1224.1	1251.2	1277.4	1302.9	1328.2	1378.4	1428.8	1479.8	1531.4	1583.9	1637.1	1691.3	1746.2
	s	0.4919	1.5879	1.5943	1.6286	1.6592	1.6872	1.7132	1.7376	1.7829	1.8246	1.8635	1.9001	1.9349	1.9680	1.9996	2.0300
	Sh			2.67	52.67	102.67	152.67	202.67	252.67	352.67	452.67	552.67	652.67	752.67	852.67	952.67	1052.67
130	v	0.01796	3.4544	3.4699	3.7489	4.0129	4.2672	4.5151	4.7589	5.2384	5.7118	6.1814	6.6486	7.1140	7.5781	8.0411	8.5033
(347.33)	h	318.95	1191.7	1193.4	1222.5	1249.9	1276.4	1302.1	1327.5	1377.9	1428.4	1479.4	1531.1	1583.6	1636.9	1691.1	1746.1
	s	0.4998	1.5813	1.5833	1.6182	1.6493	1.6775	1.7037	1.7283	1.7737	1.8155	1.8545	1.8911	1.9259	1.9591	1.9907	2.0211
	Sh				46.96	96.96	146.96	196.96	246.96	346.96	446.96	546.96	646.96	746.96	846.96	946.96	1046.96
140	v	0.01803	3.2190		3.4661	3.7143	3.9526	4.1844	4.4119	4.8588	5.2995	5.7364	6.1709	6.6036	7.0349	7.4652	7.8946
(353.04)	h	324.96	1193.0		1220.8	1248.7	1275.3	1301.3	1326.8	1377.4	1428.0	1479.1	1530.8	1583.4	1636.7	1690.9	1745.9
	s	0.5071	1.5752		1.6085	1.6400	1.6686	1.6949	1.7196	1.7652	1.8071	1.8461	1.8828	1.9176	1.9508	1.9825	2.0129
	Sh				41.57	91.57	141.57	191.57	241.57	341.57	441.57	541.57	641.57	741.57	841.57	941.57	1041.57
150	v	0.01809	3.0139		3.2208	3.4555	3.6799	3.8978	4.1112	4.5298	4.9471	5.3507	5.7568	6.1612	6.5642	6.9661	7.3671
(358.43)	h	330.65	1194.1		1219.1	1247.4	1274.3	1300.5	1326.1	1376.9	1427.6	1478.7	1530.5	1583.1	1636.5	1690.7	1745.7
	s	0.5141	1.5695		1.5993	1.6313	1.6602	1.6867	1.7115	1.7573	1.7992	1.8383	1.8751	1.9099	1.9431	1.9748	2.0052
	Sh				36.45	86.45	136.45	186.45	236.45	336.45	436.45	536.45	636.45	736.45	836.45	936.45	1036.45
160	v	0.01815	2.8336		3.0060	3.2288	3.4413	3.6469	3.8480	4.2420	4.6295	5.0132	5.3945	5.7741	6.1522	6.5293	6.9055
(363.55)	h	336.07	1195.1		1217.4	1246.0	1273.3	1299.6	1325.4	1376.4	1427.2	1478.4	1530.3	1582.9	1636.3	1690.5	1745.6
	s	0.5206	1.5641		1.5906	1.6231	1.6522	1.6790	1.7039	1.7499	1.7919	1.8310	1.8678	1.9027	1.9359	1.9676	1.9980
	Sh				31.58	81.58	131.58	181.58	231.58	331.58	431.58	531.58	631.58	731.58	831.58	931.58	1031.58
170	v	0.01821	2.6738		2.8162	3.0288	3.2306	3.4255	3.6158	3.9879	4.3536	4.7155	5.0749	5.4325	5.7888	6.1440	6.4983
(368.42)	h	341.24	1196.0		1215.6	1244.7	1272.2	1298.8	1324.7	1375.8	1426.8	1478.0	1530.0	1582.6	1636.1	1690.4	1745.4
	s	0.5269	1.5591		1.5823	1.6152	1.6447	1.6717	1.6968	1.7428	1.7850	1.8241	1.8610	1.8959	1.9291	1.9608	1.9913
	Sh				26.92	76.92	126.92	176.92	226.92	326.92	426.92	526.92	626.92	726.92	826.92	926.92	1026.92
180	v	0.01827	2.5312		2.6474	2.8508	3.0433	3.2286	3.4093	3.7621	4.1084	4.4508	4.7907	5.1289	5.4657	5.8014	6.1363
(373.08)	h	346.19	1196.9		1213.8	1243.4	1271.2	1297.9	1324.0	1375.3	1426.3	1477.7	1529.7	1582.4	1635.9	1690.2	1745.3
	s	0.5328	1.5543		1.5743	1.6078	1.6376	1.6647	1.6900	1.7362	1.7784	1.8176	1.8545	1.8894	1.9227	1.9545	1.9849
	Sh				22.47	72.47	122.47	172.47	222.47	322.47	422.47	522.47	622.47	722.47	822.47	922.47	1022.47
190	v	0.01833	2.4030		2.4961	2.6915	2.8756	3.0525	3.2246	3.5601	3.8889	4.2140	4.5365	4.8572	5.1766	5.4949	5.8124
(377.53)	h	350.94	1197.6		1212.0	1242.0	1270.1	1297.1	1323.3	1374.8	1425.9	1477.4	1529.4	1582.1	1635.7	1690.0	1745.1
	s	0.5384	1.5498		1.5667	1.6006	1.6307	1.6581	1.6835	1.7299	1.7722	1.8115	1.8484	1.8834	1.9166	1.9484	1.9789
