U. S. NUCLEAR REGULATORY COMMISSION REGION I
OPERATOR LICENSING EXAMINATION REPORT

EXAMINATION REPORT NO. 50-443/85-04(OL)

FACILITY DOCKET NO. 50-443

FACILITY CONSTRUCTION PERMIT NO. CPPR-135

LICENSEE: Public Service of New Hampshire
P. O. Box 330
Manchester, New Hampshire 03105

FACILITY: Seabrook 1

EXAMINATION DATES: March 18-22, 1985

CHIEF EXAMINER: David G. Russell — Reactor Engineer (Examiner) — 5/8/85 Date

REVIEWED BY: [signature] — Chief, Projects Section 1C — 5/13/85 Date

APPROVED BY: [signature] — Chief, Projects Branch No. 1 — 5/14/85 Date

SUMMARY: Seventeen Senior Reactor Operators (SRO) and three Reactor Operators (RO) candidates were examined. One SRO candidate failed the simulator portion of the exam. All other candidates passed all portions of the exam. Five SRO candidates were identified as performing significantly above average.

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REPORT DETAILS

TYPE OF EXAMS: Initial

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail
Written Exam	2/0	17/0
Oral Exam	3/0	16/0
Simulator Exam	3/0	15/1
Overall	3/0	16/1

1. CHIEF EXAMINER AT SITE: D. Ruscitto (NRC)

2. OTHER EXAMINERS: R. Sailor (EG&G)
B. Picker (EG&G)
P. Isaksen (EG&G)
R. Cochran (NRC Consultant-Observer)

1. SUMMARY OF GENERIC DEFICIENCIES FROM ORAL AND SIMULATOR EXAMS:

Minor deficiencies with no safety significance were noted in the following areas:

Communications
Classification of events using the Emergency Plan
SS/USS liason during emergencies
Verification of ERG parameters

2. SUMMARY OF GENERIC DEFICIENCIES NOTED FROM WRITTEN EXAMS:

RO Exam (2 Candidates)

The following were areas of minor weakness:

Centrifugal Pump Operations
Steam Dump Operation
Dropped Rod Immediate Actions
RCS Depressurization from RSSP

SRO Exam (17 Candidates)

The following were areas of minor weakness:

Worst Case Conditions for MSLB and Design Features which Limit Effects
Indications and Automatic Action of EFW System
T.S. Requirements/Bases for RHR System During Refueling
Log Reviews by USS
Dose Equivalent Iodine

3. IMPROVEMENTS IN TRAINING PROGRAMS AS A RESULT OF PRIOR OPERATOR LICENSING EXAMINATIONS:

In response to comments from the December 1984 exam, additional emergency phones have been tied into the instructor's console providing more realistic simulation.

4. INTERFACE WITH PLANT STAFF DURING EXAM PERIOD:

The simulator instructors continue to perform their liaison duties in an outstanding manner, greatly enhancing the examination process. This allows last minute scenario modifications to examine new areas with little pause in the flow of the scenario.

The simulator malfunction list has a significant number of malfunctions with either no description or only a cursory description. These should be updated prior to the next exam in September.

5. PERSONNEL PRESENT AT EXIT INTERVIEW:

NRC Personnel

D. Ruscitto, Reactor Engineer (Examiner)
R. Barkley, Reactor Engineer
A. Cerne, Senior Resident Inspector
R. Cochran, Consultant

NRC Contractor Personnel

R. Sailor, EG&G, Idaho
P. Isaksen, EG&G, Idaho
B. Picker, EG&G, Idaho

Facility Personnel

P. Richardson, Training Manager
R. Hanley, Training Supervisor
L. Carlsen, Simulator Supervisor
J. Grillo, Assistant Operations Manager

6. SUMMARY OF NRC COMMENTS MADE AT EXIT INTERVIEW:

Generic deficiencies during oral/simulator exams were discussed. Training improvements and interface with plant staff were summarized as well. Preliminary results of 15 candidates clearly passing and 4 candidates being marginal were presented. 5 candidates were identified as being clearly above average on their performance on the oral and simulator portions of the examination.

7. EXAMINATION REVIEW:

At the conclusion of the written examinations, the examiners met with the following licensee personnel to review the exam and answer keys to identify any inappropriate questions relative to plant specific design and to ensure that the questions will elicit the answers in the key and that they reflect the most current plant conditions.

D. Schreiner
J. Nichols
J. Reagan
S. Simonson
R. Hanley
R. Mayes

Attachments:

1. Written Examination(s) and Answer Key(s) (SRO/RO)
2. Facility Comments on Written Examinations made after Exam Review

ATTACHMENT 2

RO EXAM COMMENTS AND RESOLUTION:

Question 2.06B	The start failure relay is also reset in addition to the answers provided on the key. Reference Drawing was provided at the exam review.
Question 3.04B	The FWP discharge valves do not close on High S/G water level. Reference is Dwg. No. 9763-M-503582.
Question 3.09B	"Lo Lo S/G level" is appropriate also. Reference is FSAR, Table 15.0-6, Sheet 1.
Question 4.03A	"Rapid drop in nuclear power" is an additional answer IAW procedure for dropped rod. Answer changed to include above phrase.

SRO EXAM COMMENTS AND RESOLUTION:

Question 6.03B	"OTΔT or Low Pressure Rx Trip" are acceptable. Reference is FSAR, Table 15.0-6, Sheet 3.
Question 8.07	This question may be confusing in that Standing Order 83-004 requires the SS to review the USS, AO, and two S/U Logs. The turnover procedure (AQ10.003A) requires the SS to review the USS, Tagging, and Temporary Modifications Log. The reviews of AQ10.003A will be the accepted correct answers.
Question 8.08	Means of communicating may not match the answer given exactly. In order that the candidates be evaluated on this area of the E-Plan that is not yet developed and the appropriate equipment installed, discretion on the part of the examiner is required. Parts B and C will be deleted as these procedures may change, however, parts A and D are still valid as these procedures are not expected to change.

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: SEABROOK 1

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/03/18

EXAMINER: ISAKSEN, P.

APPLICANT: _____

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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
25.00	25.00	_____	_____	1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
25.00	25.00	_____	_____	2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
25.00	25.00	_____	_____	3.	INSTRUMENTS AND CONTROLS
25.00	25.00	_____	_____	4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
100.00	100.00	_____	_____		TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

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QUESTION 1.01 (3.00)

Assume: 1. Rod control in manual.
2. No operator action.
3. No protective function actuations.
4. End of core life (EOL) conditions.

Compare the FINAL values (HIGHER THAN, LOWER THAN or the SAME AS) with the INITIAL values of the parameters listed below for the following two transients. EXPLAIN what CAUSES these parameters to change from the inital values to the final values.

PARAMETERS

1. Tave
2. Tfuel
3. Reactor power

TRANSIENTS (consider each separately)

a. Steam dump valve fails open with the reactor critical below the point of adding heat. (1.45)

b. Control rod drops at 50% power with turbine controls in auto. (1.55)

QUESTION 1.02 (1.50)

What are FIVE factors considered in a MODE 3 or 4 Shutdown Margin Calculation? (1.5)

QUESTION 1.03 (2.00)

a. Explain WHY the Moderator Temperature Coefficient becomes more negative over core life. (Two reasons required) (1.0)

b. At BOL and as fuel temperature increases, WHY does the magnitude of the Doppler Temperature Coefficient decrease per degree change in fuel temperature? (1.0)

QUESTION 1.04 (2.50)

Compare the CALCULATED Estimated Critical Position (ECP) for a startup to be performed 4 hours after a trip from 100% power, to the ACTUAL critical control rod position if the following events/conditions occurred. Consider each independently. Limit your answer to ECP is HIGHER than, LOWER than, or the SAME as the ACTUAL critical control rod position.

a. The FOURTH coolant pump is started two minutes prior to criticality. (0.5)

b. The startup is delayed until 8 hours after the trip. (0.5)

c. The steam dump pressure setpoint is increased to a value just below the Steam Generator PORV setpoint. (0.5)

d. Condenser vacuum is reduced by 4 inches of Mercury. (0.5)

e. All Steam Generator levels are rapidly being raised by 5% as criticality is reached. (0.5)

QUESTION 1.05 (1.50)

a. Provide TWO reasons for Xenon contributing more negative reactivity than Samarium at full power. (1.0)

b. What would happen to the magnitude of the equilibrium Samarium Concentration, if reactor power was changed from 50% to 100%? (0.5)

QUESTION 1.06 (1.75)

a. Does Beta Effective Increase, Decrease, or Remain the Same, from BOL to EOL? EXPLAIN YOUR CHOICE. (1.25)

b. For two equivalent positive reactivity additions to a critical reactor, will the SUR be the Same, Larger, or Smaller at EOL as compared to BOL? NO EXPLANATION IS NECESSARY. (0.5)

QUESTION 1.07 (2.00)

Explain HOW and WHY the Doppler Power Coefficient is affected by the following:

a. Buildup of fission gasses in the fuel to clad gap. (1.0)

b. Clad creep. (1.0)

QUESTION 1.08 (2.00)

How is the margin to DNB affected by a DECREASE in each of the following. Consider each independently.

a. Reactor power.

b. RCS flow.

c. Tcold.

d. Pressurizer pressure (2.0)

QUESTION 1.09 (3.00)

a. How are each of the following parameters affected, if at all, (INCREASE, DECREASE or NO CHANGE) if one main steam isolation valve (MSIV) closes with the plant at 50% load. Assume all controls are in automatic and that NO trip occurs. Compare to final steady state value, UNLESS "initial change only" is indicated.

