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

EXAMINATION REPORT NO. 50-29/85-22 (OL)

FACILITY DOCKET NO. 50-29

FACILITY LICENSE NO. DPR-3

LICENSEE: Yankee Atomic Electric Company
1671 Worcester Road
Framingham, Massachusetts

FACILITY: Yankee Nuclear Power Station

EXAMINATION DATES: October 29-31, 1985

CHIEF EXAMINER: _____ 11/26/86
for D. F. Johnson, Lead Reactor Engineer (Examiner) Date

REVIEWED BY: _____ 11/26/86
Robert M. Keller, Chief, Projects Section 1C Date

APPROVED BY: _____ 1/13/86
Harry B. Kister, Chief, Projects Branch No. 1 Date

SUMMARY: Three Senior Reactor Operations (SRO) and four Reactor Operators (RO) were examined. All candidates failed the written examination and one RO candidate also failed the oral operational examination.

REPORT DETAILS

TYPE OF EXAMS: Initial

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail
Written Exam	0/4	0/3
Oral Exam	3/1	3/0
Overall	0/4	0/3

1. CHIEF EXAMINER AT SITE: D. F. Johnson

2. OTHER EXAMINER: F. Jaggar (EG&G)

1. Summary of generic deficiencies noted on oral exams:

   A.) A majority of the candidates exhibited difficulty in determining the magnitude, direction and time frame of changes to major plant parameters during transient conditions.

   B.) In general, most candidates were weak in their ability to apply known theoretical knowledge in the areas of reactor theory and thermodynamics to practical applications, i.e., simple heat balance calculations, and transient effects of reactivity.

2. Summary of generic deficiencies noted from grading of written exams:

   A. Candidates did not demonstrate an adequate level of knowledge and understanding in the following areas:

      (1) operating and emergency procedures
      (2) plant systems design
      (3) instrumentation and controls

   B. Greater than 40% of the candidates were extremely weak in theory of nuclear power plant operation and thermodynamics associated with plant transients.

3. Status of Previously Identified Items

   (Closed) Inspector Follow-up Item (29/85-03-01) - Training material provided was inadequate for preparing RO/SRO examinations.

   The training material provided on July 7, 1985 for the upcoming RO/SRO examinations scheduled for October 1985 were reviewed by the operator licensing staff and found to be satisfactory. Procedures and system descriptions were revised accordingly and were adequate for the preoperation of the written and oral examinations.

   (Closed) Inspector Follow-up Items (29/85-03-02 and 85-03-03) Procedures OP-3250, OP-3111 and OP-3001 were not revised to reflect current system and plant status.

   The following Procedures were reviewed by the Region I staff:

   A. OP-3001, "Large Loss of Load Without a Reactor Scram" Rev. 8, May 1985.

   B. OP-3111, "Malfunction of Primary Pressure or Level Channels" Rev. 8, December 1984.

   C. OP-3250, "Loss of a 120 Volt A.C. Vital Bus" Rev. 10, June 1985.
      OP-3257, "Loss of No. 2 125 Volt DC Battery Bus Power" Rev. 4.

Review of the above procedures verified that revisions were made to reflect the correct and current plant status.

4. Personnel present at Exit Interview:

NRC Personnel

D. F. Johnson, Chief Examiner

NRC Contractor Personnel

F. Jaggar, EG&G

Facility Personnel

L. Laffont, Senior Instructor
D. Peirce, Instructor

5. Summary of NRC Comments made at exit interview:

Preliminary results from the oral examinations were discussed with the licensee. The remaining process of grading the written examinations and turn around time for results were also discussed.

6. Examination Review

At the conclusion of the written examinations, the Chief Examiner met with 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 status. The following licensee personnel were present:

L. Laffont
D. Peirce

Attachments:

1. RO Written Examination and Answer Key
2. SRO Written Examination and Answer Key
3. Facility RO and SRO Examination Comments and Resolutions

ATTACHMENT 1

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: YANKEE ROWE

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/10/22

EXAMINER: HEMMING, W.

APPLICANT: MASTER COPY

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~~ 25.3			1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
~~25.00~~ 24.00	~~25.00~~ 24.20			2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
25.00	~~25.00~~ 25.3			3.	INSTRUMENTS AND CONTROLS
25.00	~~25.00~~ 25.3			4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
~~100.00~~ 99.00	100.00				TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

QUESTION 1.01 (2.00)

a. If the reactor is operating in the power range, how long will it take to raise power from 20% to 40% with a +0.5 DPM Start-up rate?

QUESTION 1.02 (1.50)

Compare the calculated Estimated Critical Position (ECP) for a startup 15 hours after a trip to the actual Critical Rod Position (ACP) if the following events/conditions occurred. Consider each independently. Limit your answer to:

a. ACP higher than ECP.

b. ACP lower than ECP.

c. ACP would not be significantly different than ECP.

1. One Reactor Coolant Pump is stopped one minute prior to criticality.

2. The steam dump pressure controller setpoint is increased to a value just below the code safties setpoints.

3. The startup is delayed 2 more hours.

QUESTION 1.03 (2.00)

If the Source Range (SR) instruments indicate 50 cps with Keff equal to 0.9. Assuming BOC conditions answer the following.

a. What would the SR instruments indicate if the rods were withdrawn to bring Keff equal to 0.95? (1.0)

b. How much reactivity was added? (1.0)

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

QUESTION 1.04 (2.50)

Concerning the Moderator Temperature Coefficient (MTC), state whether the MTC value would be MORE NEG., LESS NEG., or NOT EFFECTED by each of the following. CONSIDER EACH SEPERATELY.

a. Increase in soluble boron concentration.

b. BOC to EOC.

c. Fission Product poison buildup.

d. Burnable posion rod burnup.

e. Insertion of control rods. [0.5 each]

QUESTION 1.05 (1.00)

TRUE OR FALSE?

As Boron concentration increases:

a. Moderator Temperature Coefficient becomes less negative due to increased neutron leakage. (0.5)

b. Moderator Temperature Coefficient becomes more negative due to the increased resonance absorption factor. (0.5)

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

QUESTION 1.06 (4.00)

Using the attached Xenon worth curve, Fig. 1.1, answer the following.

a. Power at T0 was at 70%. What was the approximate power level between T1 and T2? (1.0)

b. What was the length of time between T2 and T3? (1.0)

c. What happened at T2? (1.0)

d. At time T4...

1. All Xenon production stopped.

2. Iodine decay to Xenon has stopped.

3. All Xenon production remains constant, but the burnout increases.

4. Xenon production directly from fission has stopped, but Xenon production from decay of Iodine continues. (1.0)

QUESTION 1.07 (2.00)

After a secondary calorimetric and adjustment of the power range instruments it is discovered that the Auxiliary Feedwater Pumps were operating. HOW and WHY would this occurence effect the power range indication.

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

QUESTION 1.08 (3.00)

Use the steam tables and associated Mollier chart to answer the questions below, label quantites with proper units.

a. During cooldown and depressurization, you are required to remain 50 degrees F subcooled. As the pressure decreases through 2085 psig, what is the maximum Tavg allowed (nearest degree F)? (1.0)

b. Steam is leaking from a pipe flange to atmosphere. A thermocouple placed in the leakage stream reads 400 degrees F. What is the degree of superheat? (1.0)

c. If the thermocouple in part b had read 360 degrees F, and the steam pressure inside the pipe was 560 psia, what would you estimate the steam temperature to be at that pressure? (1.0)

QUESTION 1.09 (2.00)

It is desired to modify a closed-loop system, such as the CCW system, to double the flow. You have three choices to accomplish the modification.

1. Double the speed of the present pump, which is a single stage pump.
2. Add another identical pump to operate in parrallel whith the existing pump.
3. Replace the present pump with a two stage pump.

a. Which of these choices will double the flow and result in the least pump power consumption? (0.5)

b. EXPLAIN the reason for YOUR choice and WHY you rejected the other two choices. (1.5)

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

QUESTION 1.10 (2.50)

a. How would the delta T during natural circulation compare with the 100% power delta T? (0.5)

b. Assuming that the Tave is being maintained constant during natural circulation. What would happen to the delta T if heat removal was stopped from the steam generators? (0.5)

c. What are three items that an operator can check to ensure that natural circulation is satisfactory? (1.5)

QUESTION 1.11 (1.50)

Critical Heat Flux (CHF) is defined as the heat flux at which Departure from Nucleate Boiling (DNB) occurs. For an INCREASE in each of the parameters below, state how the CHF will change. (Consider each parameter separately.)

Limit your answer to Increase, Decrease, or Remains the Same.

a. Reactor Coolant Flow Rate.
b. Reactor Coolant Temperature.
c. Reactor Coolant Pressure. (1.5)

QUESTION 1.12 (1.00)

Explain the response of power AND Tave if two minutes of Emergency Boration is required while the reactor is at 10 -8 amps and 515 F. (1.0)

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

QUESTION 2.01 (3.00)

a. What is the NORMAL water supply to the suctions of the steam driven EBFP and electric driven EBFP? (1.0)

b. State two seperate methods of supplying steam to the SDEBFP.

c. State the alternate and/or emergency source(s) of water available to the steam generators. (1.0)

QUESTION 2.02 (2.00)

a. What is the purpose of the Auxiliary Governor in the Main Turbine Control System? (1.0)

b. What are the consequences of pulling the Auxiliary Governor Test Lever OUT while the reactor is at 100% power? (1.0)

QUESTION 2.03 (2.50)

The following pertain to the Electrical Distribution System at Yankee Rowe.

a. What is the length of and basis for the time delay in starting the High Pressure Safety Injection (HPSI) pumps upon reciept of a Safety Injection Signal? (1.0)

b. What is the voltage above which the diesel generator output breaker will automatically close? (0.5)

c. State the FOUR alarms and trips that are affected by the 'RESET' position on the emergency diesel generator local start switch. (1.0)

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

QUESTION 2.04 (3.00)

a. State the purpose of the SI Accumulator. (0.5)

b. At what pressure is the SI Accumulator injected into the RCS and what volume is injected (cu. ft.)? (1.0)

c. State the purpose and the normal operating pressure of each of the three compressed nitrogen systems associated with the Emergency Core Cooling System. (1.5)

QUESTION 2.05 (3.00)

a. State the purpose of the Shutdown Cooling System. Include the temperature and pressure below which the SDC may be placed in operation. (1.5)

b. Describe the pressure interlock associated with the SDC isolation valves. Include the purpose of the interlock. (1.0)

c. If the Shutdown Cooler is inoperable, what other heat exchanger can be used? (0.5)

QUESTION 2.06 (3.00)

a. What is the approximate lift pressure of the following Component Cooling System relief valves and to where does each relieve?