	Sh				18.20	68.20	118.20	168.20	218.20	318.20	418.20	518.20	618.20	718.20	818.20	918.20	1018.20
200	v	0.01839	2.2873		2.3598	2.5480	2.7247	2.8939	3.0583	3.3783	3.6915	4.0008	4.3077	4.6128	4.9165	5.2191	5.5209
(381.80)	h	355.51	1198.3		1210.1	1240.6	1269.0	1296.2	1322.6	1374.3	1425.5	1477.0	1529.1	1581.9	1635.4	1689.8	1745.0
	s	0.5438	1.5454		1.5593	1.5938	1.6242	1.6518	1.6773	1.7239	1.7663	1.8057	1.8426	1.8776	1.9109	1.9427	1.9732

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press. Lb/Sq In. (Sat. Temp)		Sat. Water	Sat. Steam	Temperature – Degrees Fahrenheit 400	450	500	550	600	700	800	900	1000	1100	1200	1300	1400	1500
	Sh			14.09	64.09	114.09	164.09	214.09	314.09	414.09	514.09	614.09	714.09	814.09	914.09	1014.09	1114.09
210	v	0.01844	2.1822	2.2364	2.4181	2.5880	2.7504	2.9078	3.2137	3.5128	3.8080	4.1007	4.3915	4.6811	4.9695	5.2571	5.5440
(385.91)	h	359.91	1199.0	1208.02	1239.2	1268.0	1295.3	1321.9	1373.7	1425.1	1476.7	1528.8	1581.6	1635.2	1689.6	1744.8	1800.8
	s	0.5490	1.5413	1.5522	1.5872	1.6180	1.6458	1.6715	1.7182	1.7607	1.8001	1.8371	1.8721	1.9054	1.9372	1.9677	1.9970
	Sh			10.12	60.12	110.12	160.12	210.12	310.12	410.12	510.12	610.12	710.12	810.12	910.12	1010.12	1110.12
220	v	0.01850	2.0863	2.1240	2.2999	2.4638	2.6199	2.7710	3.0642	3.3504	3.6327	3.9125	4.1905	4.4671	4.7426	5.0173	5.2913
(389.88)	h	364.17	1199.6	1206.3	1237.8	1266.9	1294.5	1321.2	1373.2	1424.7	1476.3	1528.5	1581.4	1635.0	1689.4	1744.7	1800.6
	s	0.5540	1.5374	1.5453	1.5808	1.6120	1.6400	1.6658	1.7128	1.7553	1.7948	1.8318	1.8668	1.9002	1.9320	1.9625	1.9919
	Sh			6.30	56.30	106.30	156.30	206.30	306.30	406.30	506.30	606.30	706.30	806.30	906.30	1006.30	1106.30
230	v	0.01855	1.9985	2.0212	2.1919	2.3503	2.5008	2.6461	2.9276	3.2020	3.4726	3.7406	4.0068	4.2717	4.5355	4.7984	5.0606
(393.70)	h	368.28	1200.1	1204.4	1236.3	1265.7	1293.6	1320.4	1372.7	1424.2	1476.0	1528.2	1581.1	1634.8	1689.3	1744.5	1800.5
	s	0.5588	1.5336	1.5385	1.5747	1.6062	1.6344	1.6604	1.7075	1.7502	1.7897	1.8268	1.8618	1.8952	1.9270	1.9576	1.9869
	Sh			2.61	52.61	102.61	152.61	202.61	302.61	402.61	502.61	602.61	702.61	802.61	902.61	1002.61	1102.61
240	v	0.01860	1.9177	1.9268	2.0928	2.2462	2.3915	2.5316	2.8024	3.0661	3.3259	3.5831	3.8385	4.0926	4.3456	4.5977	4.8492
(397.39)	h	372.27	1200.6	1202.4	1234.9	1264.6	1292.7	1319.7	1372.1	1423.8	1475.6	1527.9	1580.9	1634.6	1689.1	1744.3	1800.4
	s	0.5634	1.5299	1.5320	1.5687	1.6006	1.6291	1.6552	1.7025	1.7452	1.7848	1.8219	1.8570	1.8904	1.9223	1.9528	1.9822
	Sh				49.03	99.03	149.03	199.03	299.03	399.03	499.03	599.03	699.03	799.03	899.03	999.03	1099.03
250	v	0.01865	1.8432		2.0016	2.1504	2.2909	2.4262	2.6872	2.9410	3.1909	3.4382	3.6837	3.9278	4.1709	4.4131	4.6546
(400.97)	h	376.14	1201.1		1233.4	1263.5	1291.8	1319.0	1371.6	1423.4	1475.3	1527.6	1580.6	1634.4	1688.9	1744.2	1800.2
	s	0.5679	1.5264		1.5629	1.5951	1.6239	1.6502	1.6976	1.7405	1.7801	1.8173	1.8524	1.8858	1.9177	1.9482	1.9776
	Sh				45.56	95.56	145.56	195.56	295.56	395.56	495.56	595.56	695.56	795.56	895.56	995.56	1095.56
260	v	0.01870	1.7742		1.9173	2.0619	2.1981	2.3289	2.5808	2.8256	3.0663	3.3044	3.5408	3.7758	4.0097	4.2427	4.4750
(404.44)	h	379.90	1201.5		1231.9	1262.4	1290.9	1318.2	1371.1	1423.0	1474.9	1527.3	1580.4	1634.2	1688.7	1744.0	1800.1
	s	0.5722	1.5230		1.5573	1.5899	1.6189	1.6453	1.6930	1.7359	1.7756	1.8128	1.8480	1.8814	1.9133	1.9439	1.9732