1. Affected loop steam generator level (INITIAL change only).
2. Affected loop steam generator pressure.
3. Affected loop cold leg temperature.
4. Unaffected loop steam generator level (INITIAL change only).
5. Unaffected loop steam generator pressure.
6. Unaffected loop cold leg temperature. (2.4)

b. If a reactor trip occurred as a result of the MSIV closing, which of the reactor protection system signals could be expected to cause the reactor to trip? (If more than one, list the one that would reach the trip point first.) (0.6)

QUESTION 1.10 (2.75)

a. If steam goes through a throttling process, specifically as in a leak from the main steam high pressure header to atmosphere, HOW will the following parameters change? (2.0)

1. Enthalpy (h)
2. Pressure
3. Entropy (s)
4. Specific volume (v)
5. Temperature

b. State whether the steam will be subcooled, saturated or superheated as it leaks out. (0.75)

QUESTION 1.11 (3.00)

a. A variable speed centrifugal pump is operating at 1/4 rated speed in a CLOSED system with the following parameters:

Power = 300 KW
Pump delta P = 50 psid
Flow = 880 gpm

What are the new values for these parameters when the pump speed is increased to full rated speed? (1.5)

b. Choose the answer that most correctly completes the sentence.

"In a CLOSED system, two single stage centrifugal pumps operating in parallel will have—(choose-from-below)—, as compared to the same system with one single stage centrifugal pump operating with one pump isolated."

1. a higher head and higher flow rate.

2. the same head and the same flow rate.

3. the same head and a higher flow rate.

4. a higher head and the same flow rate. (0.5)

c. How is the available NPSH affected by an increase in system flowrate? (0.5)

d. Why is cavitation undesirable? (0.5)

QUESTION 2.01 (3.50)

a. Other than EFW flow indication/recording state the function(s)/ purpose(s) for each of the following. Please be specific.

1. EFW supply header venturi. (1.5)

2. EFW supply header flow orifice. (1.0)

b. What is the purpose/design feature of the temporary hose connection on the suction of the turbine driven EFW pump? (1.0)

QUESTION 2.02 (1.50)

What function is performed by the Air Relay Dump Valve (ARDV) on a turbine trip AND why is this action necessary? (1.5)

QUESTION 2.03 (2.50)

a. The containment structure air is sampled by hydrogen analyzers. Following a LOCA ("P" signal), what automatic action ensures that a representative sample of containment air is sampled? (1.0)

b. The containment air hydrogen concentration must be kept below ____ percent by volume to prevent the possibility of an explosion in containment. (Provide value) (0.5)

c. What system serves as a backup for the hydrogen recombiners? (1.0)

QUESTION 2.04 (4.00)

a. State the setpoints and coincidence which will automatically initiate Containment Building Spray (CBS). (1.0)

b. What is the purpose of injecting sodium hydroxide (NaOH) into the spray water? (1.0)

c. Describe how NaOH enters the CBS System. (1.0)

d. What conditions must be met for containment recirculation sump isolation valves (V-8, V-14) to automatically open? (0.5)

e. True or False

The CBS pumps will continue to operate during the switchover to the recirculation phase of operation. (0.5)

QUESTION 2.05 (3.00)

a. Assume the plant is shutdown at 500 F and 2200 psig. Will the Low Temperature Overpressure Protection System act to reduce plant pressure immediately if a loop Tcold instrument fails LOW? BRIEFLY EXPLAIN your answer, INCLUDING which train is affected, what action takes place, and any applicable setpoints. (2.0)

b. What is the purpose of the PORV interlock? (1.0)

QUESTION 2.06 (2.50)

a. List the THREE trip conditions which remain active when the EDG automatically starts as a result of a bus undervoltage condition coincident with safety injection. (1.5)

b. What TWO relays are reset by the EDG Control Reset Switch on the MCB. (1.0)

QUESTION 2.07 (2.50)

The following questions concern the Primary Component Cooling (PCCW) Systems at the Seabrook Station.

a. What TWO PCCW alarms could indicate a RCS to PCCW leak? (1.0)

b. Describe how the RCP Thermal Barrier Loop (heat exchangers and other associated piping) is protected from overpressure if either a leak OR rupture occurs into the PCCW Thermal Barrier Loop. (Include any applicable setpoints.) (1.5)

QUESTION 2.08 (3.50)

Answer the following questions utilizing the attached drawing, Figure 2-1.

a. Indicate the "failed" position for the valves labeled A through G. (2.1)

b. If left in automatic control, what position should the Letdown Pressure Control Valve (PCV-131) be found in two minutes after a safety injection initiation? (0.4)

c. What are the TWO purposes of PCV-131? (1.0)

QUESTION 2.09 (2.00)

a. What THREE signals other than manual will cause Main Steamline Isolation? (Include Setpoints) (1.0)

b. What are TWO purposes of the Main Steam Flow Restrictor? (1.0)

QUESTION 3.01 (3.00)

For each case below EXPLAIN the resulting method of reactor coolant system temperature control AND indicate the approximate final RCS Tavg. Assume all systems normal except as stated, no operator action, AND consider each case separately.

a. The normal steam pressure setpoint is reduced by 92 psi while in Hot Standby awaiting reactor startup. (1.0)

b. The train A steam dump selector switch is placed in 'off' while at 5% reactor power awaiting turbine startup. (1.0)

c. Train B reactor trip breaker fails to open upon a trip from 78% power. NOTE: Train A breaker opens. (1.0)

QUESTION 3.02 (1.50)

The plant is operating at 50% power with all systems in automatic. How does a HIGH failure of Power Range channel N-44 LOWER detector affect the following indications?

a. Lower Quadrant Power Tilt Ratio (QPTR)

b. Delta Flux (Axial Flux) Indication (Channel 4)

c. S/G Feed Flow (Initial FRV response) (1.5)

QUESTION 3.03 (2.50)

a. What associated operator action would be required during plant shutdown if an Intermediate Range Nuclear Instrumentation (IRNI) channel was grossly undercompensated? (1.0)

b. List THREE Control/Protection functions provided by the IRNI? (Include setpoints and logics.) (1.5)

QUESTION 3.04 (3.50)

a. Provide TWO additional (different/separate) AUTOMATIC signals other than High-High S/G water level (P-14), which will cause the reactor protection and logic system to generate a feedwater isolation valve closure signal. (Setpoints not required). (1.0)

b. Provide ALL direct and immediate indirect additional automatic actions associated with P-14, other than feedwater isolation valve closure. (1.8)

c. What protection is provided (reason/basis) by the P-14 signal? (0.7)

QUESTION 3.05 (3.00)

a. What input signal is used to provide the programmed pressurizer level for pressurizer level control? (0.5)

b. The CONTROLLING pressurizer level channel fails HIGH during 100% power operation. Assuming NO operator action is taken, which reactor protection signal will cause the reactor to trip? Include an explanation of the events, (causes and effects) which result in reactor trip. (2.5)

QUESTION 3.06 (3.00)

The reactor is at 80% power with rod control in automatic. Assume a rapid 10% load rejection occurs:

a. Briefly EXPLAIN how a rod insertion signal is generated by the rod control system:

1. power mismatch circuit? (1.0)

2. temperature mismatch circuit? (1.0)

b. What determines the rod insertion rate? (0.5)

c. When will inward rod motion automatically cease? (0.5)

QUESTION 3.07 (3.50)

a. List the FOUR plant parameter input signals to the Overtemperature Delta-T (OTdT) protection circuit. (2.0)

b. What core protection is provided by the OTdT protective circuit? (0.5)

c. State TWO additional functions (control/protection) other than reactor trip that the OTdT protection channel provides. (1.0)

QUESTION 3.08 (2.50)

a. Describe the opening interlocks associated with the following valves. Include setpoints where applicable.

1. Hot Leg Suction to RHR. (1.0)

2. Recirculation Sump Suction to RHR. (0.5)

b. State the TWO conditions that must be satisfied for Automatic Recirculation Sump valve opening. (1.0)

QUESTION 3.09 (2.50)

Your Reactor Protection System is designed so that a turbine trip will cause a Reactor Trip above P-9 (10% power).

a. Why is the system designed to do this? (1.0)

b. Provide a Reactor Protection signal that would act to give protection in the event that the Turbine Trip/Reactor Trip did not operate on a turbine trip from full power. (0.5)

c. State the TWO ways that the Reactor Protection System senses that a turbine trip has occured? (1.0)

QUESTION 4.01 (3.00)

The following questions concern the precautions and limitations of procedure OS 1001.05, RCP Operations.

a. Briefly explain why, when starting the first RCP while on RHR, both RHR suctions to the RCS must be open. (0.6)

b. Why, when RCS pressure is <100 psig, must the RCP #1 seal leakoff valves be closed? (0.6)

c. If, while operating at 50% power, PCCW is lost to the RCP motors, what TWO options are you given as reactor operator? (1.2)

d. Why must RCP motor starting limitations be adhered to? (0.6)

QUESTION 4.02 (3.50)

a. Assume the plant is operating at full power and the Axial Flux Difference (AFD) has been outside the target band for the last 5 minutes. What are the TWO actions specified which you may choose between to meet the Technical Specification requirements? Include time limitations. (1.5)

b. Assume that it is 0310 on 03/18/85 and the plant is presently at 45% power. Considering the AFD penalty history below, at what date and time may power be increased above 50%? EXPLAIN. (Show all work.) Assume no deviation outside the band after 0310 on 03/18/85.