1. RCP return.
2. Component Cooling Surge Tank. (1.0)

b. A source of makeup water to the Component Cooling Surge Tank is the condensate pump discharge header via LCV-200.

1. When is this source of water used?

2. What is a possible consequence of using this source?

3. What is the other source of makeup to the surge tank? (1.5)

c. Explain how cooling water can be supplied to the RCPs if both CCW pumps are inoperable. (0.5)

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

QUESTION 2.07 (3.00)

a. Boric Acid Mix Tank temperature must be maintained above 155 DEG F when adding makeup water to the tank. How is this accomplished when the makeup water is cold? (1.0)

b. Why are the anion resin bed ion exchangers valved and locked out of service during normal operations? (1.0)

c. Why must level be maintained greater than 30" in the Low Pressure Surge Tank? (1.0)

QUESTION 2.08 (3.00)

a. Why does the Condensate Recirculation Valve (CV-405) open automatically on a reactor scram above 15 MWe? (0.6)

b. List the Condensate Pump automatic trips. (1.6)

c. What is the normal discharge pressure at full load conditions of the:

1. Main Condensate Pump?

2. Boiler Feed Pump? (0.8)

QUESTION 2.09 (2.50)

The following concern Main Coolant Pumps (MCP):

a. How is cavitation prevented in a MCP and how are net positive suction head (NPSH) requirements ensured? (1.5)

b. How does the differential pressure developed by a MCP change as coolant temperature increases from 100 DEG F to 510 DEG F? Explain your answer. (1.0)

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

QUESTION 3.01 (1.50)

a. During routine shutdown operations, from where does CC-TCV-200 get a signal to open? (0.5)

b. From where does CC-TCV-200 get a signal during normal operations. (0.5)

c. At what MCS temperature is control of CC-TCV-200 shifted. (0.5)

QUESTION 3.02 (3.00)

a. Describe how a loss of control air pressure will effect the #1 AND #3 charging pump. (1.0)

b. Describe how each of the three charging pumps can be used to control pressurizer level if control air is not available. (2.0)

QUESTION 3.03 (2.00)

a. What actuates a rod stop condition during control rod motion? (0.5)

b. Describe the three ways that a 'rods in motion' signal can be developed. (1.5)

QUESTION 3.04 (2.00)

a. List the five conditions that will cause #2 MCP to trip. (1.5)

b. What interlock must be satisfied for a loop stop valve to open? (0.5)

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

QUESTION 3.05 (2.50)

a. What signal(s) will energize the Non-Return Valve (NRV) automatic trip relays? (1.0)

b. When the NRV's recieve an automatic trip signal while the reactor is at full power, what other automatic actions may be initiated as a result of the same closure signal? (1.0)

c. At what point during an MCS cooldown is the NRV auto close blocked? (0.5)

QUESTION 3.06 (3.00)

Describe how the indication from the 3 level detectors on the pressurizer will respond if:

a. the signal from the linear amplifier fails low.

b. the reference leg flashes to steam. (3.0)

QUESTION 3.07 (2.50)

a. From what part of the MCS does the Low Temperature Overpressure Protection (LTOP) system receive its operating signal? (0.5)

b. Describe the four functions of the "Kirk Key Interlock" when it is in the "ARMED" position. (2.0)

QUESTION 3.08 (2.00)

a. The Feedwater Control System maintains a level in the steam generators at a set value using both feed forward and feedback control. ~~Which of~~ 3rd Quadrant the parameter inputs are used for:

1. Feed forward?

2. Feedback? (2.0)

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

QUESTION 3.09 (2.00)

a. What is the automatic trip signal and setpoint that will close the Steam Dump valve MS-PCV-402? (0.5)

b. If the trip condition has not cleared, how can MS-PCV-402 be reopened? (0.5)

c. After the trip condition has cleared, in what mode (auto or manual) should MS-PCV-402 be shifted to recover the valve? Explain. (1.0)

QUESTION 3.10 (1.50)

a. What four parameters are plotted on the generator capability curve? (1.0)

b. With generator carrying a 'lagging' load, how can the generator Power Factor be improved? (0.5)

QUESTION 3.11 (3.00)

a. What radiation monitor(s) would be used to indicate a sudden fuel failure? (1.0)

b. How would an operator distinguish between a fuel failure and a failure of the detector or other circuit malfunction? (1.0)

c. Describe in general terms what action would be taken to minimize the radiological effects of this failure. (1.0)

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

QUESTION 4.01 (2.00)

The following concern OP-3054, Natural Circulation.

a. How is the plant cooled down if the condenser vacuum is lost due to loss of AC power? (1.0)

b. Why must the water treatment plant be restarted as soon as practical? (1.0)

QUESTION 4.02 (1.50)

State the criterion used to determine which attachment (A,B,orC) to OP-3000, Emergency Shutdown from Power, is used.

QUESTION 4.03 (2.50)

Reactor Engineering has determined that containment leakage has exceeded allowable levels and OP-3007, Loss of Vapor Containment, has been initiated.

a. What must be done to the plant and how much time can elapse before this must be accomplished. (1.0)

b. If the leakage is not corrected after part "a" is established, what must be done and in what period of time must it be done in? (1.5)

QUESTION 4.04 (2.00)

According to OP-3010, Fire or Forced Evacuation of the Control Room, which case,I,II,orIII, directs the operator to check the ventilation lineup? What is the reason for this direction?

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

QUESTION 4.05 (3.00)

a. Immediate operator action step 6 of OP-3051, Loss of Main Coolant Pressure and/or Safety Injection Actuation, is 'Accident Diagnostics'. State the three substep diagnostics that comprise this immediate action. (Para-phrasing is allowable) (1.5)

b. In addition to 'a' above, list FIVE other major immediate actions stated in OP 3051. Sub-steps not required. (1.5)

QUESTION 4.06 (1.00)

Per OP-3111, Malfunction of Primary Pressure or Level Channels, what 2 actions must be taken if the failed channel is from loop 1 or 2 and SIAS is initiated. (1.0)

QUESTION 4.07 (1.50)

OP-3115, Loss of Component Cooling, directes the stopping of the Main Coolant Pumps (MCP). If bearing water temperature exceeds a specified value after they are stopped, a special requirement is placed on any pump restarts. State the temperature limit and the special requirement placed on subsequent restarts.

QUESTION 4.08 (3.50)

List ALL of the equipment that must be operated either manually or locally during a 'Loss of #1 125 Volt D.C. Bus Power', OP-3257.

QUESTION 4.09 (2.00)

List ALL classifications of emergencies in order of severity, least to worst, per OP-3300, Classification of Emergencies.

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

QUESTION 4.10 (2.00)

The following concern OP-2151, Boric Acid Addition To The Main Coolant.

a. List the two ways boric acid may be added to the MCS. Be specific as to when each can be used. (1.0)

b. Above what pressure and/or temperature requirements must each loops SI MOV be locked open with its motor operator electrically inoperative? (0.5)

c. What plant conditions (temperature and/or pressure) are required in order to add boric acid to a single loop? (0.5)

QUESTION 4.11 (3.00)

The following pertain to 10 CFR 20.

a. Define:
- Restricted Area.
- Radiation Area
- Occupational Dose. (1.5)

b. State the maximum allowable wholebody quarterly occupational dose an individual may receive in a restricted area. What can this limit be increased to and what must be done to increase it? (1.5)

QUESTION 4.12 (1.00)

According to OP-2100, Plant Startup From Cold Shutdown, what requirements must be met when MCS temperature is between 300 F and 440 F?