	Sh				42.20	92.20	142.20	192.20	292.20	392.20	492.20	592.20	692.20	792.20	892.20	992.20	1092.20
270	v	0.01875	1.7101		1.8391	1.9799	2.1121	2.2388	2.4824	2.7186	2.9509	3.1806	3.4084	3.6349	3.8603	4.0849	4.3087
(407.80)	h	383.56	1201.9		1230.4	1261.2	1290.0	1317.5	1370.5	1422.6	1474.6	1527.1	1580.1	1634.0	1688.5	1743.9	1800.0
	s	0.5764	1.5197		1.5518	1.5848	1.6140	1.6406	1.6885	1.7315	1.7713	1.8085	1.8437	1.8771	1.9090	1.9396	1.9690
	Sh				38.93	88.93	138.93	188.93	288.93	388.93	488.93	588.93	688.93	788.93	888.93	988.93	1088.93
280	v	0.01880	1.6505		1.7665	1.9037	2.0322	2.1551	2.3909	2.6194	2.8437	3.0655	3.2855	3.5042	3.7217	3.9384	4.1543
(411.07)	h	387.12	1202.3		1228.8	1260.0	1289.1	1316.8	1370.0	1422.1	1474.2	1526.8	1579.9	1633.8	1688.4	1743.7	1799.8
	s	0.5805	1.5166		1.5464	1.5798	1.6093	1.6361	1.6841	1.7273	1.7671	1.8043	1.8395	1.8730	1.9050	1.9356	1.9649
	Sh				35.75	85.75	135.75	185.75	285.75	385.75	485.75	585.75	685.75	785.75	885.75	985.75	1085.75
290	v	0.01885	1.5948		1.6988	1.8327	1.9578	2.0772	2.3058	2.5269	2.7440	2.9585	3.1711	3.3824	3.5926	3.8019	4.0106
(414.25)	h	390.60	1202.6		1227.3	1258.9	1288.1	1316.0	1369.5	1421.7	1473.9	1526.5	1579.6	1633.5	1688.2	1743.6	1799.7
	s	0.5844	1.5135		1.5412	1.5750	1.6048	1.6317	1.6799	1.7232	1.7630	1.8003	1.8356	1.8690	1.9010	1.9316	1.9610
	Sh				32.65	82.65	132.65	182.65	282.65	382.65	482.65	582.65	682.65	782.65	882.65	982.65	1082.65
300	v	0.01889	1.5427		1.6356	1.7665	1.8883	2.0044	2.2263	2.4407	2.6509	2.8585	3.0643	3.2688	3.4721	3.6746	3.8764
(417.35)	h	393.99	1202.9		1225.7	1257.7	1287.2	1315.2	1368.9	1421.3	1473.6	1526.2	1579.4	1633.3	1688.0	1743.4	1799.6
	s	0.5882	1.5105		1.5361	1.5703	1.6003	1.6274	1.6758	1.7192	1.7591	1.7964	1.8317	1.8652	1.8972	1.9278	1.9572
	Sh				29.64	79.64	129.64	179.64	279.64	379.64	479.64	579.64	679.64	779.64	879.64	979.64	1079.64
310	v	0.01894	1.4939		1.5763	1.7044	1.8233	1.9363	2.1520	2.3600	2.5638	2.7650	2.9644	3.1625	3.3594	3.5555	3.7509
(420.36)	h	397.30	1203.2		1224.1	1256.5	1286.3	1314.5	1368.4	1420.9	1473.2	1525.9	1579.2	1633.1	1687.8	1743.3	1799.4
	s	0.5920	1.5076		1.5311	1.5657	1.5960	1.6233	1.6719	1.7153	1.7553	1.7927	1.8280	1.8615	1.8935	1.9241	1.9536
	Sh				26.69	76.69	126.69	176.69	276.69	376.69	476.69	576.69	676.69	776.69	876.69	976.69	1076.69
320	v	0.01899	1.4480		1.5207	1.6462	1.7623	1.8725	2.0823	2.2843	2.4821	2.6774	2.8708	3.0628	3.2538	3.4438	3.6332
(423.31)	h	400.53	1203.4		1222.5	1255.2	1285.3	1313.7	1367.8	1420.5	1472.9	1525.6	1578.9	1632.9	1687.6	1743.1	1799.3
	s	0.5956	1.5048		1.5261	1.5612	1.5918	1.6192	1.6680	1.7116	1.7516	1.7890	1.8243	1.8579	1.8899	1.9206	1.9500
	Sh				23.82	73.82	123.82	173.82	273.82	373.82	473.82	573.82	673.82	773.82	873.82	973.82	1073.82
330	v	0.01903	1.4048		1.4684	1.5915	1.7050	1.8125	2.0168	2.2132	2.4054	2.5950	2.7828	2.9692	3.1545	3.3389	3.5227
(426.18)	h	403.70	1203.6		1220.9	1254.0	1284.4	1313.0	1367.3	1420.0	1472.5	1525.3	1578.7	1632.7	1687.5	1742.9	1799.2
	s	0.5991	1.5021		1.5213	1.5568	1.5876	1.6153	1.6643	1.7079	1.7480	1.7855	1.8208	1.8544	1.8864	1.9171	1.9466
	Sh				21.01	71.01	121.01	171.01	271.01	371.01	471.01	571.01	671.01	771.01	871.01	971.01	1071.01
340	v	0.01908	1.3640		1.4191	1.5399	1.6511	1.7561	1.9552	2.1463	2.3333	2.5175	2.7000	2.8811	3.0611	3.2402	3.4186
(428.99)	h	406.80	1203.8		1219.2	1252.8	1283.4	1312.2	1366.7	1419.6	1472.2	1525.0	1578.4	1632.5	1687.3	1742.8	1799.0
