Facility Licenses: Northern States Power Company
Monticello Nuclear Generating Plant
2100 W. River St.
Monticello, MN 55362

Facility Docket No: 50-263

Facility License No: DPR-22

Examinations administered at the Monticello Nuclear Generating Plant at Monticello, MN.

Chief Examiner: Larry Dimmock — 7/31/84 Date Signed

Chief Examiner: EG&G Idaho, Inc. David N. Graves — 7/17/84 Date Signed

Approved By: J. I. McMillen, Section Chief — 8/10/84 Date Signed

Summary

Examinations on June 26-29, 1984

Written, oral, and simulator exams were administered to six RO candidates and three SRO candidates. One RO candidate failed the written and simulator examinations.

## REPORT DETAILS

1. Persons Examined

   RO Candidates

   S. A. Alfano
   D. R. Anderson
   K. J. Markling
   M. T. Mortensen
   J. R. Rasmusson
   T. A. Witschen

   SRO Candidates

   G. F. Holmstadt
   D. E. Nevinski
   M. A. Perry
   D. D. Tilly
   W. P. Walker III

2. Examiners

   Larry Dimmock, NRC Chief Examiner
   David Graves, EG&G Idaho
   Dale Hill, EG&G Idaho
   Craig Dodd, EG&G Idaho

3. At the conclusion of the written examinations, the examiners met with Eric Sopkin, Michael Ladd, Don Whitcomb, Gene Earney, Bob McGillic, and Doug Antony of the Training and Operations Departments to review the written examination and answer keys. As a result of this meeting, question 3.02c was deleted and the points distributed in parts a and b. Question 8.05 was deleted during grading by the grading examiner.

   Several questions, answers, or references received comments from the utility during the review. Several were minor in nature and resolved during the review. Others were more significant and taken into consideration during grading. All comments and resolution will be mentioned later in this report.

4. Exit Meeting - At the conclusion of the site visit, the examiners met with representatives of the plant and corporate training department to discuss results of the examination. Those individuals who clearly passed the oral and/or simulator examinations were identified.

## QUESTIONS DELETED FROM WRITTEN EXAMINATIONS

Question 3.02.c — For the Control Room Ventilation Inlet Air Monitor, indicate what type of radiation detector is used and what automatic actions occur, if any, on a trip of the system. Exclude alarms and annunciators.

Answer: G-M detector (0.33). Initiates automatic closure of the control room outside air inlet damper (0.5).

Reference: Process Radiation Monitors pp 7, 34, 41

Reason for Deletion: The control room radiation monitor mentioned is no longer used. Replaced by EFT ventilation modification. Reference provided.

Question 8.05 — Concerning reportable event notification, what are the differences between an IMMEDIATE NRC notification (10 CFR 50.72) and a PROMPT NRC notification with written followup (Technical Specification). (2.5)

Answer: Immediate: NRC notified within one hour. Prompt: NRC notified within 24 hours by telephone and confirmed by telegraph, mailgram, or facsimile transmission to the NRC Regional Administrator no later than the first working day following the event, with a written followup within two weeks.

Reference: MNGP T.S., pp 250, 10 CFR 50.72 (9/30/83)

Reason for Deletion: 10 CFR 50.72 also supercedes the plant's Technical Specifications that are to be used for comparison. Therefore, the question, as asked, was inappropriate and confusing to the candidates.

## DETAILED EXAM REVIEW COMMENTS, AND THEIR RESOLUTION

1.01.b Utility reviewers provided alternative values that may show up in candidates' answers.

Agree - Reference was provided showing differing values.

1.05.b Reviewers noted that likely answers may include "to avoid exceeding PCIOMR limits" and "to avoid localized flux peaking".

Agree - with "to avoid localized flux peaking". This answer was accepted.

Disagree - With "to prevent exceeding PCIOMR limit". Power was changed per the question prior to implementation of PCIOMR guidelines, therefore this answer was not accepted.

1.09.b Utility noted that pump will be started under a full load type situation resulting in extended high motor amperage (high motor power).

Agree - Meaning of reviewes answer and key answer very similar.

1.09.c Cavitation should also be accepted as a correct answer.

Agree - References provided.

2,03.c Utlity provided answer that could be given depending on what candidate assumed prior to answering, (see attached comments).

Agree - This answer would still indicate that candidates' level of knowledge was adequate on that topic.

2.08.a Utility noted that the permissives are only for the drywell spray valves.

Agree - Noted but would not affect grading due to the way the question was asked. Was available for clarification if the need came up.

2.09.a The vacuum breakers start to open at 0.25 psid and must be full open at 0.5 psid.

Agree - Accepted anything less than 1.0 psid as correct.

3.02.c The question was deleted and points incorporated into parts a and b.

3.03.b Utility provided clarification for EPR switch controls. Also provided alternative answer of lowering MPR setpoint such that it controls pressure.

Agree - Clarification of control noted and alternative answer accepted.

3.03.c Utility felt answers may include that EPR is used for turbine startup per C.1, pps 39, 40.

Agree - Question was asking for general answer. Answer provided was very specific. Willing to accept this as acceptable answer.

3.04.a Accept Wide Range Gas Monitor as initiation signal for SBGTS.

Agree - Reference provided.

3.04.b Clarification provided and referenced for actions occurring on test of SBGT.

Agree and accepted.

3.07.b Utility stated candidates are not required to memorize instrument numbers. Question was not specific enough to elicit only the answer key response. Candidates could explain Yarway or GEMAC instrument and still feel question was answered properly.