DATE	TIME WENT OUT OF BAND	TIME BACK IN BAND	POWER
03/17/85	0310	0318	85%
03/17/85	1557	1637	65%
03/18/85	0148	0310	45%

(2.0)

QUESTION 4.03 (3.50)

Answer the following according to OS1210.5, Dropped Rod procedure.

a. List FIVE symptoms of a dropped RCCA. (2.0)

b. What specific operator action(s) is/are required if a reactor startup is in progress when a RCCA drops? (1.0)

c. The plant is at power when the RCCA drops, how is the operator directed to maintain programmed Tavg? (0.5)

QUESTION 4.04 (3.50)

Answer the following according to E-3 Steam Generator Tube Rupture (SGTR) procedure OS1330.

a. The faulted S/G has been identified as "B" S/G. The "B" S/G ASDV controller setpoint is adjusted to 1125 psig; MSIV and bypass valves; blowdown isolation valves; main and emergency feed valves; and Main Steam drain valves are all closed. Is the "B" S/G isolated? EXPLAIN. (0.5)

b. What operator actions are required to be performed if the faulted S/G MSIV failed to shut? (1.0)

c. State the RCP trip criteria during a SGTR. (1.0)

d. State the ECCS reinitiation criteria during a SGTR. (1.0)

QUESTION 4.05 (2.50)

Answer the following according to FR-5.1, Response to Nuclear Power Generation/ATWS procedure.

a. What THREE conditions must you observe to "verify" a Reactor Trip? (1.5)

b. The reactor has not tripped and attempts to manually trip the reactor at the MCB have failed. Assuming the turbine has tripped and EFW pumps are running, what are your required immediate actions? (1.0)

QUESTION 4.06 (2.50)

Answer the following according to OS1200.02, Safe Shutdown and Cooldown from the Remote Safe Shutdown Facilities.

a. For a Unit 1 Control Room evacuation, what are the assignment responsibilities for the SCRO and CRO? (Assume both RSS trains available) (1.0)

b. How do you perform RCS depressurization during cooldown from the RSS panel? (0.5)

c. What would be your indication of reactor vessel head steam voiding during RCS depressurization? (0.5)

d. True or False?

Placing a selector switch at the RSS panel in LOCAL defeats most automatic controls and interlocks and divorces control and indicating lights at the main control board. (0.5)

QUESTION 4.07 (1.50)

Answer the following in accordance with Standing Operating Order No. 84-001, Use of UNTESTED procedures.

a. What is your responsibility/action when it becomes evident that strict compliance with an UNTESTED procedure could result in equipment damage? (1.0)

b. Who, by job position/title, has the authority to issue a change to the UNTESTED procedure for the condition noted in a, above? (0.5)

QUESTION 4.08 (2.00)

a. From the following, choose the provision(s) if any, required by procedure RP-5.0,"Requesting and use of RWP's and SRWP's" for an entry into a high radiation area WITHOUT a RWP. The entry is for an immediate/critical action of short duration and has been authorized by the Shift Superintendent.

1. Personnel entering are given verbal instructions and precautions.

2. Continuous health physics coverage.

3. Personnel entering must wear protective clothing over their personal clothing.

4. The job is documented on a RWP after completion. (1.0)

b. You are required to periodically check your self reading pocket dosimeter (SRPD) while in a RCA. What SRPD "reading" would require you to leave the area immediately and notify HP personnel, according to RCA Access Requirements, procedure SSRP-8.0? (1.0)

QUESTION 4.09 (3.00)

Document 10 CFR 20 provides regulations for radiation exposure at the Seabrook Facility. Answer the following questions in accordance with 10 CFR 20.

a. What is your QUARTERLY Whole Body exposure limit? (0.75)

b. What THREE criteria must be satisfied in order to exceed this limit under NON-EMERGENCY conditions? (2.25)

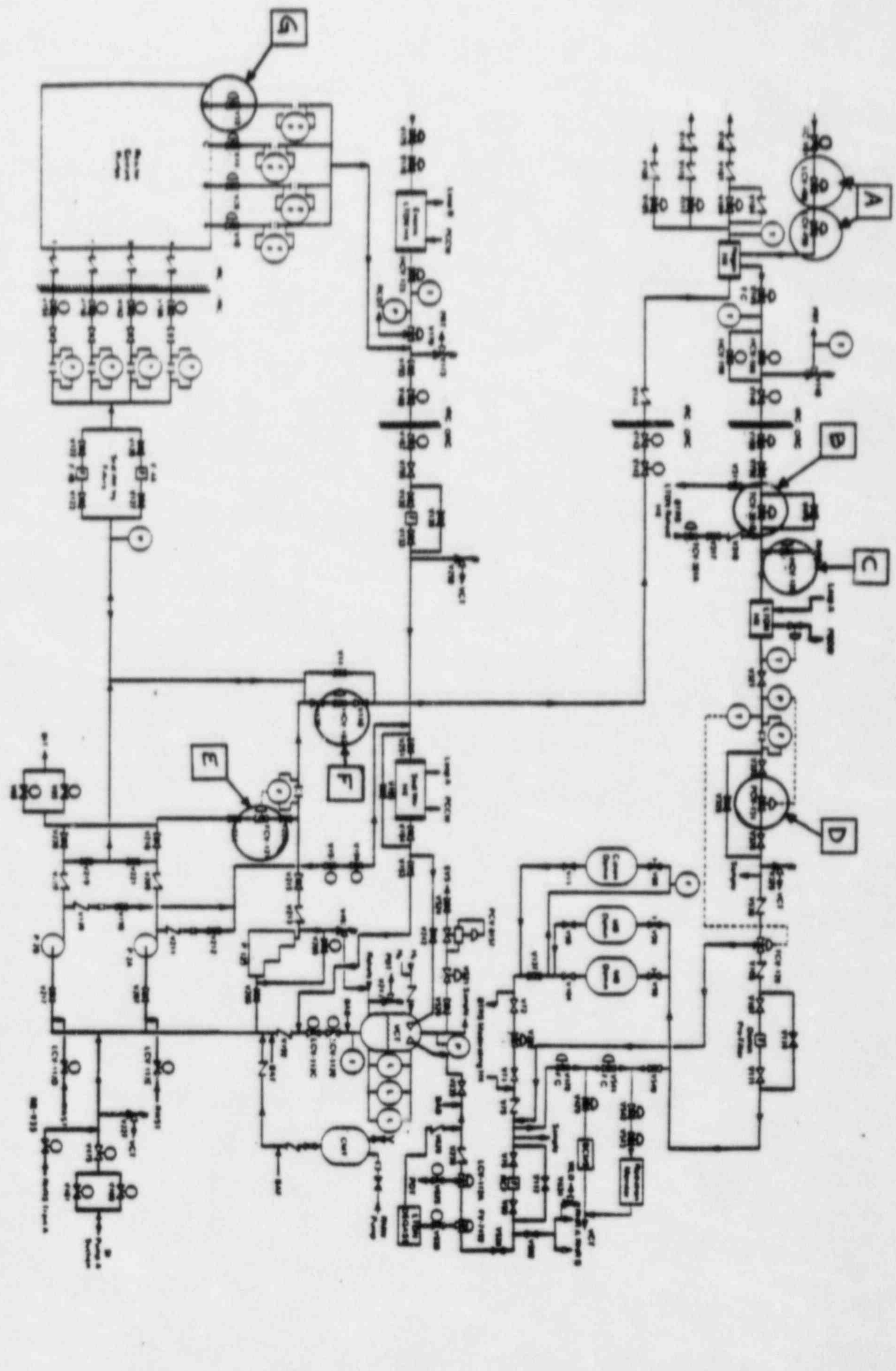

FIGURE 2-1

EQUATION SHEET

$f = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

$\dot{Q} = \dot{m} C_p \Delta t$

$\dot{Q} = UA\Delta T$

$Pwr = W_f \Delta h$

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

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

$SUR = 26.06/T$

$SUR = 26\rho/\ell^* + (\beta - \rho)T$

$T = (\ell^*/\rho) + [(\beta - \rho)/\bar{\lambda}\rho]$

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [(\ell^*/(T\ K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$P = (\Sigma_a V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$v = s/t$

$s = V_o t + 1/2\ at^2$

$a = (V_f - V_o)/t$

$w = \theta/t$

$A = \frac{\pi D^2}{4}$

$\dot{m} = V_{av} A \rho$

Cycle efficiency = (Net work out)/(Energy in)

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

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

$t_{1/2}^{eff} = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$I = I_o e^{-\Sigma x}$

$I = I_o e^{-ux}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/u$

$HVL = -0.693/u$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^{\ 2} = I_2 d_2^{\ 2}$

$R/hr = (0.5\ CE)/d^2$ (meters)

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

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ANSWER 1.01 (3.00)

a. Steam flow increases, Tave decreases [0.1]
Pos. reactivity (via MTC) [0.1]
Reactor power increases [0.15]
Tfuel increases [0.1]
Neg. reactivity (via FTC) [0.1]
Reactor power increase stops [0.15]

FINAL COMPARISON

1. Tave: lower than initial [0.25]
2. Tfuel: higher than initial [0.25]
3. Reactor power: higher than initial [0.25] (1.45)

b. Rod drops, Neg. reactivity [0.1]
Reactor power decreases [0.15]
Tfuel decreases [0.1]
Pos. reactivity (via FTC) [0.1]
Tave decreases [0.1]
Pos. reactivity (via MTC) [0.1]
Reactor power increases [0.15]

FINAL COMPARISON

1. Tave: lower than initial [0.25]
2. Tfuel: lower in fuel near dropped rod and higher in fuel remote from dropped rod (overall Tfuel is lower) [0.25]
3. Reactor power: the same as initial [0.25] (1.55)

REFERENCE
Seabrook Causes and Effects Manual 4-7, 35, 36.
Comprehensive Nuclear Training Operations--Reactor Theory and Thermal Science, Ch 12 pp 31 - 5.