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

EQUATION SHEET

$F = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

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

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

$Pwr = W_f \omega h$

$v = s/t$

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

$a = (V_f - V_o)/t$

$w = s/t$

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

$\dot{m} = V_{av} A_p$

$p = p_o 10^{sur(t)}$

$p = p_o e^{t/T}$

$SUR = 26.06/T$

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

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

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

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

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

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

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

$\Sigma = \sigma N$

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

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

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

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

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

$I = I_o e^{-ux}$

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

$TVL = 1.3/u$

$HVL = -0.693/u$

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

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

$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$

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

$M = (1 - K_{eff_o})/(1 - K_{eff_1})$

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

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

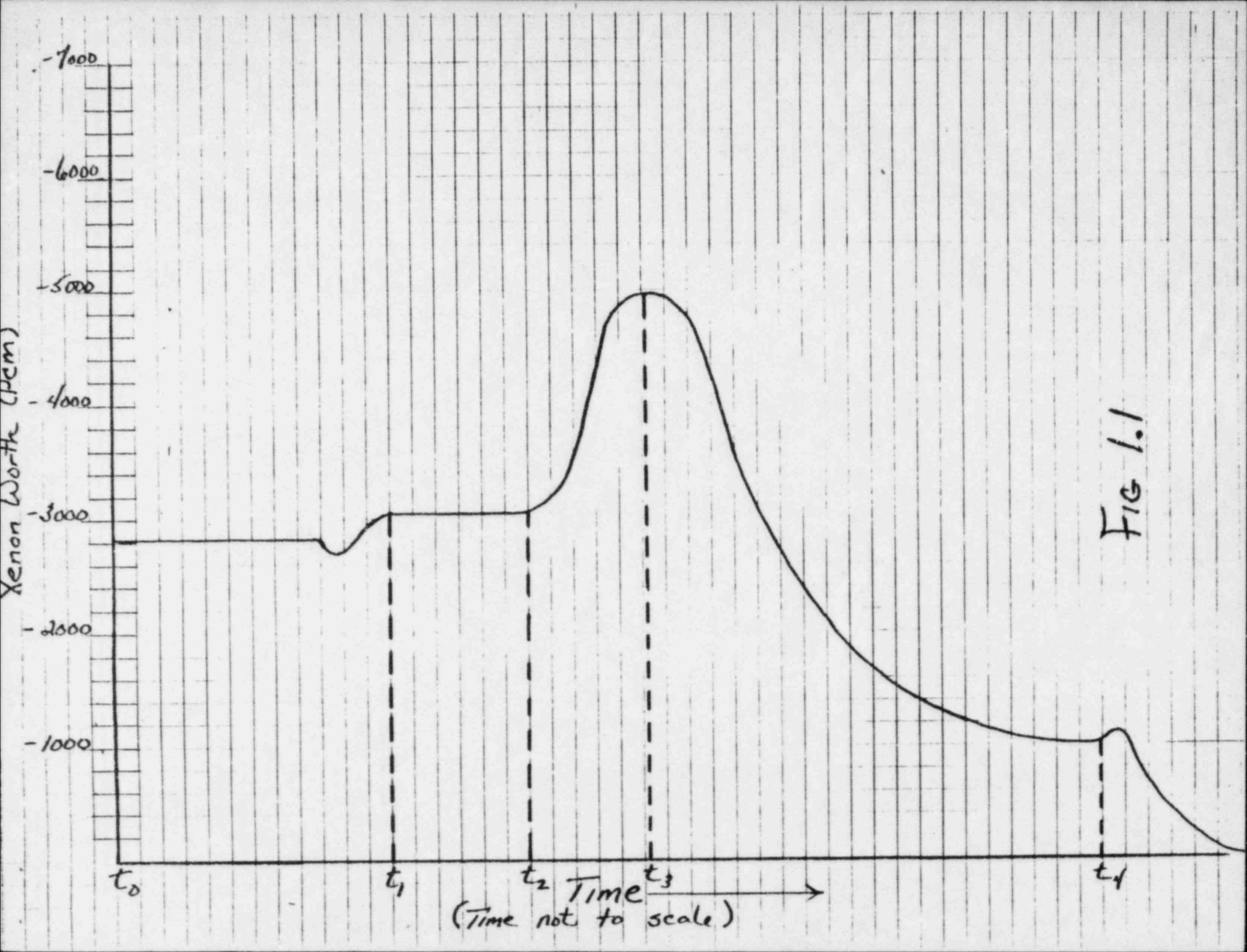
-7000
-6000
-5000
-4000
-3000
-2000
-1000
Xenon Worth (pcm)
t_0
t_1
t_2
t_3
t_4
Time
(Time not to scale)

FIG 1.1

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

MASTER COPY

ANSWER 1.01 (2.00)

sur(t)
P=P 10
0 .5(t)
40=20X10
.5(t)
2=10

.3=.5(t)

t=.6 minutes or 36 seconds. [1.0 for solution and 1.0 for answer] (2.0)

REFERENCE
SQNP, Q & A Bank , sec 1-11
ROWE, Reactor Training Manual, pp 3-142 - 3-145

ANSWER 1.02 (1.50)

1. c same

2. a Axyle

3. b Lower [0.5 ea.]

REFERENCE
SQNP, Review of Core Poisons, pp. 4 - 7
ROWE Reactor Operator Training Manual, pp 3-202 - 3-211 and 3-241 - 3-261

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 1.03 (2.00)

a. $C_1(1-K_1) = C_2(1-K_2)$
$50(1-.9) = X(1-.95)$
$5 = X(.05)$
$X = 100$ counts [.5 solution, .5 answer] (1.0)

b rho= K-1/K $K_1-1/K_1 = K_2-1/K_2$
$.9-1/.9 = .95-1/.95$
$.1111 = .0526$ $.1111-.0526 = .0585$ [.5 sol, .5 answer] (1.0)

REFERENCE
SQNP, Subcritical Multiplication lesson, p. 5; Review of Kinetics, p. 3
Cook Theory, Pp. I-4.13-15. KA001/000,K5.49,2.9.
ROWE Reactor Operator Training Manual, pp 3-155 - 3-160

ANSWER 1.04 (2.50)

a. ~~MORE~~ Less NEG.

b. MORE NEG.

c. MORE NEG.

d. LESS NEG.

e. MORE NEG. [0.5 each]

REFERENCE
ROWE Reactor Operator Training Manual, pp 3-202 - 3-211

ANSWER 1.05 (1.00)

a. False

b. False

REFERENCE
IP-3 ECI Rx Theory; Chapter 7, Pages 21, 22, and 27
DCC Rx Theory Review Text, pp. I-5.42 - .50
SHNP, RT-LP-1.13, Pp. 11-18.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ROWE Reactor Operator Training Manual, p. 3-233

ANSWER 1.06 (4.00)

a. 90% +/- 10%

b. 8 hours

c. Power reduced to 10%

d. 4 [1.0 each]

REFERENCE
SQNP, Review of core poisons lesson, p. 6 KA004/000,K3.20,3.6.
Cook Theory, Pp. I-5.57-77.
SHNP, RT-HO-1.11.
ROWE Reactor Operator Training Manual, Sec. 3, pp 241-261 and Fig. 46

ANSWER 1.07 (2.00)

NI power would be adjusted to a lower value than the actual reactor power [1.0]. This is caused by the lowering of the average feedwater temperature vs. the indicated feedwater temperature used in the calculation [1.0]. [0.5] and indicated feed flow ~~inaccurate~~ reads erroneously low [0.5] (2.0)

REFERENCE
ROWE Reactor Operator Training Manual, Sec. 2, pp 17-20, 26-27, 30-31, 84-85, 100-107

ANSWER 1.08 (3.00)

a. 592 - 593 degrees F depending on how round-off is done.

b. 188 degrees F of superheat per superheat tables.

c. 300 degrees F. 478° [1.0 each]

REFERENCE
ROWE, Steam Tables and Mollier chart

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 1.09 (2.00)

a. Choice 2. (0.5)

b. Choice 2 - A second pump in parallel will only double power requirements while doubling flow (at the same resistance) (0.5)

Choice 1 - Doubling the speed of the present pump will double the flow (no change in system resistance), but will increase power required by 8 times. (0.5)

Choice 3 - A 2 stage pump will increase head, but will not double flow, even if resistance is held constant. (0.5)

REFERENCE
ROWE Reactor Operator Training Manual, Sec. 2, PP 49-51, 90-92

ANSWER 1.10 (2.50)

a. Delta T less than full load delta T (42 F) [0.5]

b. Decrease [0.5]

c. 1. System above sat. pressure for the hottest point of system.
2. Delta T less than 100% power delta T.
3. Ensure adequate heat sink (S/Gs operable) [0.5 each]
4. Loop T_H stable
5. No abnormal Δ between core exit TC and T_H
6. T_C constant or decreasing and following T_{sat}
7. ↑ of S/G increased in STM Demand will cause T_C to ↓, T_{sat}, TC ↓

REFERENCE
ROWE Reactor Operator Training Manual, Sec. 2, PP 54-63 and Problems.

ANSWER 1.11 (1.50)

a. Increase

b. Decrease

c. Increase [0.5 each] (1.5)

REFERENCE
TP Thermodynamics and Fluid Flow Topics, P. 196-203. PT 149
ROWE Reactor Operator Training Manual, Sec. 2, PP 72-79

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 1.12 (1.00)

Tave is determined by the amount of pump heat and the steam dump pressure setting - it does not change. Power decreases at a -1/3 DPM rate to source level. (1.0)

REFERENCE
Yankee Rowe Reactor Operator Training Manual (ROTM)
Chap. 3 pp. 199-211; 144

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 2.01 (3.00)

a. Steam- Demin water storage tank.(Tk-1)
Electric- Primary water storage tank.(Tk-39) [.5 ea] (1.0)

b. Building heating system.
#2 and #3 main steam headers. [.5 ea] (1.0)

c. Charging pumps discharge header.
Safety Injection system. [.5 ea] (1.0)

REFERENCE
Rowe, RSTM, P. 3-93, 3-101.

ANSWER 2.02 (2.00)

a. Causes rapid closure of the control valves when the acceleration of the turbine is 3% of rated speed per second or greater. (1.0)

b. A reactor scram and turbine trip will occur. (1.0)

REFERENCE
Rowe, RSTM 6-41.

ANSWER 2.03 (2.50)

a. A 10 second time delay is used to allow voltage on the emergency bus to return to normal before starting the HPSI pump. (1.0)

b. >/= 460 Volts. (0.5)

c. Overspeed, overcrank, high water temperature, and low oil pressure. (1.0)

REFERENCE
Rowe, RSTM 19-22, RSTM 9-3-1, RSTM 3-1, 3-2.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 2.04 (3.00)

a. To inject borated water into the RCS cold leg in the event of a large LOCA. (0.5)

b. LOCA pressure- 473 psig. (+/- 10)
Water injected- 700 cu.ft. [.5 ea] (1.0)

c. 1294 - 1425 psig....used as injection pressure on SI actuation.
500 psig.....used to supply the pilot actuators on three accumulator relief valves.
100 psig.....used to open three trip valves (604,5,6) and to close trip valve 608 on accumulator low level.
[.2 ea pressure, 3 ea purpose] (1.5)

REFERENCE
Rowe, RSTM 19, pp. 19-49 and 53-56.

ANSWER 2.05 (3.00)

a. The SDC is used to cool the RCS from 330 F and 300 psig to 140 F or less during the final stages of plant cooldown. The SDC also removes decay heat over a long period of time following the cooldown. (1.5)

b. Valves (MOV-553 and 554) cannot be opened unless pressurizer pressure is < 375 psig. [0.5] The purpose is to prevent inadvertant overpressurization of the SDC system. [0.5] (1.0)

c. The LPST cooler can be used. (0.5)

REFERENCE
Rowe, STM Ch. 21, p.1.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 2.06 (3.00)

a. 1. NST at 150 psig [0.25]
   2. VC Drain Tank or the Brass Box Drain at 48 psig [0.25]. (1.0)

b. 1. When Component Cooling Surge Tank level is low, not normal supply, emergency via. [0.25]
   2. Could cause a BFP trip.
   3. Demin water from PWST via LPST makeup pump header [.5 ea] (1.5)

c. A hose connection permits the use of fire water as an emergency source of water. (0.5)

REFERENCE
Rowe, STM Ch. 20, P.19,21.