	s	0.6026	1.4994		1.5165	1.5525	1.5836	1.6114	1.6606	1.7044	1.7445	1.7820	1.8174	1.8510	1.8831	1.9138	1.9432
	Sh				18.27	68.27	118.27	168.27	268.27	368.27	468.27	568.27	668.27	768.27	868.27	968.27	1068.27
350	v	0.01912	1.3255		1.3725	1.4913	1.6002	1.7028	1.8970	2.0832	2.2652	2.4445	2.6219	2.7980	2.9730	3.1471	3.3205
(431.73)	h	409.83	1204.0		1217.5	1251.5	1282.4	1311.4	1366.2	1419.2	1471.8	1524.7	1578.2	1632.3	1687.1	1742.6	1798.9
	s	0.6059	1.4968		1.5119	1.5483	1.5797	1.6077	1.6571	1.7009	1.7411	1.7787	1.8141	1.8477	1.8798	1.9105	1.9400
	Sh				15.59	65.59	115.59	165.59	265.59	365.59	465.59	565.59	665.59	765.59	865.59	965.59	1065.59
360	v	0.01917	1.2891		1.3285	1.4454	1.5521	1.6525	1.8421	2.0237	2.2009	2.3755	2.5482	2.7196	2.8898	3.0592	3.2279
(434.41)	h	412.81	1204.1		1215.8	1250.3	1281.5	1310.6	1365.6	1418.7	1471.5	1524.4	1577.9	1632.1	1686.9	1742.5	1798.8
	s	0.6092	1.4943		1.5073	1.5441	1.5758	1.6040	1.6536	1.6976	1.7379	1.7754	1.8109	1.8445	1.8766	1.9073	1.9368
	Sh				10.39	60.39	110.39	160.39	260.39	360.39	460.39	560.39	660.39	760.39	860.39	960.39	1060.39
380	v	0.01925	1.2218		1.2472	1.3606	1.4635	1.5598	1.7410	1.9139	2.0825	2.2484	2.4124	2.5750	2.7366	2.8973	3.0572
(439.61)	h	418.59	1204.4		1212.4	1247.7	1279.5	1309.0	1364.5	1417.9	1470.8	1523.8	1577.4	1631.6	1686.5	1742.2	1798.5
	s	0.6156	1.4894		1.4982	1.5360	1.5683	1.5969	1.6470	1.6911	1.7315	1.7692	1.8047	1.8384	1.8705	1.9012	1.9307

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam – *Continued*

Abs Press. Lb/Sq In. (Sat. Temp)		Sat. Water	Sat. Steam	Temperature – Degrees Fahrenheit 450	500	550	600	650	700	800	900	1000	1100	1200	1300	1400	1500
	Sh			5.40	55.40	105.40	155.40	205.40	255.40	355.40	455.40	555.40	655.40	755.40	855.40	955.40	1055.40
400	v	0.01934	1.1610	1.1738	1.2841	1.3836	1.4763	1.5646	1.6499	1.8151	1.9759	2.1339	2.2901	2.4450	2.5987	2.7515	2.9037
(444.60)	h	424.17	1204.6	1208.8	1245.1	1277.5	1307.4	1335.9	1363.4	1417.0	1470.1	1523.3	1576.9	1631.2	1686.2	1741.9	1798.2
	s	0.6217	1.4847	1.4894	1.5282	1.5611	1.5901	1.6163	1.6406	1.6850	1.7255	1.7632	1.7988	1.8325	1.8647	1.8955	1.9250
	Sh			60	50.60	100.60	150.60	200.60	250.60	350.60	450.60	550.60	650.60	750.60	850.60	950.60	1050.60
420	v	0.01942	1.1057	1.1071	1.2148	1.3113	1.4007	1.4856	1.5676	1.7258	1.8795	2.0304	2.1795	2.3273	2.4739	2.6196	2.7647
(449.40)	h	429.56	1204.7	1205.2	1242.4	1275.4	1305.8	1334.5	1362.3	1416.2	1469.4	1522.7	1575.9	1630.8	1685.8	1741.6	1798.0
	s	0.6276	1.4802	1.4808	1.5206	1.5542	1.5835	1.6100	1.6345	1.6791	1.7197	1.7575	1.7932	1.8269	1.8591	1.8899	1.9195
	Sh				45.97	95.97	145.97	195.97	245.97	345.97	445.97	545.97	645.97	745.97	845.97	945.97	1045.97
440	v	0.01950	1.0554		1.1517	1.2454	1.3319	1.4138	1.4926	1.6445	1.7918	1.9363	2.0790	2.2203	2.3605	2.4998	2.6384
(454.03)	h	434.77	1204.8		1239.7	1273.4	1304.2	1333.2	1361.1	1415.3	1468.7	1522.1	1575.9	1630.4	1685.5	1741.2	1797.7
	s	0.6332	1.4759		1.5132	1.5474	1.5772	1.6040	1.6286	1.6734	1.7142	1.7521	1.7878	1.8216	1.8538	1.8847	1.9141
	Sh				41.50	91.50	141.50	191.50	241.50	341.50	441.50	541.50	641.50	741.50	841.50	941.50	1041.50
460	v	0.01959	1.0092		1.0939	1.1852	1.2691	1.3482	1.4242	1.5703	1.7117	1.8504	1.9872	2.1226	2.2569	2.3903	2.5230
(458.50)	h	439.83	1204.8		1236.9	1271.3	1302.5	1331.8	1360.0	1414.4	1468.0	1521.5	1575.4	1629.9	1685.1	1740.9	1797.4