ANSWER 1.02 (1.50)

Reactivities associated with --
1. Control rod position
2. Samarium concentration
3. Xenon concentration
4. RCS Boron concentration
5. Plant temperature (Tave)
6. Fuel burnup (core age)

[five required, 0.3 each] (1.5)

REFERENCE
RN-1731

MASTER COPY

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 1.03 (2.00)

a. Reduction in boron concentration decreases the positive effects of boron removal during temperature increases [0.5]. The buildup of Pu-240 increases resonance absorbtion [0.5]. (1.0)

b. FTC becomes less negative as fuel temperature increases because resonant band widening is reduced at higher temperatures. (1.0)

REFERENCE
HO-RTR-76 to-78,-85

ANSWER 1.04 (2.50)

a. SAME

b. ECP LOWER than ACP

c. ECP LOWER than ACP

d. SAME

e. ECP HIGHER than ACP [0.5 each] (2.5)

REFERENCE
RN-1735

ANSWER 1.05 (1.50)

a. 1. Higher fission yield.
2. Larger (thermal) absorbtion cross section (1.0)

b. Remains the same (0.5)

REFERENCE
HO-RTR-111,-114

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 1.06 (1.75)

a. Decreases [0.5] Pu 239 concentration increases (while U 235 concentration decreases) [0.75]. (1.25)

b. Larger SUR. (0.5)

REFERENCE
HO-RTR-23 to-27

ANSWER 1.07 (2.00)

a. Fission gasses pollute the Helium gas causing a reduction in gap thermal conductivity [0.5]. This results in increased fuel temperature change for a given power change, causing an increase in the magnitude of the coefficient [0.5]. (1.0)

b. Clad creep effectively shrinks the clad into closer contact with the fuel, increasing the gap thermal conductivity [0.5]. This results in a fuel temperature decrease and a lower value for the coefficient [0.5]. (1.0)

REFERENCE
HO-RTR-87,-88

ANSWER 1.08 (2.00)

a. INCREASE
b. DECREASE
c. INCREASE
d. DECREASE

REFERENCE
THF-3

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 1.09 (3.00)

a. 1. DECREASE
2. INCREASE
3. INCREASE
4. INCREASE
5. DECREASE
6. DECREASE [0.4 each] (2.4)

b. Lo-Lo S/G level (0.6)

REFERENCE
Seabrook Simulator Malfunction no. 40

ANSWER 1.10 (2.75)

a. 1. SAME
2. DECREASE
3. INCREASE
4. INCREASE
5. DECREASE [0.4 each] (2.0)

b. Superheated (0.75)

REFERENCE
THF-1

ANSWER 1.11 (3.00)

a. $Power(2) = Power(1) * (N2/N1)^3 = 300 * (4)^3 = 19.2$ MW (0.5)

$Delta\ P(2) = delta\ P(1) * (N2/N1)^2 = 50 * (4)^2 = 800$ psid (0.5)

$Flow(2) = Flow(1) * (N2/N1) = 880 * 4 = 3520$ gpm (0.5)

b. Answer: #1 (0.5)

c. DECREASES (0.5)

d. Pump efficiency and flowrate are reduced and mechanical pump damage (erosion, pitting and vibration). (0.5)

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

REFERENCE
THF-4

ANSWER 2.01 (3.50)

a. 1. Provides backup (passive) protection to the high flow isolation function, limiting flow in the faulted header[0.5] (750 gpm) protecting the EFW pumps from runout[0.5] and prevents robbing all the EFW flow from other S/G's[0.5] (1.5)

2. Provides input for the high flow isolation signal of the faulted header (closure of the FCV at 450 gpm) (1.0)

b. One of the required (safety related) sources for makeup water to the Spent Fuel Pool. (1.0)

REFERENCE
HO-EFW 18, 23

ANSWER 2.02 (1.50)

The ARDV closes, interrupting the instrument air to the extraction steam line non-return valves allowing them to close [0.75], which prevents a reversal of steam flow that could cause a turbine overspeed condition [0.75]. (1.5)

REFERENCE
HO-TGM-116, 117, 123

ANSWER 2.03 (2.50)

a. The containment recirculating filter system fans start. (1.0)

b. 4 (0.5)

c. Containment Structure Purge System. (1.0)

REFERENCE
HO-CGCS p. 17, 20-22, 37; OS1023.40

ANSWER 2.04 (4.00)

a. 18 psig (HI-3) 2/4. (1.0)

b. To aid in iodine removal and retention. (1.0)

c. From the SAT which gravity drains to the RWST mixing chamber (through two parallel lines) to the suction of the CBS pumps. (1.0)

d. RWST LOW-LOW level in conjunction with SIS. (0.5)

e. True (0.5)

REFERENCE
HO-CBS-18, 20, 23, 54

ANSWER 2.05 (3.00)

a. - NO PRESSURE REDUCTION; The Train A PORV only opens on auctioneered Thot that it provides. [0.5]
- Auctioneered Tcold inputs to Train B. [0.25]
- At about 350 F [0.25] the Train A PORV (456A) is armed and its respective Isolation Valve (V-122) is opened. [1.0] (2.0)

b. It prevents depressurization of the RCS past the interlock setpoint (2185 psig) if a pressure channel selected to a PORV fails high. (1.0)

REFERENCE
HO-PPLC-31, 33-35.

ANSWER 2.06 (2.50)

a. 1. Overspeed
2. Low lube oil pressure
3. Generator differential lockout. (1.5)

b. 1. Emergency start
2. Engine trouble shutdown relays. (1.0)
3. START FAILURE RELAY

REFERENCE
HO-EDm-61-64

ANSWER 2.07 (2.50)

a. -High head tank level
-High head tank overflow rate
-PCCW liquid radiation monitor [0.5 each, two required] (1.0)

b. (leak) Overpressure protection via a 150# relief valve [0.5]
(rupture High flow of 150 gpm shuts the thermal barrier outlet isolation valve. A check valve will close on reverse flow to isolate the thermal barrier. A 2500# relief valve is installed in this (high pressure) section of pipe.[1.0) (1.5)

REFERENCE
HO-PCC-18 to -24

ANSWER 2.08 (3.50)

a. A (LCV 460,459) CLOSED
B (TCV 3818) OPEN
C (HCV 128) CLOSED
D (PCU 131) OPEN
E (FCV-121) OPEN
F (HCU-182) OPEN
G (V59) OPEN [0.3 each] (2.1)

b. Full closed (0.4)

c. - Prevent flashing downstream of LD FCVs (Drag valves) (Normally)
- Control Plant pressure while solid (Shutdown) (1.0)

REFERENCE
HO-CVCS-32 to 34 and 171 ON 1242.01-Attachment A

ANSWER 2.09 (2.00)

a. -Containment Pressure High-2 4.3#
-Steamline Low Press. (>P-11) 585#
-Steamline High Press. Rate (<P-11) 100#/50 sec [0.33 each] (1.0)

b. -Limit steam flow on a steamline break accident
-Provide d/p for steam flow measurement [0.5 each] (1.0)

REFERENCE
HO-MS-17,-18 and STC#852 (Setpoint Summary)

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 3.01 (3.00)

a. The normal steam pressure setpoint of 1092 psig maintains Tavg at ~557 F, a decrease in the setpoint to 1000 psig would cause the dumps to open and cool Tavg to ~550 F where the P-12 interlock would close all steam dumps (Note: 0.25 credit given for correct conversion to Tsat ~547 F) (1.0)

b. Secondary pressure would rise to the setpoint of the secondary atmospheric relief valves [0.5] which would maintain pressure at 1125 psig [0.25] and primary temperature 560 +/-1 F [0.25]. (1.0)

c. A signal by the Load Rejection controller [0.5] would control primary temperature at "No Load" Tref +2 F deviation (dead band) (559 F) [0.5]. (1.0)

REFERENCE
Seabrook HO SD p. 17, 27, 34, 41.
MS Dump Control Logic Print C-509050

ANSWER 3.02 (1.50)

a. INCREASE

b. MORE NEGATIVE

c. INCREASE (FRV OPENS) [0.5 each] (1.5)

REFERENCE
Seabrook Instrument Failure Reference Manual, Section K, p. 5,6,8,9

ANSWER 3.03 (2.50)

a. Operator will be required to manually reinstate power to the Source Range instruments. (1.0)

b. - Input to P-6 [0.3] 10-10 amps [0.1] 1/2 [0.1]
- High flux rod stop [0.3] Ieq 20% [0.1] 1/2 [0.1]
- High flux Rx trip [0.3] Ieq 25% [0.1] 1/2 [0.1] (1.5)

REFERENCE
Seabrook Instrument Failure Reference Manual, Section J, p. 2-4
HO-NIS-74

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 3.04 (3.50)

a. 1. SI
2. Rx trip coincident with Low Tavg (1.0)

b. 1. Feedwater pumps trip
~~2. Closure of FW pump discharge valves.~~
3. Block start of start-up feed pump
4. Turbine trip
5. Reactor Trip (>P9)
6. FRV and bypass valves shut [0.3 each] (1.8)

c. Protect the Turbine from S/G moisture carryover. (0.7)

REFERENCE
Seabrook Logic Print C-509053, HD-RPS p. 79, HD-IS-52

ANSWER 3.05 (3.00)

a. Auctioneered high Tavg. (0.5)

b. Charging flow decreases [0.5], pressurizer level decreases [0.5], letdown isolates [0.5], and pressurizer level increases [0.5]. High Pressurizer level trip (92%) [0.5]. (2.5)

REFERENCE
Seabrook Instrument Failure Reference Manual, Section D, p. 1-4

ANSWER 3.06 (3.00)

a. 1. Turbine impulse pressure decreases [0.5] in respect to N-44, causing a rate of change signal which drives rods in. [0.5] (1.0)

2. Turbine impulse pressure decreases (Tref) [0.5] below Tavg causing a temperature mismatch error which drives rod in. [0.5] (1.0)

b. The magnitude of the power mismatch rate signal PLUS the temperature mismatch signal. (0.5)

c. When Tavg and Tref are within 1 F. (0.5)

REFERENCE
Seabrook HD-FLRC p. 20-23

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 3.07 (3.50)

a. Tavg, dt, Pressure, dI [0.5 each] (2.0)

b. Prevent exceeding DNB (0.5)

c. Turbine runback
Blocks automatic and manual rod withdrawal (C-3) [0.5 each] (1.0)

REFERENCE
Seabrook HD-RPS, p.54-59

ANSWER 3.08 (2.50)

a. 1. - RCS pressure < 365 psig. (auto close at 660 psig).
- RHRS to CVCS/SIS isolation valves (RH-V 35 and 36) closed. (1.0)

2. RCS suction valves to RHR closed. (0.5)

b. 1. RWST Low-Low level.
2. "S" signal present. (1.0)