ANSWER 2.07 (3.00)

a. The steam supply temperature regulating valve on the tank heater is bypassed. (1.0)

b. They would remove boric acid from the coolant thereby causing a change in reactivity (1.0)

c. To provide the volume required to quench pressurizer safety valve discharge. delete (1.0)

REFERENCE
a. STM 17-11
b. STM 16-12
c. STM 16-16

ANSWER 2.08 (3.00)

a. To provide adequate flow through the air ejector [0.2] and gland steam condensers [0.2]. (0.6)

b. 1. High Vapor Container pressure w/ Low main steam pressure
   2. Overcurrent
   3. Undervoltage
   4. Stuck breaker (1.6)

c. 1. 200 psig +/-20 psig
   2. 750 psig +/-50 psig (0.8)

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

REFERENCE
STM Chap. 3 pp. 4, 17, 20

ANSWER 2.09 (2.50)

a. By maintaining the Main Coolant System dynamic and static pressure head at the pump impeller above saturation pressure. [.75] Minimum pressure for Main Coolant Pump operation is 250 PSIG, ~~[.75]~~ [0.375] and 200 psig above Sat. press. as min. [0.375] (1.5)

b. The differential pressure drops(from 99 to 78 PSIG) [0.5] due to the change in coolant density. [0.5] (1.0)

REFERENCE
STM 13-10

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 3.01 (1.50)

a. SDCP suction.

b. LPST temperature.

c. 140 F. [.5 each] (1.5)

REFERENCE
Rowe, STM 21-8, 21-8, 9.

ANSWER 3.02 (3.00)

a. Charging flow from the pumps will go to zero and the pumps (all three) will trip. (1.0)

b. Charging pump #2 can be used by pulling the F-8 fuses located inside the main control board.
Charging pumps 1 and 3 can be used by manually controlling the pumps speed locally at the pump.
[1.0 each] (2.0)

REFERENCE
Rowe, RSTM, p. 15-24, 15-25.

ANSWER 3.03 (2.00)

a. High SUR of 1.5 DPM on either I.R. Channels. (0.5)

b. 1. Placing selector switch in 'all in' position.
2. High Tave with selector switch in 'auto'.
3. Manual switch to 'in' position. [.5 each] (1.5)

REFERENCE
Rowe, RSTM 34-13, 34-15.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 3.04 (2.00)

a. 1. Manual.
2. Undervoltage.
3. Overcurrent.
4. {Loop bypass valve closed. and
{Either Th or Tc stop valve closed. [.375 each] (1.5)

0.3 off for extra wrong answers

b. ~~[illegible]~~ </= 20 F. [Co.25] (0.5)
Tc of loop with valve shut is not more than 20°F colder than max. temp of other Tc (0.25)

REFERENCE
Rowe, RSTM, p. 13-16,-17,-18,-20.

ANSWER 3.05 (2.50)

a. Low steam line pressure and high containment pressure. (1.0)

b. Condensate pump trip and reactor trip. (1.0)

c. 1800 psig. (0.5)

REFERENCE
Rowe, ROTM, Chapter 9, p. 7-11. Chapter 6, p.6-97, 6-85.

ANSWER 3.06 (3.00)

a. PR-LT-6 (NR) indicates low level.
PR-LT-8 (WR) indicates low level.
PR-LT-705 (WR) ~~indicates high level~~. no change [.5 each] (1.5)

b. PR-LT-6 (NR) indicates higher than actual.
PR-LT-8 (WR) indicates higher than actual
PR-LT-705 (WR) indictes lower than actual. [.5 each] (1.5)

REFERENCE
Rowe, FSAR chapter 201, ROTM 6-43,44.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 3.07 (2.50)

a. Loop 1 hot leg. (0.5)

b. 1. Resets [0.1] 'LTOP System Misaligned' alarm on MCB. [0.4]
2. When MCS is less than 450 psig [0.25] the 'LTOP System Armed' alarm will actuate [0.25]
3. The 'LTOP System High Pressure' alarm is enabled at 400 psig.
4. Enables power operated [0.15] and motor operated relief [0.15] valves to actuate at 500 psig [0.2]

[.5 each] (2.0)

REFERENCE
Rowe, ROTM 6-54, RSTM 14-20.

ANSWER 3.08 (2.00)

Steam flow (pressure compensated)
Steam generator level (2.0)

REFERENCE
Engineering Design Change 83-03

ANSWER 3.09 (2.00)

a. Low condenser vacuum ---18 inches (0.5)

b. Must be opened manually at the mezzanine. (0.5)

c. Should be placed in the manual mode. If placed in Auto. the valve will return to required setpoint at a rate determined by the error between actual pressure and the controller set point. (1.0)

REFERENCE
Engineering Design Change 83-03

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 3.10 (1.50)

a. Megawatts
Megavars
Constant Power Factor
Hydrogen Pressure (1.0)

b. ~~Decreasing~~ Increasing field current by ~~lowering~~ raising generator voltage sheds inductive load. (0.5)

REFERENCE
ROTM Chap. 9 pp. 1-6; 1-7

ANSWER 3.11 (3.00)

a. (1) Bleed Line Process Radiation Monitor.
(2) Accident Area Radiation Monitor. [0.5each] (1.0)

b. Survey Valve Room piping with portable radiation instruments to verify bleedline radiation level. (1.0)

c. Reduce power commensurate with system demands [0.5] and maximize purification flow. [0.5] (1.0)

REFERENCE
OP 3100, p. 1, 2

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 4.01 (2.00)

a. Manually use and throttle the emrgency atmospheric steam dumps. (1.0)

b. To prevent exceeding the T.S. requirment of 85,000 gallons. (1.0)
or indicate you are ~~losing~~ Losing water inventory and need make up

REFERENCE
Rowe, OP-3054.

ANSWER 4.02 (1.50)

Attachment A- No auto isolation of #1 2400 Volt bus (normal trip).

Attachment B- Auto isolation and re-energization of #1 2400 Volt bus.

Attachment C- Auto isolation and de-energization of #1 2400 Volt bus.

[.5 each] (1.5)

REFERENCE
Rowe, OP-7000, P.1.

ANSWER 4.03 (2.50)

a. Must be in Hot Standby within 6 hours. (1.0)

b. Must proceed to Cold Shutdown (0.5) below 300 psig (0.5) within 30 hours. (0.5) (1.5)

REFERENCE
Rowe, OP-3007, P.1.

ANSWER 4.04 (2.00)

The direction is a note located in the symptoms section which applies to all cases. [.0] The direction is there to ensure the smoke is not entering the control room from an external source. [.0] (2.0)

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

REFERENCE
Rowe, OP-3010, P.1.

ANSWER 4.05 (3.00)

a. 1. If condenser air ejector radiation and/or steam line radiation is high AND containment pressure/radiation are normal, go to OP-3107, S/G Tube Rupture.

2. If steamline pressure is low and decreasing in one or more S/G's, go to OP-3201, Steamline Break.

3. If VC pressure, OR VC radiation are high or increasing, go to OP-3106, Loss of Main Coolant.
[.5 each] (1.5)

b. -Initiate OP-3000. (Emergency Shutdown From Power)
If SI is spurious, go to attachment A.
-Verify SI initiation at 1700 psig.
-Verify containment isolation.
-Insure emergency power is available.
-Initiate heat removal via intact S/G's.
-Initiate OP-3300. (Classification of Emergencies)
[any 5 at .3 each] (1.5)

REFERENCE
Rowe, OP-3051, P.2-3.

ANSWER 4.06 (1.00)

1. Switch inoperable SI channel to manual.
2. Commence realignment of SI System after inadvertant actuation. (1.0)

REFERENCE
Rowe, OP-3111, P. 2.

ANSWER 4.07 (1.50)

200 F [.5]

CCW water must flow at 135 gpm [.5] for 20 minutes. [.5] (1.5)

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

REFERENCE
Rowe, OP-3115, p.2.

ANSWER 4.08 (3.50)

Main turbine.
#2 Boiler feedpump.
#3 Boiler feedpump.
Condensate recirc ~~pump~~ valve
OCB Z-126.
OCB Y-177.
Generator exciter field breaker. [.5 each] (3.5)
#2 Heater Drain pump

REFERENCE
Rowe, OP-3257, p.2.

ANSWER 4.09 (2.00)

Unusual Event.
Alert.
Site Area Emergency.
General Emergency. [.5 each] (2.0)

REFERENCE
Rowe, OP-3300, p.1.

ANSWER 4.10 (2.00)

a. -Via the normal charging line, any mode.
-Via the Loop Fill Line, <300 psig or </= 200 F. [.5 each] (1.0)

b. When MCS pressure is >/= 1000 psig or >330 F. (0.5)

c. </= 330 F or < 1000 psig. (0.5)

REFERENCE
Rowe, OP-2151, p.1-2.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 4.11 (3.00)

a. -Any area access to which is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.
-Any area, accessible to personnel, in which there exists radiation... at such levels that a major portion of the body could receive in one hour a dose in excess of 5 mrem, or in any 5 consecutive days a dose in excess of 100 mrem.
-Exposure to radiation in restricted areas or in the course of employment in which duties involve exposure to radiation. Shall not include exposure for the purposes of medical diagnosis or therapy. [.5 each definition] (1.5)

b. 1 1/4 rem per quarter.[.3]
3 rem per quarter not to exceed 5(N-18).[.6] Must have form NRC-4 on file AND past exposure calculated. [.6] (1.5)

REFERENCE
Rowe, 10 CFR 20.3,101,and 202.

ANSWER 4.12 (1.00)

-Maintain a 500 psig margin between plant conditions and the NDT Upper Limit Curve.
-Dedicate an operator to monitor MCS pressure, pzr. heaters, SI pumps, and valve lineup. [.5 each] (1.0)

REFERENCE
Rowe, OP-2100, p.2.

ATTACHMENT 2

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

FACILITY: YANKEE ROWE

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/10/29

EXAMINER: HENNING, W.