	s	0.6387	1.4718		1.5060	1.5409	1.5711	1.5982	1.6230	1.6680	1.7089	1.7469	1.7826	1.8165	1.8488	1.8797	1.9093
	Sh				37.18	87.18	137.18	187.18	237.18	337.18	437.18	537.18	637.18	737.18	837.18	937.18	1037.18
480	v	0.01967	0.9668		1.0409	1.1300	1.2115	1.2881	1.3615	1.5023	1.6384	1.7716	1.9030	2.0330	2.1619	2.2900	2.4173
(462.82)	h	444.75	1204.8		1234.1	1269.1	1300.8	1330.5	1358.8	1413.6	1467.3	1520.9	1574.9	1629.5	1684.7	1740.6	1797.2
	s	0.6439	1.4677		1.4990	1.5346	1.5652	1.5925	1.6176	1.6628	1.7038	1.7419	1.7777	1.8116	1.8439	1.8748	1.9045
	Sh				32.99	82.99	132.99	182.99	232.99	332.99	432.99	532.99	632.99	732.99	832.99	932.99	1032.99
500	v	0.01975	0.9276		0.9919	1.0791	1.1584	1.2327	1.3037	1.4397	1.5708	1.6992	1.8256	1.9507	2.0746	2.1977	2.3200
(467.01)	h	449.52	1204.7		1231.2	1267.6	1299.1	1329.1	1357.7	1412.7	1466.6	1520.3	1574.4	1629.1	1684.4	1740.3	1796.9
	s	0.6490	1.4639		1.4921	1.5284	1.5595	1.5871	1.6123	1.6578	1.6990	1.7371	1.7730	1.8069	1.8393	1.8702	1.8998
	Sh				28.93	78.93	128.93	178.93	228.93	328.93	428.93	528.93	628.93	728.93	828.93	928.93	1028.93
520	v	0.01982	0.8914		0.9466	1.0321	1.1094	1.1816	1.2504	1.3819	1.5085	1.6323	1.7542	1.8746	1.9940	2.1125	2.2302
(471.07)	h	454.18	1204.5		1228.3	1264.8	1297.4	1327.7	1356.5	1411.8	1465.9	1519.7	1573.9	1628.7	1684.0	1740.0	1796.7
	s	0.6540	1.4601		1.4853	1.5223	1.5539	1.5818	1.6072	1.6530	1.6943	1.7325	1.7684	1.8024	1.8348	1.8657	1.8954
	Sh				24.99	74.99	124.99	174.99	224.99	324.99	424.99	524.99	624.99	724.99	824.99	924.99	1024.99
540	v	0.01990	0.8577		0.9045	0.9884	1.0640	1.1342	1.2010	1.3284	1.4508	1.5704	1.6880	1.8042	1.9193	2.0336	2.1471
(475.01)	h	458.71	1204.4		1225.3	1262.5	1295.7	1326.3	1355.3	1410.9	1465.1	1519.1	1573.4	1628.2	1683.6	1739.7	1796.4
	s	0.6587	1.4565		1.4786	1.5164	1.5485	1.5767	1.6023	1.6483	1.6897	1.7280	1.7640	1.7981	1.8305	1.8615	1.8911
	Sh				21.16	71.16	121.16	171.16	221.16	321.16	421.16	521.16	621.16	721.16	821.16	921.16	1071.16
560	v	0.01998	0.8264		0.8653	0.9479	1.0217	1.0902	1.1552	1.2787	1.3972	1.5129	1.6266	1.7388	1.8500	1.9603	2.0699
(478.84)	h	463.14	1204.2		1222.2	1260.3	1293.9	1324.9	1354.2	1410.0	1464.4	1518.6	1572.9	1627.8	1683.3	1739.4	1796.1
	s	0.6634	1.4529		1.4720	1.5106	1.5431	1.5717	1.5975	1.6438	1.6853	1.7237	1.7598	1.7939	1.8263	1.8573	1.8870
	Sh				17.43	67.43	117.43	167.43	217.43	317.43	417.43	517.43	617.43	717.43	817.43	917.43	1017.43
580	v	0.02006	0.7971		0.8287	0.9100	0.9824	1.0492	1.1125	1.2324	1.3473	1.4593	1.5693	1.6780	1.7855	1.8921	1.9980
(482.57)	h	467.47	1203.9		1219.1	1258.0	1292.1	1323.4	1353.0	1409.2	1463.7	1518.0	1572.4	1627.4	1682.9	1739.1	1795.9
	s	0.6679	1.4495		1.4654	1.5049	1.5380	1.5668	1.5929	1.6394	1.6811	1.7196	1.7556	1.7898	1.8223	1.8533	1.8831
	Sh				13.80	63.80	113.80	163.80	213.80	313.80	413.80	513.80	613.80	713.80	813.80	913.80	1013.80
600	v	0.02013	0.7697		0.7944	0.8746	0.9456	1.0109	1.0720	1.1892	1.3008	1.4093	1.5160	1.6211	1.7252	1.8284	1.9309
(486.20)	h	471.70	1203.7		1215.9	1255.6	1290.3	1322.0	1351.8	1408.3	1463.0	1517.4	1571.9	1627.0	1682.6	1738.8	1795.6
	s	0.6723	1.4461		1.4590	1.4993	1.5329	1.5621	1.5884	1.6351	1.6769	1.7155	1.7517	1.7859	1.8184	1.8494	1.8797
	Sh				5.11	55.11	105.11	155.11	205.11	305.11	405.11	505.11	605.11	705.11	805.11	905.11	1005.11