REFERENCE
Seabrook HD-RHRS p. 44-47

ANSWER 3.09 (2.50)

a. Because the turbine serves as the heat sink to the reactor, a reactor trip follows a turbine trip to minimize the RCS temperature transient (and/or resulting safety valve operation). (1.0)

b. - High pzr pressure
- High pzr level
- OT Delta T [1 required] (0.5)
- S/G LO-LO LEVEL

c. - All turbine stop valves shut
- Emergency oil (Emer. Trip Fluid System) pressure low (< 800 psig) [0.5 each] (1.0)

REFERENCE
HD-RPS-65 and 66
Dwg. 9783-C-589956

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 4.01 (3.00)

a. Ensures both RHR reliefs are available to combat a pressure spike. (0.6)

b. Prevent backflow through the seals. (0.6)

c. - Immediately restore CCW
- Trip the RCPs [0.6 each] (1.2)

d. Prevent winding damage (from excessive starting current heat). (0.6)

REFERENCE
OS 1001.05; pages 2 to 5

ANSWER 4.02 (3.50)

a. Within 15 (or next 10) minutes [0.5] either
1. Restore the indicated AFD to within the target band [0.5], or
2. Reduce the thermal power to <90% of rated thermal power.[0.5] (1.5)

b. Accumulated penalty over the past 24 hours is 89 minutes.[1.0]
The penalty will be reduced to 60 minutes at 1618 minutes on
03/18/85 and then power may be increased.[1.0] (2.0)

85%	0318-0310	=	8		[0.25]
65%	1637-1557	=	40		[0.25]
45%	0310-0148	=	82/2	= 41	[0.5]
				89	min total penalty

03/17/85, from 1557; 81 min left -60 = 21 min -> 1618 03/18/85 [1.0]

REFERENCE
TS; 3.2.1

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 4.03 (3.50)

a. - Individual RCCA bottom light
- RCCA position deviation alarm
- PR NI Delta I alarm
- Rapid drop in Tavg/[illegible] power
- Detector or channel current comparator alarm
- Tavg-Tref deviation alarm
- Control rods stepping out in AUTO [5 required, 0.4 each] (2.0)

b. Insert rods to shutdown the reactor [0.8] and investigate the problem.[0.2] (1.0)

c. Adjustment of turbine load. (0.5)

REFERENCE
Seabrook Dropped Rod Procedure OS1210.05

ANSWER 4.04 (3.50)

a. NO -Steam supply to TDEFW pump(MS-V128)not closed. (0.5)

b. - Verify (turbine trip) Main Turbine stop valves closed (and main steam drains closed).
- Close remaining MSIV's and bypass valves.
- (Use intact SG ASDV's for steam dump) (1.0)

c. - At least one high head pump running (CCP or SI)
- RCS subcooling less than 30-F. (1.0)

d. - PRZR level cannot be maintained >5% (30% adverse containment)
- RCS subcooling less than 30-F. (1.0)

REFERENCE
Seabrook E-3 SGTR procedure OS1330 p. 2-4 and Action Summary.

ANSWER 4.05 (2.50)

a. 1. Rod bottom lights
2. Reactor trip and bypass breakers open
3. Neutron flux decreasing. [0.5 each] (1.5)

b. 1. Manually insert control rods
2. Emergency Borate. [0.5 each] (1.0)

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

REFERENCE
Seabrook FR-5.1 p. 2,3

ANSWER 4.06 (2.50)

a. SCRO - RSS panel (B) operator
CRO - RSS panel (A) operator (1.0)

b. By opening a PRZR PORV. (0.5)

c. PRZR level increases or oscillations. (0.5)

d. True (0.5)

REFERENCE
Seabrook OS1200.02, p. 4, 5 and 19

ANSWER 4.07 (1.50)

a. Notify the SS or USS. (1.0)

b. SS or USS. (0.5)

REFERENCE
Seabrook Standing Operating Order No. 84-001

ANSWER 4.08 (2.00)

a. 1, 2 AND 4 (1.0)

b. Unexpected OR excessive OR if it exceeds 3/4 scale (any one for full credit). (1.0)

REFERENCE
Seabrook Administrative Procedures RP-5.0 p. 5 and SSRP-8.0 p. 4

ANSWERS -- SEABROOK 1 -85/03/18-ISAKSEN, P.

ANSWER 4.09 (3.00)

a. 1.25 Rem/Quarter (0.75)

b. -3 Rem/Quarter is NOT exceeded. [0.75]
-Total accumulated dose does not exceed 5(N-18). [0.75]
-Accumulated exposure on record (NRC-4). [0.75] (2.25)

REFERENCE
10 CFR 20

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

FACILITY: SEABROOK 1

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/03/18

EXAMINER: RUSCITTO,D.

APPLICANT: MASTER

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.

ATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
00.00	100.00			TOTALS

FINAL GRADE _____%

ll work done on this examination is my own. I have neither iven nor received aid.

_____
APPLICANT'S SIGNATURE

QUESTION 5.01 (2.00)

It is the responsibility of the reactor operator to ensure that the core power distribution limits are maintained at all times. Operation within these limits is reasonably assured when four conditions are met. What are these four conditions that will prevent exceeding core power distribution limits/hot channel factors?

QUESTION 5.02 (1.50)

Explain why Reactor Coolant System Delta T can be used as a measure of reactor power, but secondary coolant Delta T cannot.

QUESTION 5.03 (.50)

Assume RCP's are tripped following a LOCA. After the break has been isolated which of the following situations would be MOST desirable?

	P PZR	T PZR	T HOT	T COLD
a.	1240	570	580	570
b.	1100	557	540	530
c.	750	520	520	520
d.	640	540	520	500

QUESTION 5.04 (1.50)

For each of the following conditions, describe how each term of the heat transfer equation Q = UA(DELTA T) changes and why. Assume power remains constant.

a. Scale formation increases on steam generator tubes. [0.75]

b. Additional steam generator tubes are plugged. [0.75]

QUESTION 5.05 (2.50)

Answer the following concerning the 1/M plot:

a. What are two purposes of the 1/M plot during startup? [1.0]

b. Why is the inverse count rate plotted rather than count rate? [0.75]

c. Why is the time interval between reactivity changes important with regard to constructing a 1/M plot? [0.75]

QUESTION 5.06 (3.00)

After operation at 100% power for several weeks near the end of cycle, it is decided to reduce power to 75% using rods only.

a. After reaching 75% power, what rod motion would be required to maintain the plant at 75% power over the next 40 hours assuming no change in boron concentration?

b. Explain what causes these reactivity changes. [1.5 each]

QUESTION 5.07 (3.00)

List the four parameters affecting Departure from Nucleate Boiling(DNB) and state whether the probability of approaching DNB is increased or decreased as these parameter values increase.

QUESTION 5.08 (1.50)

Why is there a Technical Specification limit on Shutdown Margin?

QUESTION 5.09 (3.00)

Answer the following concerning emergency boration:

a. Explain the response of reactor power and TAVE after 2 minutes of emergency boration at 100% power. Assume rod control is in manual.

b. Explain the response of reactor power and TAVE after 2 minutes of emergency boration at 10 - 8 AMPS and no load TAVE. [1.5 each]

QUESTION 5.10 (2.50)

Answer the following concerning fission product poisons:

a. State the production and removal mechanisms for Xe-135 and Sm-149 in the reactor core.[1.0]

b. State the reactivity value for peak xenon concentration following a trip from 100% power and the time required to reach this peak condition.[0.75]

c. State the reactivity value for 100% equilibrium xenon concentration and the time to reach this condition from startup with a clean reactor core.[0.75]

QUESTION 5.11 (1.50)

A variable speed centrifugal pump is operating at 1/4 rated speed in a closed system with the following parameters. What are the new values of these parameters when speed is increased to rated speed?

a. Power = 500 KW

b. Flow = 900 GPM

c. Head = 70 PSIG

QUESTION 5.12 (2.50)

a. Why does reactor coolant pump amperage increase during a plant cooldown? [0.5]

b. During primary system cooldown, why do steam dump valves have to be opened further as temperature decreases to maintain the same cooldown rate? [1.0]

c. Why is vessel Delta T always less than core Delta T? [1.0]

QUESTION 6.01 (2.00)

Answer the following concerning a high failure of RHR Train B pressure transmitter PT-405. Assume the plant is at 300 DEG F cooling down using both RHR trains.

a. Explain the effects on the automatic actions/interlocks associated with the RHR isolation valves. [1.0]

b. What other indications could be used to verify this failure? [1.0]

QUESTION 6.02 (3.00)

Answer the following concerning the Steam Dump System:

a. Why does the C-7 load rejection arming signal lock in? [1.0]

b. Why must the Steam Dump Mode Selector Switch be reset upon completion of a large load rejection? [1.0]

c. How do you know if the C-7 arming signal is actuated? [1.0]

QUESTION 6.03 (4.00)

Answer the following concerning the Pressurizer Pressure Control System. Assume that the plant is at 100% power:

a. List the indications in the Main Control Room if the controlling channel (455) of pressurizer pressure fails high. Do not include alarms. [2.0]

b. What COULD cause a reactor trip on the above failure? [0.75]

c. What actions should be taken to restore the plant to a stable condition once the failed channel is identified? [1.25]

QUESTION 6.04 (4.00)

Answer the following concerning a main steam line break:

a. Explain how each of the following affect the severity of a main steam line break accident:

(1) Mode (HSB, S/U, etc.) [1.0]
(2) Time in cycle (BOL, EOL, MOL, etc) [1.0]

b. What specific plant design features were incorporated to limit the severity of a main steam line break? [0.5]

c. Following a main steam line break inside containment, which signals will cause safety injection actuation? Include primary and backup signals, setpoints, and coincidence. [1.5]

QUESTION 6.05 (3.00)

The plant is operating at 60% power when a T hot narrow range RTD fails high. Explain how this failure will affect the following. Consider each item independently. Assume no operator action and that all control systems are in automatic.

a. Rod insertion limit setpoint.

b. Charging flow (initially).

c. Control rod bank position.

d. Steam dump control system. [0.75 each]

QUESTION 6.06 (3.00)

Where are the source range, intermediate range and power range detectors located vertically with respect to the core? Why?