APPLICANT: MASTER COPY

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~~ 26.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
~~25.00~~ 24.00	~~25.00~~ 24.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	~~25.00~~ 26.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
~~25.00~~ 24.00	~~25.00~~ 24.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
~~100.00~~ 98.00	100.00			TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

QUESTION 5.01 (3.00)

Use the steam tables and associated Mollier chart to answer the questions below, label quantites with proper units.

a. During cooldown and depressurization, you are required to remain 50 degrees F subcooled. As the pressure decreases through 2085 psig, what is the maximum Tavg allowed (nearest degree F)? (1.0)

b. Steam is leaking from a pipe flange into a room. A thermocouple (TC) placed in the leakage stream reads 400 degrees F. How many degrees of superheat is this? (1.0)

c. If the thermocouple in part b had read 360 degrees F, and the steam pressure inside the pipe was 560 psig, what would you estimate the steam temperature to be at that pressure? (1.0)

QUESTION 5.02 (1.00)

The reactor is producing 100% rated thermal power at a core delta T of 42 degrees and a mass flow rate of 100% when a blackout occurs. Natural circulation is established and core delta T goes to 28 degrees. If decay heat is 2%, what is the core mass flow rate (in %)?

QUESTION 5.03 (2.00)

Assume one Reactor Coolant Pump trips at 30% power, without a reactor protective system actuation or a change in turbine load. Indicate whether the following parameters will INCREASE, DECREASE or REMAIN THE SAME.

a. Flow in the OPERATING reactor coolant loops.

b. Reactor vessel Delta P

c. Core Delta T

d. An OPERATING LOOP steam generator steam flow (2.0)

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

QUESTION 5.04 (1.50)

What effect does nucleate boiling have on heat transfer in the core (increase, decrease or no effect)? Explain the mechanism of this effect. (1.5)

QUESTION 5.05 (1.50)

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)

QUESTION 5.06 (1.50)

What is the most significant type of heat transfer (conduction, convection, or radiation) taking place under each of the following conditions? Consider each condition separately.

a. Nucleate boiling.
b. Accident condition in which coolant is boiled and converted to steam in the reactor vessel.
c. Heat from fission thru the fuel rod.
d. Decay heat removal by natural circulation of coolant.
e. Decay heat of fission products to clad surface.

[0.3 each]

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

QUESTION 5.07 (2.50)

a. How AND why does the Doppler Defect change as reactor power is increased? (1.0)

b. How does each of the following affect the Fuel Temperature Coefficient(More negative, less negative, or no effect)?

1. Accumulation of Xenon and Krypton gases in the fuel to clad gap.

2. Increase in the amount of fuel to clad contact.

3. Buildup of PU239 over core life. (1.5)

QUESTION 5.08 (1.50)

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

b. Explain why you agree or disagree with the following statement: 'Equilibrium Samarium concentration at 50% power is approximately half its concentration at 100% power.' (0.5)

QUESTION 5.09 (1.00)

For a reactor operating at a constant power and temperature, the thermal neutron flux near EOL will be (GREATER THAN, SMALLER THAN, or THE SAME AS) the flux near BOL? EXPLAIN. (1.0)

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

QUESTION 5.10 (3.00)

a. Define the term 'Shutdown Margin'. (0.5)

b. The reactor is at 70% power with rod control in automatic. Power level is increased to 80%. (Assume boron is constant throughout and sufficient rod worth to accomodate the change.) EXPLAIN each answer.

1. What happens to Shutdown Margin immediately following the power change? (0.5)

2. Five hours after the transient? (0.5)

3. Thirty hours after the transient? (0.5)

c. Would your answer to part 'b.1' be any different if the operator had adjusted boron concentration for the power change? EXPLAIN. (1.0)

QUESTION 5.11 (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 control rod position if the following events/conditions occurred. Consider each independently. Limit your answer to HIGHER than, LOWER than, or SAME as the ECP.

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

b. The startup is delayed until 9 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 being raised by 5% as the ECP is reached. (0.5)

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

QUESTION 5.12 (1.50)

Compare the responce of the followins at BOL and EOL to a dropped rod at full power. (Assume all rods out, the dropped rod has the same worth at BOL and EOL, and the reactor does not trip, no operator action.)

a. Initial power drop. (Greater or Less) Explain. (0.5)

b. Rate of power recovery. (Faster or Slower) Explain. (0.5)

c. Final steady state Tave. (Higher or Lower) Explain. (0.5)

QUESTION 5.13 (2.50)

a. What two coefficients of reactivity are used to calculate the Isothermal Temperature Coefficient? (1.0)

b. HOW and WHY is the magnitude of the Isothermal Temperature Coefficient effected by an decrease of boron concentration from 500 ppm to 100 ppm at EOL conditions? (1.5)

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

QUESTION 6.01 (2.00)

a. What is the purpose of the Auxiliary Governor in the Main Turbine Control System? (1.0)

b. What are the consequences of pulling the Auxiliary Governor Test Lever OUT while the reactor is at 100% power? (1.0)

QUESTION 6.02 (2.50)

The following pertain to the Electrical Distribution System at Yankee Rowe.

a. What is the length of and basis for the time delay in starting the High Pressure Safety Injection (HPSI) pumps upon reciept of a Safety Injection Signal? (1.0)

b. What is the voltage above which the diesel generator output breaker will automatically close? (0.5)

c. State the FOUR alarms and trips that are affected by the "RESET" position on the emergency diesel generator local start switch. (1.0)

QUESTION 6.03 2.00 (~~3.00~~)

a. Boric Acid Mix Tank temperature must be maintained above 135 DEG F when adding makeup water to the tank. How is this accomplished when the makeup water is cold? (1.0)

b. Why are the anion resin bed ion exchangers valved and locked out of service during normal operations? (1.0)

~~c. Why must level be maintained greater than 30" in the Low Pressure Surge Tank?~~ deleted part "c". WCH

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

QUESTION 6.04 (2.50)

The following concern Main Coolant Pumps (MCP):

a. How is cavitation prevented in a MCP and how are net positive suction head (NPSH) requirements ensured? (1.5)

b. How does the differential pressure developed by a MCP change as coolant temperature increases from 100 DEG F to 510 DEG F? Explain your answer. (1.0)

QUESTION 6.05 (3.00)

a. Describe how a loss of control air pressure will effect the #1 AND #3 charging pump. (1.0)

b. Describe how each of the three charging pumps can be used to control pressurizer level if control air is not available. (2.0)

QUESTION 6.06 (2.00)

a. List the five conditions that will cause #2 MCP to trip. (1.5)

b. What interlock must be sat fied for a loop stop valve to open? (0.5)

QUESTION 6.07 (2.50)

a. What signal(s) will energize the Non-Return Valve (NRV) automatic trip relays? (1.0)

b. When the NRV's receive an automatic trip signal while the reactor is at full power, what other automatic actions may be initiated as a result of the same closure signal? (1.0)

c. At what point during an MCS cooldown is the NRV auto close blocked? (0.5)

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

QUESTION 6.08 (2.50)

a. From what part of the NCS does the Low Temperature Overpressure Protection (LTOP) system receive its operating signal? (0.5)

b. Describe the four functions of the 'Kirk Key Interlock' when it is in the 'ARMED' position. (2.0)

QUESTION 6.09 (2.00)

a. What is the automatic trip signal and setpoint that will close the Steam Dump valve MS-PCV-402? (0.5)

b. If the trip condition has not cleared, how can MS-PCV-402 be reopened? (0.5)

c. After the trip condition has cleared, in what mode (auto or manual) should MS-PCV-402 be shifted to recover the valve? Explain. (1.0)

QUESTION 6.10 (3.00)

a. What radiation monitor(s) would be used to indicate a sudden fuel failure? (1.0)

b. How would an operator distinguish between a fuel failure and a failure of the detector or other circuit malfunction? (1.0)

c. Describe in general terms what action would be taken to minimize the radiological effects of this failure. (1.0)

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

QUESTION 7.01 (2.00)

For each of the listed responsibilities or authorities, indicate whether it corresponds to the Shift Supervisor (SS) position, Supervisory Control Room Operator (SCRO) position, or BOTH. (Use a separate answer page)

1. To know what records, reports, surveillance procedures, and logs are required to be maintained and direct their completion.

2. To determine any plant activity which could jeopardize personnel safety or plant equipment.

3. To grant permission to other departments to perform their procedures, such as operational or surveillance procedures when required by that procedure.

4. To obtain assistance from other plant personnel when conditions warrant.

5. To grant permission to personnel to enter vital areas.

6. To shutdown the reactor when it is determined that the safety of the plant is in jeopardy or when operating parameters exceed reactor protection setpoints.

7. To be explictly aware of when a safety related system is removed from or returned to service and to ensure the information is transmitted to all appropriate personnel.

8. To maintain the skills of the operating shift by passing on information gained from LERs, standing orders, and changes to systems and procedures.

QUESTION 7.02 (3.00)

a. Procedure OP-4708, Determination of Shutdown Margin, provides a method of calculating shutdown margin (SDM) for three conditions. Being specific, list the three conditions and include applicable modes. (1.5)

b. When must a SDM be calculated? Include any applicable modes, time limits, or other conditions. (1.5)

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

QUESTION 7.03 (3.00)

The followins concern OP-2156, Operation of the Component Cooling System.

a. What precaution must be taken when startins a CCW pump? Why? (1.0)

b. If CCW pressure drops to 50 psis with both pumps runnins, what must be done? (1.0)

c. State the minimum flow required through the CCW pump. What can be done to achieve this minimum? Why is the minimum required? (1.0)

QUESTION 7.04 (2.00)

The followins concern OP-2151, Boric Acid Addition To The Main Coolant.

a. List the two ways boric acid may be added to the MCS. Be specific as to when each can be used. (1.0)

b. When must each loop's SI MOV be locked open with it's motor operator electrically inoperative? (0.5)

c. What plant conditions are required in order to add boric acid to a sinsle loop? (0.5)

QUESTION 7.05 (1.50)

Per OP-2101, Plant Startup From Hot Standby, when must the entire SI system be in the Automatic Operational Lineup? State any associated modes. (1.5)

QUESTION 7.06 (2.00)

List the immediate operator actions required by OP-3004, Plant Action In the Event of a Bomb Threat, Situation II, Bomb Threat Phone Call With Breach of Plant Protected Area. (2.0)

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

QUESTION 7.07 (1.00)

According to OP-2100, Plant Startup From Cold Shutdown, what requirements must be met when RCS temperature is between 300 F and 440 F?

QUESTION 7.08 (1.00)

If the Control Room must be evacuated immediately, what items must be taken with the evacuating personnel?