650	v	0.02032	0.7084		0.7173	0.7954	0.8634	0.9254	0.9835	1.0929	1.1969	1.2979	1.3969	1.4944	1.5909	1.6864	1.7813
(494.89)	h	481.89	1202.8		1207.6	1249.6	1285.7	1318.3	1348.7	1406.0	1461.2	1515.9	1570.7	1625.9	1681.6	1738.0	1794.9
	s	1.6828	1.4381		1.4430	1.4858	1.5207	1.5507	1.5775	1.6249	1.6671	1.7059	1.7422	1.7765	1.8092	1.8403	1.8701
	Sh					46.92	96.92	146.92	196.92	296.92	396.92	496.92	596.92	696.92	796.92	896.92	996.92
700	v	0.02050	0.6556			0.7271	0.7928	0.8520	0.9072	1.0102	1.1078	1.2023	1.2948	1.3858	1.4757	1.5647	1.6530
(503.08)	h	491.60	1201.8			1243.4	1281.0	1314.6	1345.6	1403.7	1459.4	1514.4	1569.4	1624.8	1680.7	1737.2	1794.3
	s	0.6928	1.4304			1.4726	1.5090	1.5399	1.5673	1.6154	1.6580	1.6970	1.7335	1.7679	1.8006	1.8318	1.8617
	Sh					39.16	89.16	139.16	189.16	289.16	389.16	489.16	589.16	689.16	789.16	889.16	989.16
750	v	0.02069	0.6095			0.6676	0.7313	0.7882	0.8409	0.9386	1.0306	1.1195	1.2063	1.2916	1.3759	1.4592	1.5419
(510.84)	h	500.89	1200.7			1236.9	1276.1	1310.7	1342.5	1401.5	1457.6	1512.9	1568.2	1623.8	1679.8	1736.4	1793.6
	s	0.7022	1.4232			1.4598	1.4977	1.5296	1.5577	1.6065	1.6494	1.6886	1.7252	1.7598	1.7926	1.8239	1.8538
	Sh					31.79	81.79	131.79	181.79	281.79	381.79	481.79	581.79	681.79	781.79	881.79	981.79
800	v	0.02087	0.5690			0.6151	0.6774	0.7323	0.7828	0.8759	0.9631	1.0470	1.1289	1.2093	1.2885	1.3669	1.4446
(518.21)	h	509.81	1199.4			1230.1	1271.1	1306.8	1339.3	1399.1	1455.8	1511.4	1566.9	1622.7	1678.9	1735.7	1792.9
	s	0.7111	1.4163			1.4472	1.4869	1.5198	1.5484	1.5980	1.6413	1.6807	1.7175	1.7522	1.7851	1.8164	1.8464
	Sh					24.76	74.76	124.76	174.76	274.76	374.76	474.76	574.76	674.76	774.76	874.76	974.76
850	v	0.02105	0.5330			0.5683	0.6296	0.6829	0.7315	0.8205	0.9034	0.9830	1.0606	1.1366	1.2115	1.2855	1.3588
(525.24)	h	518.40	1198.0			1223.0	1265.9	1302.8	1336.0	1396.8	1454.0	1510.0	1565.7	1621.6	1678.0	1734.9	1792.3
	s	0.7197	1.4096			1.4347	1.4763	1.5102	1.5396	1.5899	1.6336	1.6733	1.7102	1.7450	1.7780	1.8094	1.8395
	Sh					18.05	68.05	118.05	168.05	268.05	368.05	468.05	568.05	668.05	768.05	868.05	968.05
900	v	0.02123	0.5009			0.5263	0.5869	0.6388	0.6858	0.7713	0.8504	0.9262	0.9998	1.0720	1.1430	1.2131	1.2825
(531.95)	h	526.70	1196.4			1215.5	1260.6	1298.6	1332.7	1394.4	1452.2	1508.5	1564.4	1620.6	1677.1	1734.1	1791.6
	s	0.7279	1.4032			1.4223	1.4659	1.5010	1.5311	1.5822	1.6263	1.6662	1.7033	1.7382	1.7713	1.8028	1.8329

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb

Table 3. Superheated Steam — *Continued*

Abs Press. Lb/Sq In. (Sat. Temp)		Sat Water	Sat Steam	Temperature – Degrees Fahrenheit 550	600	650	700	750	800	850	900	1000	1100	1200	1300	1400	1500
	Sh			11.61	61.61	111.61	161.61	211.61	261.61	311.61	361.61	461.61	561.61	661.61	761.61	861.61	961.61
900	v	0.02141	0.4721	0.4883	0.5485	0.5993	0.6449	0.6871	0.7272	0.7656	0.8030	0.8753	0.9455	1.0142	1.0817	1.1484	1.2143
(538.39)	h	534.74	1194.7	1207.6	1255.1	1294.4	1329.3	1361.5	1392.0	1421.5	1450.3	1507.0	1563.2	1619.5	1676.2	1733.3	1791.0
	s	0.7358	1.3970	1.4098	1.4557	1.4921	1.5228	1.5500	1.5748	1.5977	1.6193	1.6595	1.6967	1.7317	1.7649	1.7965	1.8267
	Sh			5.42	55.42	105.42	155.42	205.42	255.42	305.42	355.42	455.42	555.42	655.42	755.42	855.42	955.42
1000	v	0.02159	0.4460	0.4535	0.5137	0.5636	0.6080	0.6489	0.6875	0.7245	0.7603	0.8295	0.8966	0.9622	1.0266	1.0901	1.1529