QUESTION 6.07 (1.00)

How could Vital Instrument Panel PP-1A be supplied if UPS 1A was not available?

QUESTION 6.08 (3.00)

Answer the following concerning the Emergency Feedwater(EFW) System:

a. What automatic action occurs at 450 GPM in any EFW system feed line. Why? Under what plant condition is this in effect? [1.0]

b. How are the EFW pumps protected against runout? [0.75]

c. How would an operator know if local control of either EFW pump has been taken? [0.5]

d. Which, if any of the automatic initiation signals will start the EFW pumps under the conditions in part c above? [0.75]

QUESTION 6.09 (2.00)

Answer the following concerning the Combustible Gas Control System.

a. Following a LOCA inside containment, what are three major sources of hydrogen? [1.0]

b. At what level does hydrogen in the containment become a problem? Explain. [0.5]

c. How can hydrogen be removed from the containment? [0.5]

QUESTION 7.01 (3.00)

During 80% power operation, with rod control in automatic, a Power Range NI channel fails low.

a. What immediate actions, if any must be taken? Explain. [1.5]

b. What other actions must be taken in accordance with the Technical Specifications? [1.5]

QUESTION 7.02 (1.50)

Following a loss of Primary Component Cooling Water(PCCW) while at power, PCCW was isolated from the containment, the reactor was tripped and Reactor Coolant Pumps(RCP) were tripped. RCP A #1 seal leakoff susequently was reported to be 6.5 GPM. What action, if any must be taken?

QUESTION 7.03 (1.00)

Why must the effluent of the letdown degassifier be directed to the CRIE for ten minutes prior to discharging the effluent to the VCT?

QUESTION 7.04 (3.00)

Following a fire in the Control Room ventilation system while operating at power, the following actions are taken: The reactor and turbine are manually tripped, RCPs are stopped, all MSIVs and bypasses are shut. You have just manned Remote Safe Shutdown Panel A.

a. How will the following parameters be controlled while cooling down to 450 DEG F and 1000 PSIG?

(1) Steam pressure
(2) Steam generator level
(3) Pressurizer pressure
(4) Pressurizer level [0.6 each]

b. How will the plant be depressurized to 1000 PSIG? [0.6]

QUESTION 7.05 (3.50)

Answer the following concerning E-0, Reactor Trip or Safety Injection:

a. What are the five conditions that require SI initiation? (Include setpoints) [2.5]

b. The Main Turbine has not tripped and you attempt a manual trip as directed, with no response. What additional action are you required to take in order to shutdown the turbine? [1.0]

QUESTION 7.06 (2.00)

Fill in the following precautions and limitations from various operating procedures:

a. The RHR System shall be isolated from the Reactor Coolant System(RCS) before RCS exceeds _____ DEG F or _____ PSIG. [0.5]

b. The Reactor Coolant Pumps(RCP) shall not be operated when the number one seal differential pressure is less than _____ PSID or the Volume Control Tank pressure is less than _____ PSIG. [0.5]

c. RCP seal injection water temperature should not exceed _____ DEG F. [0.25]

d. At least one RCP should be in operation with Tave greater than _____ DEG F. [0.25]

e. The boron concentration in the pressurizer should be maintained within _____ PPM of the RCS loop concentration. [0.25]

f. The pressurizer sprays shall not be used if the differential temperature between the in-service spray Tcold and the pressurizer steam space exceeds _____ DEG F. [0.25]

QUESTION 7.07 (3.00)

Answer the following concerning intial core loading:

a. What two specific conditions would require an immediate increase in boron concentration? [1.0]

b. What are four conditions that would require the suspension of core loading? (In addition to the above two) [2.0]

QUESTION 7.08 (3.50)

a. Refueling Technical Specifications require that one RHR loop be operating during refueling. What are two reasons for this requirement? [1.5]

b. What is the reason for the requirement that two RHR loops be operable when water level is less than 23 feet above the vessel flange? [1.0]

c. Under what conditions is it permissible to stop RHR flow during refueling? [1.0]

QUESTION 7.09 (3.00)

a. In addition to alarms, list four indications of a dropped control rod? [1.0]

b. What are the immediate operator actions required for a single dropped rod? [1.0]

c. If the quadrant power tilt ratio is calculated to be 1.10, as a result of a dropped rod, what is the time limit specified in the Technical Specifications for reducing power and how far must power be reduced? [1.0]

QUESTION 7.10 (1.50)

Answer the following concerning radiation detection and effects:

a. Consider two point gamma sources, each with 1 curie strength. Source A gamma energy is 2 MEV and Source B gamma energy is 1 MEV. If readings were taken at the same distance from each unshielded source with a Geiger Mueller(GM) type meter, how would the readings compare? Briefly explain. [1.0]

b. If a worker was exposed to a 1 RAD/HR neutron radiation field, would the biological damage be less than, greater than, or the same as if the 1 RAD/HR field was due to gamma radiation? [0.5]

QUESTION 8.01 (3.00)

During a normal reactor startup with the reactor at 3% power, a steam dump system malfunction occurs resulting in a Tave decrease to 545 DEG F.

a. What immediate actions must be taken in accordance with the Technical Specifications? [1.0]

b. What are the four bases for the Technical Specification Action requirements? [2.0]

QUESTION 8.02 (2.50)

The plant is heating up from 310 DEG F at 35 DEG F/HR. Maintenance reports that Residual Heat Removal(RHR) Pump 8B repairs will not be completed for 6 hours but that RHR Pump 8A is operable, and the Technical Specifications Action Statement allows 72 hours to repair an inoperable pump in Mode 3. What action, if any, should be taken?

QUESTION 8.03 (3.00)

During shift turnover, you notice that Axial Flux Difference(AFD) has been outside of the target band for the last 10 minutes. Power is 98% and you have accumulated 29 penalty minutes in the past 24 hours.

a. What action, if any must be taken? [0.75]

b. What action, if any must be taken if power were 83%? Why? [0.75]

c. What action, if any must be taken if you exceed 60 penalty minutes in the previous 24 hours? How will this affect future operation? [1.5]

QUESTION 8.04 (3.00)

At 0840, while operating at 99% power, the USS is informed that MSIV A is open and inoperable. The estimated time of repair is four hours. At 1230 the Maintenance Supervisor states that repairs will take an additional hour or so. The USS orders load removed and power is stabilized at 98%. The MSIV is returned to operable status at 1425 and power raised to 99%. Did the USS violate Technical Specifications? Explain your answer. Refer to Figure 8.1.

QUESTION 8.05 (1.50)

The monthly surveillance test for the turbine driven emergency feedwater pump differential pressure was due to be completed on February 4. A check of the surveillance records showed that the test was not performed until February 13. The Operations Supervisor states that it was still within the extension time allowed by the Technical Specifications. Is he correct? Explain your answer.

QUESTION 8.06 (1.00)

Abnormal vibration in Primary Component Cooling Water Pump 11D causes the pump to be removed from service and tagged out. Is that PCCW train operable? Explain your answer.

QUESTION 8.07 (2.50)

Answer the following concerning log reviews by the Unit Shift Supervisor:

a. What logs are reviewed? [2.0]

b. How often are they reviewed? [0.5]

QUESTION 8.08 (2.00)

What is the primary means of communication between the control room and each of the following organizations during an emergency?

a. NRC

b. Mass/NH State Police

c. Near-Term Response Personnel

d. Station Security [0.5 each]

QUESTION 8.09 (1.50)

What is the difference between the review process for intent and non-intent procedure changes to SORC approved procedures?

QUESTION 8.10 (1.00)

What restrictions are placed on the composition of the Fire Brigade?

QUESTION 8.11 (2.50)

Answer the following concerning Radiation Work Permits (RWP):

a. Under what conditions may the Shift Superintendent authorize entry into an area normally requiring a RWP without actually being provided a RWP prior to entry? [1.0]

b. What three actions must be taken in the above situation to ensure that personnel safety and proper documentation are maintained? [1.5]

QUESTION 8.12 (1.50)

Answer the following concerning Reactor Coolant System(RCS) limits:

a. Technical Specifications provide steady state and transient RCS chemistry limits. What is the period of time you are allowed to operate if the actual chemisty concentrations are between these two limits? [0.5]

b. RCS specific activity limits refer to the term Dose Equivalent I-131. What is Dose Equivalent I-131? [1.0]

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 5.01 (2.00)

a. All control rods in a single group are moved together with no single rod in the group differing by more than 12 steps from group position.

b. Control rod groups are sequenced with proper bank overlap.

c. Control rod insertion limits are observed.

d. Axial power distribution is maintained within specified limits. [0.5 each]

REFERENCE
WNTC Rx Core Control, 8-32

ANSWER 5.02 (1.50)

The temperature rise in the coolant is directly proportional to the heat input as long as no phase change takes place. [0.75] As vaporization takes place in the secondary, heat is added with no change in temperature. [0.75]

REFERENCE
HO-THF-3

ANSWER 5.03 (.50)

b.