QUESTION 7.09 (2.50)

According to OP-3010, Fire or Forced Evacuation of the Control Room, what can be used to substitute for, or regain control of, the following if they should be lost during the casualty. Be specific as to what is used and/or where it is located.

- RCS pressure. [.5]
- Pressurizer level. [.5]
- Charging pumps. [.75]
- Core temperature. [.75]

QUESTION 7.10 (1.00)

State the automatic actions that occur per OP-3254, Total Loss of AC with the integrity of RC System not established.

QUESTION 7.11 (3.00)

The following pertain to 10 CFR 20.

a. Define:
   - Restricted Area.
   - Radiation Area
   - Occupational Dose. (1.5)

b. State the maximum allowable wholebody quarterly occupational dose an individual may receive in a restricted area. What can this limit be increased to and what must be done to increase it? (1.5)

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

QUESTION 7.12 (3.00)

a. Immediate operator action step 6 of OP-3051, Loss of Main Coolant Pressure and/or Safety Injection Actuation, is 'Accident Diagnostics'. State the three substep diagnostics that comprise this immediate action. (Para-phrasing is allowable) (1.5)

b. In addition to 'a' above, list FIVE other major immediate actions stated in OP 3051. Sub-steps not required. (1.5)

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

QUESTION 8.01 (3.00)

Discuss how each of the following prevent release of radioactivity to the enviorment.

a. Limiting Condition for Operation.

b. Limiting Safety System Settings.

c. Safety Limits.

QUESTION 8.02 (1.50)

The following concern the tagging of plant equipment:

a. Who (by Job title) is the Local Control Authority for tagging a Diesel Generator out of service? (.75)

b. Who may perform locally controlled plant tagging? (.75)

~~QUESTION 8.03 (1.00)~~

~~While in Mode 1 at 10% power, an operator reports IR channel 1 has failed low. What actions, if any, must be taken?~~

deleted question. WK

QUESTION 8.04 (2.00)

a. For each Technical Specification frequency notation shown below, state the Technical Specification frequency (include time units). (1.0)

W, Q, SA, R, P

b. As stated in Technical Specifications, Section 3, what is the allowable time interval for surveillance requirements? (1.0)

QUESTION 8.05 (2.50)

In August of 1982, Yankee Rowe was exempted by the NRC from having to meet the fixed fire suppression requirements of 10 CFR 50, appendix R, for the Control Room area. List 5 of the 7 Justifications that allowed this exemption to be granted.

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

QUESTION 8.06 (2.00)

a. How many members are required on the fire brigade per Technical Specifications, Section 6? (0.5)

b. Who may NOT be included as members of the brigade? (1.0)

c. Who is responsible to function as the fire brigade leader? (0.5)

QUESTION 8.07 (3.00)

a. As directed by OP-3321, De-escalation and Recovery, who has the final authority to de-escalate an emergency? (0.5)

b. Who has the primary responsibility to recommend de-escalating an emergency to the individual in part 'a'? (0.5)

c. What group of personnel confer to determine the appropriate time and classification for de-escalating. (1.0)

d. What plant conditions should exist before de-escalation can be considered? (1.0)

QUESTION 8.08 (2.00)

When a medical on-site emergency exists in a radiation area, what are the guidelines, per OP-3305, Onsite Medical emergencies, for:

-entering an area where there is an injured person.

-radiation exposure.

-moving of an injured person from the area.

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

QUESTION 8.09 (2.50)

a. In accordance with OP-3300, Classification of Emergencies, define:

-Emergency Action Level.

-Event. (1.0)

b. What is the time limit established to notify offsite authorities when needed. When does this time period start? (1.5)

QUESTION 8.10 (3.50)

The following concern Technical Specifications 3.4.1, Main Coolant Loops.

a. List the requirements for the main coolant loops in Modes 1-5. (1.5)

b. When in Mode 5, what can be used in place of main coolant loops 1-4 to satisfy the operability requirements? (1.0)

c. When in Modes 3, 4, and 5, the required cooling pumps may be de-energized providing what two conditions are maintained? (1.0)

QUESTION 8.11 (2.00)

The following concern Shutdown Margin (SDM).

a. The plant has just entered Mode 3 from Mode 4. (RCS temperature at 500 F). A SDM indicates the SDM is 5.5%. Describe any actions to be taken. (1.0)

b. List 4 of 6 factors that are considered when calculating SDM? (1.0)

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

EQUATION SHEET

$F = ma$

$v = s/t$

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

$w = mg$

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

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

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

$PE = mgh$

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

$V_f = V_o + at$

$w = s/t$

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

$W = v\ \Delta P$

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

$\Delta E = 931\ \Delta m$

$\dot{m} = V_{av} A_o$

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

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

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

$Pwr = W_f \Delta h$

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

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

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$p = p_o 10^{sur(t)}$

$p = p_o e^{t/T}$

$SUR = 26.06/T$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$I_1 d_1 = I_2 d_2$

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

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

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

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

$\Sigma = \sigma N$

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 -- YANKEE ROWE -85/10/29-HEMMING, W.

MASTER COPY

ANSWER 5.01 (3.00)

a. 592 - 593 degrees F depending on how round-off is done.

b. 188 degrees F of superheat per superheat tables.

c. 500 degrees F. [1.0 each]

REFERENCE
ROWE, Steam Tables and Nollier chart

ANSWER 5.02 (1.00)

Flow is prop. to cube root of power.

2% 1/3 power = 1.259% flow

REFERENCE
General Physics, HT & FF, Section 3.2
ROWE Reactor Operator Training Manual, Sec. 2, pp 54-63

ANSWER 5.03 (2.00)

a. Increase
b. Decrease
c. Increase
d. Increase [0.5 each] (2.0)

REFERENCE
Summer Plant Systems Descriptions, Auxiliary Building Systems, Chapter AB-4, p 16; Summer Heat Transfer Thermodynamics and Fluid Flow Book, pp 180, 211, 322, 328 GLJ 175
ROWE Reactor Operator Training Manual, Sec. 2, pp 40-44

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 5.04 (1.50)

Increases heat transfer [0.5]. Bubble formation/removal breaks up the laminar layer allowing cooler fluid to get to the cladding [0.5]. Also, the bubbles carry away latent heat of vaporization which is released in the bulk coolant when the bubbles collapse [0.5].

REFERENCE
Farley Thermodynamics Manual, Chapter 4, p 9, Chapter 5, p 10 & Fig V-1 GLJ 137
ROWE Reactor Operator Training Manual, Sec. 2, pp 72-83

ANSWER 5.05 (1.50)

Power(2) = Power(1)(N2/N1)cubed = $300 \times (4)^3$ = 19.2 Mw (0.5)

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

Flow(2) = Flow(1) (N2/N1) = 800x(4) = 3520 gpm (0.5)

REFERENCE
GPNT Vol. III, Ch. 2, Sect. H, p. 2-234. PT 91
ROWE Reactor Operator Training Manual, Sec. 2, pp 49-50

ANSWER 5.06 (1.50)

a. Convection
b. Radiation/convection (large Delta T)
c. Conduction
d. Convection (natural)
e. Conduction [0.3 each]

REFERENCE
WTHP Chapter 13 PT 11
ROWE Reactor Operator Training Manual, Sec. 2, pp 64-69

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 5.07 (2.50)

a. As power increases, fuel temperature increases, the Doppler Defect becomes more negative (1.0)

b. 1. More negative.
2. Less negative.
3. ~~More~~ Less negative. [0.5 each] (1.5)

REFERENCE
CP&L Reactor Theory Chap. 14 pp. 14-7 thru 14-11
ROWE Reactor Operator Training Manual, Sec. 3, pp 189-202

ANSWER 5.08 (1.50)

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

b. Disagree [0.1] Equilibrium Sm concentration is not power dependent.[0.4] (0.5)

REFERENCE
GPNT, Vol. II, Ch. 4, Sect D, p. 4-144 to 4-150. PT 84
ROWE Reactor Operator Training Manual, Sec. 3, pp 243-244, 261A-267

ANSWER 5.09 (1.00)

Greater Than [0.5];

RR = Macroscopic absorp. in fuel * Thermal Flux

since amount of fuel decreases the thermal flux must increase to maintain a constant RR [0.5] (1.0)

REFERENCE
H. B. Robinson RO Lesson Plan, RxTh-LP-9
RxTh-LP-47
ROWE Reactor Operator Training Manual, Sec. 3, pp 97-99

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 5.10 (3.00)

a. Shutdown Margin is the instantaneous amount of reactivity the reactor is or would be subcritical from its present condition assuming all full length rods are fully inserted except the rod of highest worth is assumed to be fully withdrawn. (0.5)

b. 1. Immediately following the transient, the movement of the control rods exactly compenates for the change in power defect. Therefore no change in shutdown margin. (0.5)

2. Five hours later Xenon is at a lower value so rods must be inserted to compensate. Therefore shutdown margin decreases since power defect is the same (80% value). (0.5)

3. Thirty hours later Xenon has increased close to the 80% value. Rods have withdrawn to compensate. Therefore shutdown margin has increased. (0.5)

c. Yes [0.5], if boron concentration was reduced to compensate for power defect and control rods were at the original position the shutdown margin has decreased [0.5]. (1.0)

REFERENCE
CP&L Reactor Theory Chap. 15; OP 1009.3
ROWE Reactor Operator Training Manual, Sec. 3, pp 220-241
Sec. 4, OP-4708
Technical Specifications, p. 1-3

ANSWER 5.11 (2.50)

a. SAME

b. HIGHER

c. HIGHER

d. SAME

e. LOWER [0.5 each] (2.5)

REFERENCE
McGuire Reactor Theory Lesson Plans; Reactivity Balances, p. 3
Reactivity Coefficients, pp 14, 22
Operating Procedures; Reactivity Balance Calculation OP/0/A/6100/06

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ROWE Reactor Operator Training Manual, Sec. 3, pp 202-218, 235-241

ANSWER 5.12 (1.50)

a. The initial power drop will be greater at EOL. The smaller B, the greater the prompt drop for a given reactivity addition. (0.5)

b. The reactor responds faster at EOL. The smaller B, the higher the SUR for a given reactivity insertion. (0.5)

c. Tave will be lower at BOL. The smaller MTC requires a larger temperature drop to to balance the negative reactivity inserted by the rod. (0.5)

REFERENCE
HO-RTR Sec. 8.2
ROWE Reactor Operator Training Manual, Sec. 3, pp 135-136, 140-142, 202-211

ANSWER 5.13 (2.50)

a. MTC
FTC [0.5 ea] (1.0)

b. Becomes more negative [0.5]. Because as the coolant is heated or cooled the amount of boron that is effectively changed in the core is reduced thus MTC has a greater effect [1.0]. (1.5)

REFERENCE
VCS Curve Book, fig. II-15,
Reactor Theory p. 1-5.22,
Westinghouse Theory, p. 3-34.
ROWE Reactor Operator Training Manual, Sec. 3, pp 211, 218-220

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, M.