(544.58)	h	542.55	1192.9	1199.3	1249.3	1290.1	1325.9	1358.7	1389.6	1419.4	1448.5	1505.4	1561.9	1618.4	1675.3	1732.5	1790.3
	s	0.7434	1.3910	1.3973	1.4457	1.4833	1.5149	1.5426	1.5677	1.5908	1.6126	1.6530	1.6905	1.7256	1.7589	1.7905	1.8207
	Sh				49.47	99.47	149.47	199.47	249.47	299.47	349.47	449.47	549.47	649.47	749.47	849.47	949.47
1050	v	0.02177	0.4222		0.4821	0.5312	0.5745	0.6142	0.6515	0.6872	0.7216	0.7881	0.8524	0.9151	0.9767	1.0373	1.0973
(550.53)	h	550.15	1191.0		1243.4	1285.7	1322.4	1355.8	1387.2	1417.3	1446.6	1503.9	1560.7	1617.4	1674.4	1731.8	1789.6
	s	0.7507	1.3851		1.4358	1.4748	1.5072	1.5354	1.5608	1.5842	1.6062	1.6469	1.6845	1.7197	1.7531	1.7848	1.8151
	Sh				43.72	93.72	143.72	193.72	243.72	293.72	343.72	443.72	543.72	643.72	743.72	843.72	943.72
1100	v	0.02195	0.4006		0.4531	0.5017	0.5440	0.5826	0.6188	0.6533	0.6865	0.7505	0.8121	0.8723	0.9313	0.9894	1.0468
(556.28)	h	557.55	1189.1		1237.3	1281.2	1318.8	1352.9	1384.7	1415.2	1444.7	1502.4	1559.4	1616.3	1673.5	1731.0	1789.0
	s	0.7578	1.3794		1.4259	1.4664	1.4996	1.5284	1.5542	1.5779	1.6000	1.6410	1.6787	1.7141	1.7475	1.7793	1.8097
	Sh				39.18	89.18	139.18	189.18	239.18	289.18	339.18	439.18	539.18	639.18	739.18	839.18	939.18
1150	v	0.02214	0.3807		0.4263	0.4746	0.5162	0.5538	0.5889	0.6223	0.6544	0.7161	0.7754	0.8332	0.8899	0.9456	1.0007
(561.82)	h	564.78	1187.0		1230.9	1276.6	1315.2	1349.9	1382.2	1413.0	1442.8	1500.9	1558.1	1615.2	1672.6	1730.2	1788.3
	s	0.7647	1.3738		1.4160	1.4582	1.4923	1.5216	1.5478	1.5717	1.5941	1.6353	1.6732	1.7087	1.7422	1.7741	1.8045
	Sh				32.81	82.81	132.81	182.81	232.81	282.81	332.81	432.81	532.81	632.81	732.81	832.81	932.81
1200	v	0.02232	0.3624		0.4016	0.4497	0.4905	0.5273	0.5615	0.5939	0.6250	0.6845	0.7418	0.7974	0.8519	0.9055	0.9584
(567.19)	h	571.85	1184.8		1224.2	1271.8	1311.5	1346.9	1379.7	1410.8	1440.9	1499.4	1556.9	1614.2	1671.6	1729.4	1787.6
	s	0.7714	1.3683		1.4061	1.4501	1.4851	1.5150	1.5415	1.5658	1.5883	1.6298	1.6679	1.7035	1.7371	1.7691	1.7996
	Sh				22.58	72.58	122.58	172.58	222.58	272.58	322.58	422.58	522.58	622.58	722.58	822.58	922.58
1300	v	0.02269	0.3299		0.3570	0.4052	0.4451	0.4804	0.5129	0.5436	0.5729	0.6287	0.6822	0.7341	0.7847	0.8345	0.8836
(577.42)	h	585.58	1180.2		1209.9	1261.9	1303.9	1340.8	1374.6	1406.4	1437.1	1496.3	1554.3	1612.0	1669.8	1727.9	1786.3
	s	0.7843	1.3577		1.3860	1.4340	1.4711	1.5022	1.5296	1.5544	1.5773	1.6194	1.6578	1.6937	1.7275	1.7596	1.7902
	Sh				12.93	62.93	112.93	162.93	212.93	262.93	312.93	412.93	512.93	612.93	712.93	812.93	912.93
1400	v	0.02307	0.3018		0.3176	0.3667	0.4059	0.4400	0.4712	0.5004	0.5282	0.5809	0.6311	0.6798	0.7272	0.7737	0.8195
(587.07)	h	598.83	1175.3		1194.1	1251.4	1296.1	1334.5	1369.3	1402.0	1433.2	1493.2	1551.8	1609.9	1668.0	1726.3	1785.0
	s	0.7966	1.3474		1.3652	1.4181	1.4575	1.4900	1.5182	1.5436	1.5670	1.6096	1.6484	1.6845	1.7185	1.7508	1.7815
	Sh				3.80	53.80	103.80	153.80	203.80	253.80	303.80	403.80	503.80	603.80	703.80	803.80	903.80
1500	v	0.02346	0.2772		0.2820	0.3328	0.3717	0.4049	0.4350	0.4629	0.4894	0.5394	0.5869	0.6327	0.6773	0.7210	0.7639
(596.20)	h	611.68	1170.1		1176.3	1240.2	1287.9	1328.0	1364.0	1397.4	1429.2	1490.1	1549.2	1607.7	1666.2	1724.8	1783.7
	s	0.8085	1.3373		1.3431	1.4022	1.4443	1.4782	1.5073	1.5333	1.5572	1.6004	1.6395	1.6759	1.7101	1.7425	1.7734
	Sh					45.13	95.13	145.13	195.13	245.13	295.13	395.13	495.13	595.13	695.13	795.13	895.13