REFERENCE
Steam Tables
HO-THF-2

ANSWER 5.04 (1.50)

a. Scale reduces heat transfer ability, therefore U decreases and with constant power, Delta T must go up to compensate. [0.75]

b. Plugged tubes reduces heat transfer area, therefore, A decreases and with a constant power, Delta T must go up. [0.75]

REFERENCE
HO-THF-3 CAF for answer

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 5.05 (2.50)

a. (1) Criticality prediction based on count rate. [0.5]
(2) Ensures criticality does not occur below minimum Rod Insertion Limits and therefore ensures minimum Shutdown Margin. [0.5]

b. The approach to zero is easier to see than the approach to infinity. [0.75]

c. As Keff approaches one, it takes longer for count rate to stabilize, because more generations are required to level count rate. [0.75]

REFERENCE
a. HO-RTR-54
b. HO-RTR-54
c. CAF for answer

ANSWER 5.06 (3.00)

a. Rods will need to be withdrawn for about 5 hours [0.75] and then inserted for the next 35 hours. [0.75]

b. After the power decrease, the production of xenon from fission [0.25] and from the decay of iodine [0.25] is greater than the removal by decay of xenon [0.25] and burnout by flux. [0.25] After five hours, the removal rate is greater than the production [0.25] and positive reactivity is being added until equilibrium at about 40 hours. [0.25]

REFERENCE
HO-RTR-109, 110

ANSWER 5.07 (3.00)

a.	Reactor Power	Increases	
b.	Reactor Coolant Temperature	Increases	
c.	Reactor Coolant Flow	Decreases	
d.	Primary Pressure	Decreases	[0.75 each]

REFERENCE
HO-THF-3

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 5.08 (1.50)

A SDM ensures that the reactor can be made subcritical from all operating conditions [0.5] and that the reactivity transients associated with postulated accident conditions are controllable. [0.5] It ensures that the reactor will be maintained sufficiently subcritical to preclude inadvertant criticality in the shutdown condition. [0.5]

REFERENCE
RX 1707, p.2

ANSWER 5.09 (3.00)

a. Power decreases initially due to the boron addition.[0.5] The primary to secondary mismatch causes TAVE to decrease.[0.5] The decrease in TAVE inserts positive reactivity and restores power to a level slightly lower than or the same as initial power.[0.5] (Possible low pressure trip, LO-LO TAVE implies low pressure)

b. Tave is determined by the amount of pump heat [0.5] and the steam dump setting thus it does not change.[0.5] After the initial transient, power decreases (at a -1/3 DPM rate) to the multiplied source level.[0.5]

REFERENCE
HO-RTR-95/97

ANSWER 5.10 (2.50)

a. (1) Xe-135 production directly from fission and the decay of iodine [0.25] and removal by decay and burnout. [0.25]

(2) Sm-149 production from the decay of promethium [0.25] and removal by burnout. [0.25]

b. 5300 pcm at 7-10 hours [0.75]

c. 2800 pcm at 40-60 hours [0.75]

REFERENCE
HO-RTR-104/116

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 5.11 (1.50)

a. $P2 = P1(N2/N1)^3 = 500 \times 4^3 = 32$ MW

b. $Q2 = Q1(N2/N1) = 900 \times 4 = 3600$ GPM

c. $H2 = H1(N2/N1)^2 = 70 \times 4^2 = 1120$ PSIG

REFERENCE
HO-THF-4

ANSWER 5.12 (2.50)

a. As temperature decreases, the density of the fluid increases. More power is required to pump the heavier fluid.[0.5]

b. As temperature decreases, both steam density and steam velocity decrease.[0.5] The steam dump valves must be opened further to maintain a constant mass flow rate.[0.5]

c. About 5% of the total RCS flow bypasses the core and picks up very little heat.[0.5] In the upper plenum, these two flows mix, reducing vessel outlet temperature.[0.5]

REFERENCE
HO-THF-2/4

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 6.01 (2.00)

a. Train B provides interlock and automatic isolation for the upstream valves of both trains. Therefore, RHR Train A (RC-V23) and RHR Train B (RC-V88) upstream isolation valves will shut and be prevented from opening. [1.25]

b. Pressure meter and recorder on the Main Control Board. [0.75]

[Credit given for indications of RHR system isolation and pump cavitation as well as indications of PORV actuatuation (If assumption is made that LTOP is armed)]

REFERENCE
HO-RHRS-25/26

005000K1.09 RO 3.6 SRO 3.9
005000K4.01 RO 3.0 SRO 3.2
005000A2.01 RO 2.7 SRO 2.9

ANSWER 6.02 (3.00)

a. Prevents Steam Dump Valves from shutting once impulse pressure stops decreasing. [1.0]

b. The dump will remain armed and a failure low of the other impulse channel (PT-505) or a high failure of any temperature channel input to Tave would cause dump actuation. [1.0]

c. TURB IMPULSE CHAMBER PRESS PERMISSIVE status light on the Main Control Board. [1.0]

REFERENCE
a. HO-SD-39
b. HO-SD-39,40
c. HO-SD-40

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 6.03 (4.00)

a. (1) Spray valves open. [0.67]
(2) PORV 456A opens until pressure channel indicates 2185 PSIG, [0.67] then PORV 456A closes. [0.67]

b. The rapid pressure transient could cause Low Pressure Trip (2/4 at 1945 PSIG) or OT Delta T (2/4). [0.75] Added additional answer

c. (1) Select alternate channel (457) on Channel Selector. [0.5] OR
(2) Turn heaters off, manually close spray valve, check PORVs closed or close block valves until transient stops. [0.75]

[Credit given for an explanation of using heaters to restore pressure.]

REFERENCE
Instrument Failure Manual, pp. C1-C6
HO-PPLC-24/33

ANSWER 6.04 (4.00)

a. (1) Hot Zero Power [0.50] because of the greatest mass in the SG results in the largest RCS cooldown. [0.50]

(2) EOL [0.50] because MTC is at its maximum negative value. [0.50]

b. Flow restrictors in the S/G outlet nozzles (and BIT) [0.5]

c. (1) Steam line low pressure 585 PSIG 2/3 any steam header

(2) Pressurizer low pressure 1850 PSIG 2/4

(3) High containment pressure 4.3 PSIG 2/3 [0.5 each]

REFERENCE
HO-ECCS-44
HO-RPS-70/72
Setpoint Summary

Fast Transient will be Low Pressure but Slow Transient will be OTΔT

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 6.05 (3.00)

a. Increases due to auctioneered High Delta T input. (Tave input set to zero)

b. Increases to raise pressurizer level to 100% program, because of the higher temperature input.

c. Rods move in, because of the Auctioneered Tave/Tref mismatch.

d. No effect, the demand signal is present (Tave/Tref) but there is not an arming signal present. [0.75 each]

REFERENCE
Instrument Failure Reference Manual pp. A1-A5

ANSWER 6.06 (3.00)

a. During startup, the flux is mainly in the bottom of the core. [0.5] therefore, the source range detector is located at the bottom. [0.5]

b. At low power levels with control rods inserted and during much of reactor startup operation the flux remains low in the core. [0.5] therefore, the intermediate range detector is located at the mid plane. [0.5]

c. The power range detector covers the full core height [0.5] which enables them to determine relative axial power production. [0.5]

REFERENCE
HO-NIS-20/22

ANSWER 6.07 (1.00)

From MCC-E531 via a 480/120 VAC transformer (and the mechanically interlocked supply breaker)

REFERENCE
HO-E'AC-24

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 6.08 (3.00)

a. At 450 GPM, when the motor-operated flow control valves are in remote (MCB) control,[0.3] they will shut and the remaining three sets will be blocked open [0.4] to ensure isolation to a failed steam generator (SG) and provide feedflow to the unaffected SGs. [0.3]

b. The flow venturi in each line limits flow to 750 GPM. [0.75]

c. Alarm on the MCB. [0.5]

d. None, all automatic initiations are blocked in local operation.[0.75]

REFERENCE
HO-EFW-16/25,38

ANSWER 6.09 (2.00)

a. (1) Radiolysis of water
(2) Zirconium/Water reactions
(3) Coolant H2 inventory
(4) NaOH/Zinc/Aluminum reactions [0.33 each, 3 req.]

b. Hydrogen is explosive in concentrations above 4%. [0.5]

c. (1) H2 recombiners
(2) Compressed air puge and vent [0.25 each]

REFERENCE
HO-CGCS-8/23

will accept "flammable" or "combustible"

ANSWERS -- SEABROOK 1 -85/03/16-RUSCITTO,D.

ANSWER 7.01 (3.00)

a. No immediate actions are required since all control functions except rod stop are 2/4 coincidence. [1.5]

b. The inoperable channel must be tripped within one hour. [1.5]

REFERENCE
Instrument Failure Reference Manual p. K-11
TS p. 3/4 3-6

ANSWER 7.02 (1.50)

Close seal leakoff valve[1.0] within 5 minutes. [0.5]

REFERENCE
OS1201.01 p.3

ANSWER 7.03 (1.00)

To prevent reactor power variations due to changes in boron concentration.

REFERENCE
OS1002.04, page 2

ANSWER 7.04 (3.00)

a. (1) Steam pressure will be maintained (less than 1000 PSIG) with the atmospheric dump valves.
(2) Steam generator level will be maintained (65 - 95%) with the emergency feed system.
(3) Pressurizer pressure will be maintained using heaters.
(4) Pressuizer level will be controlled by adjusting the cooldown rate. [0.6 each]

b. The plant is depressurized using the pressurizer PORV. [0.6]

REFERENCE
OS1200.02, pp.2-19

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 7.05 (3.50)

a. (1) Pressurizer pressure less than 1850 PSIG and decreasing.
(2) Containment pressure greater than 4.0 PSIG.
(3) Steamline pressure less than 585 PSIG and decreasing.
(4) Reactor Coolant System subcooling less than 30 DEG F.
(5) Pressurizer level less than 5% and decreasing. [0.5 each]

b. (1) Close the MSIVs
(2) Open the Generator Breaker [0.5 each]

REFERENCE
F-0, pp.2,3

ANSWER 7.06 (2.00)

a. 350 DEG F/425 PSIG [0.5]
b. 220 PSID/15 PSIG [0.5]
c. 220 DEG F [0.25]
d. 350 DEG F [0.25]
e. 50 PPM [0.25]
f. 320 DEG F [0.25]