ANSWER 6.01 (2.00)

a. Causes rapid closure of the control valves when the acceleration of the turbine is 3% of rated speed per second or greater. (1.0)

b. A reactor scram and turbine trip will occur. (1.0)

REFERENCE
Rowe, RSTM 6-41.

ANSWER 6.02 (2.50)

a. A 10 second time delay is used to allow voltage on the emergency bus to return to normal before starting the HPSI pump. (1.0)

b. >/= 460 Volts. (0.5)

c. Overspeed, overcrank, high water temperature, and low oil pressure. (1.0)

REFERENCE
Rowe, RSTM 19-22, RSTM 9-3-1, RSTM 3-1, 3-2.

ANSWER 6.03 2.00 (~~3.00~~)

a. The steam supply temperature regulating valve on the tank heater is bypassed. (1.0)

b. They would remove boric acid from the coolant thereby causing a change in reactivity (1.0)

c. ~~To provide the voltage required to actuate the pressurizer spray valve discharge~~ deleted part "c" wk. (no)

REFERENCE
a. STM 17-11
b. STM 16-12
c. STM 16-16

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 6.04 (2.50)

a. By maintaining the Main Coolant System dynamic and static pressure head at the pump impeller above saturation pressure. [.75] Minimum pressure for Main Coolant Pump operation is 250 PSIG. [.75] (1.5)

b. The differential pressure drops(from 99 to 78 PSIG) [0.5] due to the change in coolant density. [0.5] (1.0)

REFERENCE
STM 13-10

ANSWER 6.05 (3.00)

a. Charging flow from the pumps will go to zero and the pump will trip. (1.0)

b. Charging pump #2 can be used by pulling the F-8 fuses located inside the main control board.
Charging pumps 1 and 3 can be used by manually controlling the pumps speed locally at the pump.
[1.0 each] (2.0)

REFERENCE
Rowe, RSTM, p. 15-24, 15-25.

ANSWER 6.06 (2.00)

a. Manual.
Undervoltage.
Overcurrent.
Loop bypass valve closed and
Either Th or Tc stop valve closed. 4 @ .375 each [~~.8~~ each] (1.5)

b. Th-Tc </= 20 F. (0.5)

REFERENCE
Rowe, RSTM, p. 13-16,-17,-18,-20.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 6.07 (2.50)

a. Low steam line pressure and high containment pressure. (1.0)

b. Condensate pump trip and reactor trip. (1.0)

c. 1800 psig. (0.5)

REFERENCE
Rowe, ROTM, Chapter 9, p. 7-11. Chapter 6, p.6-97, 6-85.

ANSWER 6.08 (2.50)

a. Loop 1 hot leg. (0.5)

b. 1. Resets 'LTOP System Misaligned' alarm on MCB.
2. When MCS is less than 450 psig, the 'LTOP System Armed' alarm will actuate.
3. The 'LTOP System High Pressure' alarm is enabled at 400 psig.
4. Enables power operated and motor operated relief valves to actuate at 500 psig.
[.5 each] (2.0)

REFERENCE
Rowe, ROTM 6-54, RSTM 14-20.

ANSWER 6.09 (2.00)

a. Low condenser vacuum ---18 inches (0.5)

b. Must be opened manually at the mezzanine. (0.5)

c. Should be placed in the manual mode. If placed in Auto. the valve will return to required setpoint at a rate determined by the error between actual pressure and the controller set point. (1.0)

REFERENCE
Engineering Design Change 83-03

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 6.10 (3.00)

a. (1) Bleed Line Process Radiation Monitor.
(2) Accident Area Radiation Monitor. [0.5each] (1.0)

b. Survey Valve Room piping with portable radiation instruments to verify bleedline radiation level. (1.0)

c. Reduce power commensurate with system demands [0.0] and maximize purification flow. [0.5] (1.0)

REFERENCE
OP 3100, p. 1, 2

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 7.01 (2.00)

1. Both
2. SCRO
3. SS
4. SS
5. SS
6. Both
7. Both
8. Both [.25 each] (2.0)

REFERENCE
Rowe, AP-2001, PP.2-7.

ANSWER 7.02 (3.00)

a. Reactor critical in modes 1-2 with 1 or more stuck rods.
Reactor subcritical in modes 3-5 without stuck rods.
Reactor subcritical in 3-5 with 1 or more stuck rods. [.5 each] (1.5)

b. Modes 1-5, calculate within 1 hour after detection of an inoperable rod and at least every 12 hours thereafter.
Modes 3-5 at least once every 24 hours.
Prior to any mode change. [.5 each] (1.5)

REFERENCE
Rowe, OP-4708, P.1.

ANSWER 7.03 (3.00)

a. The discharge valve must be closed prior to starting. [.5] This prevents reverse accelleration of the pump from backflow and minimizes disruptions to plant operations. [.5] (1.0)

b. Reduce cooling demand if possible or increase service water supply to the component coolers. (1.0)

c. 1500 gpm.[.5] Establish flow through the idle heat exchange equipment.[.25] To prevent overheating of the pump.[.25] (1.0)

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

REFERENCE
Rowe, OP-2156, p.3.

ANSWER 7.04 (2.00)

a. -Via the normal charging line, any mode.
-Via the Loop Fill Line, <300 psig or </= 200 F. [.5 each] (1.0)

b. When MCS pressure is >/= 1000 psig or >330 F. (0.5)

c. </= 330 F or < 1000 psig. (0.5)

REFERENCE
Rowe, OP-2151, p.1-2.

ANSWER 7.05 (1.50)

Modes 1-2 at MCS pressure >/= 1800 psig.
Mode 3 at MCS pressure >/= 1800 psig or at MCS temperature of >/= 490 F.

[.25 ea mode,.25 ea setpoint] (1.5)

REFERENCE
Rowe, OP-2101, p.2.

ANSWER 7.06 (2.00)

-Notify Shift Supervisor.
-Initiate plant shutdown.
-Notify higher plant managment.
-Initiate Bomb Search Procedure[.25] and Operator VC Housekeeping Inspection if VC integrity is not established.[.25]
-Classify the emergency (OP-3300).
-Evacuate all non-shift personnel.
-At detonation minus 15 minutes, sound the plant emergency alarm.

[.25 each response] 2.0 ~~(2.5)~~

REFERENCE
Rowe, OP-3004.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 7.07 (1.00)

-Maintain a 500 psig margin between plant conditions and the NDT Upper Limit Curve.
-Dedicate an operator to monitor MCS pressure, pzr. heaters, SI pumps, and valve lineup. [.5 each] (1.0)

REFERENCE
Rowe, OP-2100, p.2.

ANSWER 7.08 (1.00)

-Electrical Keys.
-Station Log Book.
-OP-3000.
-Plant Personnel Telephone Directory. [.25 each] (1.0)

REFERENCE
Rowe, OP-3010, p.3.

ANSWER 7.09 (2.50)

-MCS pressure using the Hiese Gauge in the PAB.[.5]
-Pzr. level may be approximated using the low pressure surge tank ~~level~~ level.[.5]
-Charging pumps can be operated locally by overriding their controllers and jumping the CCP breaker control circuits.[.5] Instructions and jumpers are inside the breaker cabinets.[.25]
-Core temperature by using a portable potentiometer [.5] and monitoring the ICI T/C's at the #1 VC blister.[.25] (2.5)

REFERENCE
Rowe, OP-3010, p.4.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 7.10 (1.00)

-Auto openins of emergency bus tie BT1A and BT1B, 2A and 2B, 3A and 3B.
-Auto start of all available emergency D/G's and
auto closure of their respective ACB's.
[.5 each] (1.0)

REFERENCE
Rowe, OP-3254.

ANSWER 7.11 (3.00)

a. -Any area access to which is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.
-Any area, accessible to personnel, in which there exists radiation... at such levels that a major portion of the body could receive in one hour a dose in excess of 5 mrem, or in any 5 consecutive days a dose in excess of 100 mrem.
-Exposure to radiation in restricted areas or in the course of employment in which duties involve exposure to radiation. Shall not include exposure for the purposes of medical diagnosis or therapy. [.5 each definition] (1.5)

b. 1 1/4 rem per quarter.[.3]
3 rem per quarter not to exceed 5(N-18).[.6] Must have form NRC-4 on file AND past exposure calculated. [.6] (1.5)

REFERENCE
Rowe, 10 CFR 20.3,101,and 202.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 7.12 (3.00)

a. 1. If condenser air ejector radiation and/or steam line radiation is high AND containment pressure/radiation are normal, go to OP-3107, S/G Tube Rupture.

2. If steamline pressure is low and decreasing in one or more S/G's, go to OP-3201, Steamline Break.

3. If VC pressure, OR VC radiation are high or increasing, go to OP-3106, Loss of Main Coolant.

[.5 each] (1.5)

b. -Initiate OP-3000. (Emergency Shutdown From Power)
If SI is spurious, go to attachment A.
-Verify SI initiation at 1700 psig.
-Verify containment isolation.
-Insure emergency power is available.
-Initiate heat removal via intact S/G's.
-Initiate OP-3300. (Classification of Emergencies)

[any 5 at .3 each] (1.5)

REFERENCE
Rowe, OP-3051, p.2-3.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 8.01 (3.00)

a. LCOs indicate the lowest functional capability or performance level of equipment required for safe operation of the facility. [1.0]

b. As long as automatic protection occurs prior to exceeding a LSSS, then the abnormal condition will be corrected prior to exceeding a Safety Limit. [1.0]

c. The integrity of the physical barriers which guard against the uncontrolled release of radioactivity is protected as long as a Safety Limit is not violated. [1.0] (3.0)

REFERENCE
10CFR50.36

ANSWER 8.02 (1.50)

a. Shift Supervisor (.75)

b. Only those persons authorized on the Local Control Tagging List (.75)

REFERENCE
Rowe, AP 0017, P.1

~~ANSWER 8.03 (1.00)~~

~~Bypass the channel 50.53 within one hour. 50.53~~ (1.00)

deleted question WH.