1600	v	0.02387	0.2555			0.3026	0.3415	0.3741	0.4032	0.4301	0.4555	0.5031	0.5482	0.5915	0.6336	0.6748	0.7153
(604.87)	h	624.20	1164.5			1228.3	1279.4	1321.4	1358.5	1392.8	1425.2	1486.9	1546.6	1605.6	1664.3	1723.2	1782.3
	s	0.8199	1.3274			1.3861	1.4312	1.4667	1.4968	1.5235	1.5478	1.5916	1.6312	1.6678	1.7022	1.7347	1.7657
	Sh					36.87	86.87	136.87	186.87	236.87	286.87	386.87	486.87	586.87	686.87	786.87	886.87
1700	v	0.02428	0.2361			0.2754	0.3147	0.3468	0.3751	0.4011	0.4255	0.4711	0.5140	0.5552	0.5951	0.6341	0.6724
(613.13)	h	636.45	1158.6			1215.3	1270.5	1314.5	1352.9	1388.1	1421.2	1483.8	1544.0	1603.4	1662.5	1721.7	1781.0
	s	0.8309	1.3176			1.3697	1.4183	1.4555	1.4867	1.5140	1.5388	1.5833	1.6232	1.6601	1.6947	1.7274	1.7585
	Sh					28.98	78.98	128.98	178.98	228.98	278.98	378.98	478.98	578.98	678.98	778.98	878.98
1800	v	0.02472	0.2186			0.2505	0.2906	0.3223	0.3500	0.3752	0.3988	0.4426	0.4836	0.5229	0.5609	0.5980	0.6343
(621.02)	h	648.49	1152.3			1201.2	1261.1	1307.4	1347.2	1383.3	1417.1	1480.6	1541.4	1601.2	1660.7	1720.1	1779.7
	s	0.8417	1.3079			1.3526	1.4054	1.4446	1.4768	1.5049	1.5302	1.5753	1.6156	1.6528	1.6876	1.7204	1.7516
	Sh					21.44	71.44	121.44	171.44	221.44	271.44	371.44	471.44	571.44	671.44	771.44	871.44
1900	v	0.02517	0.2028			0.2274	0.2687	0.3004	0.3275	0.3521	0.3749	0.4171	0.4565	0.4940	0.5303	0.5656	0.6002
(628.56)	h	660.36	1145.6			1185.7	1251.3	1300.2	1341.4	1378.4	1412.9	1477.4	1538.8	1599.1	1658.8	1718.6	1778.4
	s	0.8522	1.2981			1.3346	1.3925	1.4338	1.4672	1.4960	1.5219	1.5677	1.6084	1.6458	1.6808	1.7138	1.7451
	Sh					14.20	64.20	114.20	164.20	214.20	264.20	364.20	464.20	564.20	664.20	764.20	864.20
2000	v	0.02565	0.1883			0.2056	0.2488	0.2805	0.3072	0.3312	0.3534	0.3942	0.4320	0.4680	0.5027	0.5365	0.5695
(635.80)	h	672.11	1138.3			1168.3	1240.9	1292.6	1335.4	1373.5	1408.7	1474.1	1536.2	1596.9	1657.0	1717.0	1777.1
	s	0.8625	1.2881			1.3154	1.3794	1.4231	1.4578	1.4874	1.5138	1.5603	1.6014	1.6391	1.6743	1.7075	1.7389
	Sh					7.24	57.24	107.24	157.24	207.24	257.24	357.24	457.24	557.24	657.24	757.24	857.24
2100	v	0.02615	0.1750			0.1847	0.2304	0.2624	0.2888	0.3123	0.3339	0.3734	0.4099	0.4445	0.4778	0.5101	0.5418
(642.76)	h	683.79	1130.5			1148.5	1229.8	1284.9	1329.3	1368.4	1404.4	1470.9	1533.6	1594.7	1655.2	1715.4	1775.7
	s	0.8727	1.2780			1.2942	1.3661	1.4125	1.4486	1.4790	1.5060	1.5532	1.5948	1.6327	1.6681	1.7014	1.7330
	Sh					55	50.55	100.55	150.55	200.55	250.55	350.55	450.55	550.55	650.55	750.55	850.55
2200	v	0.02669	0.1627			0.1636	0.2134	0.2458	0.2720	0.2950	0.3161	0.3545	0.3897	0.4231	0.4551	0.4862	0.5165
(649.45)	h	695.46	1122.2			1123.9	1218.0	1276.8	1323.1	1363.3	1400.0	1467.6	1530.9	1592.5	1653.3	1713.9	1774.4
	s	0.8828	1.2676			1.2691	1.3523	1.4020	1.4395	1.4708	1.4984	1.5463	1.5883	1.6266	1.6622	1.6956	1.7273
	Sh						44.11	94.11	144.11	194.11	244.11	344.11	444.11	544.11	644.11	744.11	844.11
2300	v	0.02727	0.1513				0.1975	0.2305	0.2566	0.2793	0.2999	0.3372	0.3714	0.4035	0.4344	0.4643	0.4935
(655.89)	h	707.18	1113.2				1205.3	1268.4	1316.7	1358.1	1395.7	1464.2	1528.3	1590.3	1651.5	1712.3	1773.1
	s	0.8929	1.2569				1.3381	1.3914	1.4305	1.4628	1.4910	1.5397	1.5821	1.6207	1.6565	1.6901	1.7219

Sh = superheat, F
v = specific volume, cu ft per lb
h = enthalpy, Btu per lb
s = entropy, Btu per F per lb