REFERENCE
OS1000.01 pp. 3,4
OS1001.05 p. 6

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 7.07 (3.00)

a. (1) Reactor Coolant System boron concentration less than 2000 PPM or Keff greater than 0.95. [0.5]
(2) The 1/M plots indicate that criticality is imminemt. [0.5]

b. (1) An unexplained decrease in the boron concentration greater than 20 PPM from nominal.
(2) An unanticipated increase in the count rate by a factor of five occurs on any channel during any step after loading of the eight initial fuel assemblies.
(3) Audible count rate in the containment or control room is lost.
(4) Loss of communications between the control room and the refueling station.
(5) The containment evacuation alarm is sounded.
(6) Mechanical damage to a fuel assembly occurs.
(7) Containment integrity is lost.
(8) Less than 1/2 CPS attributable to core neutrons exist on three of the four channels following installation of the initial eight assemblies.
(9) An unanticipated increase in count rates by a factor of two occurs on all channels during any step after loading of the eight initial assemblies. [0.5 each, 4 required]

REFERENCE
1-ST-4 pp. 7-9

ANSWER 7.08 (3.50)

a. (1) Sufficient capacity to remove decay heat and maintain temperature less than 140 DEG F. [0.75]

(2) Sufficient circulation to minimize the effects of a boron dilution accident and prevent stratification. [0.75]

b. Ensure that a single failure will not result in a loss of heat removal capability(with a diminished heat sink). [1.0]

c. May be stopped for one hour per eight hour period for core alterations in the vicinity of the hot legs. [1.0]

REFERENCE
TS p. 3/4 9-8, B3/4 9-2

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 7.09 (3.00)

a. (1) Change in Delta I indication
(2) Control rod bank rapidly stepping out(Auto only)
(3) Decreasing Tave
(4) Decreasing pressurizer level
(5) Decreasing pressurizer pressure
(6) Decreasing flux on one or more channels
(7) Rod position indication/Rod bottom light [0.25 each, 4 required]
(8) Tave deviates from Tref
(9) Decreasing steam pressure

b. Place rod control in manual [0.5], and reduce turbine load to maintain Tave/Tref. [0.5]

c. Power to be reduced by 30% of rated thermal power [0.5] within 30 minutes. [0.5]

will accept additional explanation if rods are assumed to be in "auto".

REFERENCE
TS p. 3/4 2-12
OS1210.5 p.1

ANSWER 7.10 (1.50)

a. The readings would be approximately the same [0.5]. GM meter readings are not dependent on the energy level of the source since each interaction results in complete ionization of the gas in the detector, giving a pulse. [0.5] (If a compensating filter is assumed in GM tube, full credit will be given for Source A reading approximately twice Source B reading)

b. Greater than. [0.5]

REFERENCE
CAF

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 8.01 (3.00)

a. Restore Tave to greater than 551 DEG F within 15 minutes [0.5] or be in hot standby within the next 15 minutes [0.5]

b. This limitation is required to ensure that:

(1) MTC is within its analyzed temperature range.
(2) Protective instrumention is within its analyzed temperature range.
(3) The pressurizer is capable of being operated with a steam bubble.
(4) The reactor pressure vessel is above minimum RTNDT. [0.5 each]

REFERENCE
TS pp. 3/4 1-6, B 3/4 1-2

ANSWER 8.02 (2.50)

The Technical Spcifications require that all LCOs be satisfied prior to entry into an operational mode. [0.75] Since you are about to enter Mode 3 [0.75] the heatup must be discontinued [0.5] and temperature held at less than 350 DEG F until RHR Pump 8B is proven operable. [0.5]

REFERENCE
TS p. 3/4 0-1,2

ANSWER 8.03 (3.00)

a. Reduce power to less than 90%. [0.75]

b. None required because accumulated penalty is within the limits of the Technical Specifications. (60 MIN) [0.75]

c. Reduce power to less than 50% within 30 minutes. [0.75] Operation at greater than 50% may not resume until penalty minutes fall below 60 in the previous 24 hours. [0.75]

REFERENCE
RN 1740, p.4
TS, p.3/4 2-1

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 8.04 (3.00)

The Technical Specification was violated because it requires the operator to take action to have power below 5% two hours after the four hour repair time has expired. Lowering power one percent commenced load reduction but by 1425, load could not be reduced fast enough to achieve 5% within the next 15 minutes and he was therefore in violation.

REFERENCE
TS p.3/4 7-9

ANSWER 8.05 (1.50)

No, because the maximum extension is 25% of the specified time interval, which in this case has been exceeded.

REFERENCE
TS p.3/4 0-2

ANSWER 8.06 (1.00)

Yes, [0.5] Standing Order 84-004 gives operational guidelines on the Technical Specification interpretation. [0.5]

REFERENCE
Standing Operating Order 84-004

ANSWER 8.07 (2.50)

a. (1) Tagging Order Log
(2) Temporary Modifications Log
(3) Station Logs
(4) USS Journal [0.5 each]

b. Once per shift [0.5]

REFERENCE
AQ 10.003

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

ANSWER 8.08 (2.00)

a. ENS Hotline
b. Nuclear Alert System
c. Radio Paging System
d. Telephone/PA System [~~0.5~~ 1.0 each]

deleted since procedures not yet firm.

REFERENCE
Emergency Plan Figure 3.1

ANSWER 8.09 (1.50)

Prior to implimentation, intent changes must be reviewed by SORC and signed by the Station Manager [0.75], whereas non-intent changes are reviewed by SORC within 14 days but approval only requires concurrance of both a Station Staff Supervisor knowledgable in the area affected and either the Unit Shift Supervisor or Shift Superintendant. [0.75]

REFERENCE
AQ1.002, p.15, 16

ANSWER 8.10 (1.00)

The Fire Brigade shall not include the Shift Superintendent and the three other members of the minimum shift crew necessary for the safe shutdown of the unit (and any personnel required for other essential functions during a fire emergency).

REFERENCE
T.S. 6.2.2

ANSWER 8.11 (2.50)

a. When critical and immediate action is required [0.5] for work of a short duration. [0.5]

b. (1) The workers are given verbal instructions and precautions.
(2) Continuous health physics coverage is provided.
(3) The job is documented on a RWP after completion. [0.5 each]

ANSWERS -- SEABROOK 1 -85/03/18-RUSCITTO,D.

REFERENCE
RP-1.0, p. 5

ANSWER 8.12 (1.50)

a. 24 hours [0.5]

b. Dose Equivalent I-131 is that concentration of I-131 which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134 and I-135 actually present. [1.0]

REFERENCE
a. TS 3/4 4-22
b. TS 1-2

TEST CROSS REFERENCE PAGE 1

QUESTION	VALUE	REFERENCE
05.01	2.00	DGR0000816
05.02	1.50	DGR0000817
05.03	.50	DGR0000818
05.04	1.50	DGR0000819
05.05	2.50	DGR0000820
05.06	3.00	DGR0000821
05.07	3.00	DGR0000822
05.08	1.50	DGR0000823
05.09	3.00	DGR0000825
05.10	2.50	DGR0000826
05.11	1.50	DGR0000827
05.12	2.50	DGR0000828
	25.00	
06.01	2.00	DGR0000832
06.02	3.00	DGR0000833
06.03	4.00	DGR0000834
06.04	4.00	DGR0000835
06.05	3.00	DGR0000836
06.06	3.00	DGR0000839
06.07	1.00	DGR0000840
06.08	3.00	DGR0000841
06.09	2.00	DGR0000842
	25.00	
07.01	3.00	DGR0000838
07.02	1.50	DGR0000846
07.03	1.00	DGR0000858
07.04	3.00	DGR0000859
07.05	3.50	DGR0000860
07.06	2.00	DGR0000864
07.07	3.00	DGR0000865
07.08	3.50	DGR0000866
07.09	3.00	DGR0000867
07.10	1.50	DGR0000868
	25.00	
08.01	3.00	DGR0000824
08.02	2.50	DGR0000837
08.03	3.00	DGR0000843
08.04	3.00	DGR0000844
08.05	1.50	DGR0000845
08.06	1.00	DGR0000850
08.07	2.50	DGR0000851
08.08	2.00	DGR0000852
08.09	1.50	DGR0000854
08.10	1.00	DGR0000855

QUESTION	VALUE	REFERENCE
08.11	2.50	DGR0000856
08.12	1.50	DGR0000857
	25.00	
	100.00	

EQUATION SHEET

$F = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

$\dot{Q} = \dot{m} C_p \Delta t$

$\dot{Q} = UA \Delta T$

$Pwr = W_f \Delta h$

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

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

$SUR = 26.06/T$

$SUR = 26\rho/\ell^* + (\beta - \rho)T$

$T = (\ell^*/\rho) + [(\beta - \rho)/\bar{\lambda}\rho]$

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [(\ell^*/(T K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$P = (\Sigma\phi V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$v = s/t$

$s = V_o t + 1/2\ at^2$

$a = (V_f - V_o)/t$

$w = \theta/t$

$A = \frac{\pi D^2}{4}$

$\dot{m} = V_{av} A \rho$

Cycle efficiency = (Net work out)/(Energy in)

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

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

$t_{1/2}^{eff} = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$I = I_o e^{-\Sigma x}$

$I = I_o e^{-ux}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/u$

$HVL = -0.693/u$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^{\ 2} = I_2 d_2^{\ 2}$

$R/hr = (0.5\ CE)/d^2 (meters)$

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

MAIN STEAM LINE ISOLATION VALVES

LIMITING CONDITION FOR OPERATION

3.7.1.5 Each main steam line isolation valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

MODE 1 - With one main steam line isolation valve inoperable but open, POWER OPERATION may continue provided the inoperable valve is restored to OPERABLE status within 4 hours; otherwise reduce power to less than or equal to 5 percent of RATED THERMAL POWER within 2 hours.

MODE 2 and 3 - With one main steam line isolation valve inoperable, subsequent operation in MODES 2 or 3 may proceed provided:

a. The isolation valve is maintained closed.

b. The provisions of Specification 3.0.4 are not applicable.

Otherwise, be in HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

SURVEILLANCE REQUIREMENTS

4.7.1.5 Each main steam line isolation valve shall be demonstrated OPERABLE by verifying full closure within 5.0 seconds when tested pursuant to Specification 4.0.5.

FIG. 8.1