~~REFERENCE
TS 3/4 3-5~~

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 8.04 (2.00)

a. W -At least once every 7 days.
Q -" " " " 92 days.
SA -" " " " 184 days.
R -" " " " 18 months.
P -Prior to each release. [.~~25~~ .20 each] (1.0)

b. Maximum extension not to exceed 25% of the requirement. [.5]
A maximum combined interval time for any 3 consecutive intervals not to exceed 3.25 times the required interval. [.5] (1.0)

REFERENCE
Rowe, Tech. Spec. Section 3.

ANSWER 8.05 (2.50)

- Control Room is continuously manned.
- Fire detection equipment is installed in areas not visible to operators.
- Electrical penetrations are sealed.
- Fire dampers are installed in all vent lines.
- Portable fire extinguishers are readily available.
- Inadvertant operation of a fixed system could cause equipment damage or Control Room evacuation.
- Flammable material inventory is low and controlled.

[.5 each for any 5]

REFERENCE
Rowe, T.S. exemption letter dated August, 1982 (in front of T.S.).

ANSWER 8.06 (2.00)

a. 5. (0.5)

b. Brigade shall not include the minimum shift crew required for safe shutdown of the plant, 2 licensed operators, or any personnel required for essential functions during the fire. (1.0)

c. Supervisory Control Room Operator. (0.5)

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

REFERENCE
Rowe, T.S. Section 6, p.6-2 and AP-2001, p.5.

ANSWER 8.07 (3.00)

a. Recovery Manager. (0.5)

b. TSC coordinator. (0.5)

c. Recovery Manager.
TSC Coordinator.
Plant Emergency Director.
Emergency Coordinator.
Engineering Support Center. [.20 each,] (1.0)

d. Stable plant conditions with some certainty that the severity of the emergency is not likely to worsen. (1.0)

REFERENCE
Rowe, OP-3321, p.1.

ANSWER 8.08 (2.00)

-Enter if the whole body exposure will be 100 rem or less AND the victim may be alive.
-Choose the oldest person for the rescue as the 100 rem is once per lifetime.
-Move the victim only if the radiation exposure will kill him.
-Do not move the victim if the exposure dose is 50 mrem or less and moving could cause more injury.
[.5 each] (2.0)

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 8.09 (2.50)

a. -Emergency Action Level...A specific abnormal plant instrument reading OR plant condition which requires plant staff to declare one of the four emergency classifications. (0.5)
-Event.....A catagory of EAL's grouped according to plant systems or conditions. (0.5)

b. 15 minutes.[.5]The time is begins from the time at which operators recognize that an EAL has been reached and that the event warrants classification. [1.0] (1.5)

REFERENCE
Rowe, CP-3300, P.2.

ANSWER 8.10 (3.50)

a. Modes 1 and 2...all main coolant loops (MCL) in operation.
Mode 3.....at least one MCL in operation with all operable.
Mode 4.....at least one MCL or shutdown cooling system in operation with all MCLs operable.
Mode 5.....at least one MCL or shutdown cooling system in operation with at least 2 MCLs or shutdown cooling systems operable. [~~.5~~ .3 each mode] (1.5)

b. Shutdown Cooling System with the shutdown cooling pump.
Shutdown Cooling System with the low pressure surge tank cooling pump and cooler. [.5 each] (1.0)

c. No operations that will dilute the MCS and core outlet temperature must remain 10 F below saturatiuon. (1.0)

REFERENCE
Rowe, T.S. 3.4.1.

ANSWERS -- YANKEE ROWE -85/10/29-HEMMING, W.

ANSWER 8.11 (2.00)

a. Initiate and continue to emergency borate at greater than 26 GPM of 2200 PPM boric acid until SDM is restored. (1.0)

b. (1) MCS Boron Concentration
(2) Control Rod Position
(3) Xenon Concentration
(4) Samarium Concentration
(5) Fuel Burnup
(6) MCS T AVE [any 4 at .25 each] (1.0)

REFERENCE
Rowe, TS 3/4.1.1 and OP 4708, p.3.

QUESTION	VALUE	REFERENCE
05.01	3.00	WCH0000255
05.02	1.00	WCH0000256
05.03	2.00	WCH0000257
05.04	1.30	WCH0000258
05.05	1.50	WCH0000259
05.06	1.50	WCH0000260
05.07	2.50	WCH0000261
05.08	1.50	WCH0000262
05.09	1.00	WCH0000263
05.10	3.00	WCH0000264
05.11	2.50	WCH0000265
05.12	1.50	WCH0000266
05.13	2.50	WCH0000267
	25.00	
06.01	2.00	WCH0000299
06.02	2.50	WCH0000300
06.03	3.00	WCH0000301
06.04	2.50	WCH0000302
06.05	3.00	WCH0000303
06.06	2.00	WCH0000304
06.07	2.50	WCH0000305
06.08	2.50	WCH0000306
06.09	2.00	WCH0000307
06.10	3.00	WCH0000308
	25.00	
07.01	2.00	WCH0000268
07.02	3.00	WCH0000269
07.03	3.00	WCH0000270
07.04	2.00	WCH0000271
07.05	1.50	WCH0000272
07.06	2.00	WCH0000273
07.07	1.00	WCH0000274
07.08	1.00	WCH0000275
07.09	2.50	WCH0000276
07.10	1.00	WCH0000278
07.11	3.00	WCH0000279
07.12	3.00	WCH0000311
	25.00	
08.01	3.00	WCH0000280
08.02	1.50	WCH0000281
08.03	1.00	WCH0000282
08.04	2.00	WCH0000283
08.05	2.50	WCH0000284
08.06	2.00	WCH0000285

QUESTION	VALUE	REFERENCE
08.07	3.00	WCH0000286
08.08	2.00	WCH0000287
08.09	2.50	WCH0000288
08.10	3.50	WCH0000289
08.11	2.00	WCH0000290
	25.00	
	100.00	

ATTACHMENT 3

YANKEE ROWE RO AND SRO EXAMINATION
COMMENTS AND RESOLUTIONS

RO Exam

Comment: 1.04....A. Incorrect answer
Makes the MTC less negative or even positive
(Reference: RO Training Manual, RE Section, Page 3-208, Paragraph e)

NRC Resolution: Answer changed to "less negative".

Comment: 1.10....May get emergency procedure answers for c
(Reference: OP-3054, Natural Circulation, Step 3 of Subsequent Actions)

NRC Resolution: Answer altered to accept both answer key and procedure referenced above.

SECTION II

Comment: 2.01....A. TK-1 DWST, TK-39 PWST
DWST TK-1 or PWST TK-39
Safety Injection Tank
(Reference: OP-3203, Loss of Feedwater)

NRC Resolution: Comment not accepted. Question clearly states normal lineup and does not ask for alternate supplies.

Comment: 2.07....Part C. This is no longer true
Pressurizer Safety Valves discharge to Vapor Container through Rupture Disc
(Ref: Systems Training Manual, Page 14-26)
(Ref: Systems Training Manual, Page 16-17)

NRC Resolution: Question deleted.

SECTION III

Comment: 3.06....Part A. PR-LT-6 (NR indicates high)
PR-LT-8 (WR indicates high)
PR-LT-705 (WR indicates low)

(Ref: RO Training Manual, Page 6-44, paragraph 3)

Part B. This will react the same as the other two channels when the reference flashes. Answer should read higher than actual.

(Ref: RO Training Manual, I&C Section, Page 6-43, last paragraph)

NRC Resolution: Comment not accepted. Training material indicates that the linear amp processes a positive output for PR-LT-6 and 8 which would make the answer key correct if power is lost. PR-LT-705 answer was altered to be "fails as is" as linear amplifier is not in its circuitry. In part B, the answer key remains unchanged. Training material indicates that PR-LT-705 responses opposite of the other two channels where the reference leg is lost.

SECTION IV

Comment: 4.08....Answer should read condensate recirculation valve
(Ref: OP-3257, Loss of #1, 125 volt D.C. Bus)

NRC Resolution: Comment accepted, answer key altered.

SRO EXAM
SECTION V

Comment: 5.07....B. Part 2: How does fuel to clad contact effect the FTC? Answer key said Less Negative.
As clad to pellet contact increases, the heat transfer fuel to clad improves, this lowers the fuel temperature for any power level.

If the fuel temperature becomes less negative with increase in fuel temperature, then the opposite must be true. The FTC becomes more negative as fuel temperature is decreased.

(Ref: RO Training Manua, RE Section
Page 3-199, first paragraph also page 3-202, first paragraph)

NRC Resolution: Comment not accepted. Answer key is supported by the above references and figure 13.

Comment: 5.07....B. Part 3: How does the buildup of PU-239 core life effect FTC?

Answer key said, more negative
Should be less negative
(Ref: RO Training Manual, Pg. 3-192, second paragraph)

NRC Resolution: Comment accepted, answer key altered to be "less negative".

SECTION VI

Comment: 6.03....Part C. This is no longer true, Pressurizer Safety Valves discharge to Vapor Container.

(Ref: Systems Training Manual, pg. 14-26)
(Ref: Systems Training Manual, pg. 16-17)

NRC Resolution: Question deleted.

SECTION VII

Comment: 8.03....While in Mode 1 at 10% power, an operator reports IR channel 1 has failed low. What action, if any, must be taken? There is no IR channel #1, it's 3 & 4. The question was not clear; was it talking about intermediate or intermediate power range?

Answer Key indicated the question was talking about IR Channels 3 & 4 but the answer is wrong. If the plant is at 10% power it would be at 18 MWe.

b. of Action 3 states above 15 MWe operation may continue. (Ref: Yankee's Technical Specification, pg. 3/4 3-2 and 3/4 3-5)

NRC Resolution: Question deleted.