Agree - Will accept explanation for either type instrument.

4.09.b Must also be an Emergency Team Member should be accepted as an answer also.

Agree - Reference provided.

5.04 Same as 1.01.b

6.02.b To provide unnecessary throttling and possible cutting of valve seat on the Dump FCV (CV-2403).

Agree - Reference provided.

6.03.a Accept -47" or -48" in addition to 6'7" above TAV.

Agree - Reference provided.

6.08.a Same as 3.04.a.

6.08.b Same as 3.04.b.

7.01.b Provided other times when TIP scans should be run.

Agree - Reference provided.

7.02.c Utility thinks 3 should be an acceptable answer as well as answer key answer.

Agree - Reference provided.

7.03.d Accept -47" or -48" as Low-Low level.

Agree

7.05.b Utility states answer #1 is not a single pump operating limitation but a limitation for starting a second pump.

Agree

7.09.c. Delete. No question 7.09c

8.05 Deleted by grader. That portion of the T.S. no longer applicable making question confusing to candidate.

8.07.b Accept Operations Superintendent instead of D. Antony.

Agree

8.09.a Provided other acceptable answer.

Agree - Reference provided.

Comment on Section 8 question regarding Emergency Exposure rejected. There is no Section 8 question on Emergency Exposure.

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U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: _MONTICELLO_______________

REACTOR TYPE: _BWR____________________

DATE ADMINISTERED: _84/06/26_______________

EXAMINER: _GRAVES, D.______________

APPLICANT: _________________________

INSTRUCTIONS TO APPLICANT:

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

| CATEGORY VALUE | % OF TOTAL | APPLICANT'S SCORE | % OF CATEGORY VALUE | CATEGORY |
|---|---|---|---|---|
| 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

QUESTION 1.01 (2.00)

A. Excess reactivity is initially loaded into the reactor to compensate for Keff decreasing from BOL to EOL. Give two (2) reasons why Keff will decrease at various times from BOL to EOL. (1.0)

B. For a period of time during core life, Keff will actually increase (become more reactive). Give two (2) reasons for the core becoming more reactive. (1.0)

QUESTION 1.02 (2.00)

A. Why is the slowing down time for a delayed neutron less than that for a prompt neutron? (1.0)

B. Does the diffusion time differ for a prompt and delayed neutron? If so explain. (1.0)

QUESTION 1.03 (1.00)

Select the word(s) in the parenthesis that will make the below statement correct and EXPLAIN your choice.

For the same change in moderator temperature, the change at a higher temerature will add (MORE, LESS, THE SAME) negative reactivity than for the same temperature change at a lower temperature. Assume no voiding exists. (1.0)

QUESTION 1.04 (2.00)

A. Power is increased from 40% to 50% by increasing recirculation flow. HOW and WHY does the steady state negative reactivity contribution due to voids change between these two power levels? EXPLAIN. (1.0)

B. If the change was from 90% to 100%, HOW and WHY would it affect the MAGNITUDE of the change discussed in part (a) above? (1.0)

QUESTION 1.05 (1.00)

During high power operations (>60%), WHY is it more desirable to change power with recirculation flow than with control rods? (1.0)

QUESTION 1.06 (1.50)

Using the Steam Tables, match the following conditions (a-c) with the term that identifies those conditions:

| | |
|---|---|
| a. 550 F, 978.13 psia | 1. saturation |
| b. 544 F, 995.22 psia | 2. subcooled |
| c. 400 F, 235.83 psia | 3. superheated |

(1.5)

QUESTION 1.07 (2.00)

Give two (2) reasons why nucleate boiling is a better heat transfer mechanism than natural convection. (2.0)

QUESTION 1.08 (2.00)

Your reactor has just scrammed from extended full power operation. Ten (10) hours later cooldown is complete, and the SDM is measured at the time to be 1% k/k. Describe the changes, if any, to the SDM for the NEXT 20 hours. (Include in your discussion any adverse conditions). (2.0)

QUESTION 1.09 (3.00)

Give ONE undesirable result for each of the following.(Be more specific than 'pump failure'):

A. Operating a centrifugal pump for extended periods of time with the discharge valve shut. (1.0)

B. Starting a centrifugal pump with the discharge valve full open. (1.0)

C. Operating a motor driven pump under 'PUMP RUNOUT' conditions. (1.0)

QUESTION 1.10 (3.00)

Assume the reactor is operating at 100% power and one recirculation pump trips. Indicate how each listed indicated parameter would first change (Increase or Decrease) and briefly explain why the change occurs.

A. reactor power (1.0)

B. reactor water level (1.0)

C. feedwater flow (1.0)

QUESTION 1.11 (1.50)

For each condition (a-d) given below, indicate whether it will cause an INCREASE, a DECREASE, or have NO EFFECT on CRITICAL POWER:

a. Increasing fuel bundle flow (0.5)

b. Increasing coolant pressure (0.5)

c. Increasing inlet subcooling (0.5)

QUESTION 1.12 (2.00)

A. What is one disadvantage of condensate depression? (0.5)

B. How does increased condensate depression affect condensate pump net positive suction head? (0.5)

C. Give two (2) examples of how condensate depression can be increased. (1.0)

QUESTION 1.13 (2.00)

Three (3) minutes following a reactor scram from high power, indicated reactor power is 75 on range 4 and decreasing.

a. What will INDICATED power be one (1) minute later? (Show calculations) (1.0)

b. Explain why power decreased at this rate. (1.0)

QUESTION 2.01 (3.00)

A. The addition of the High Density Fuel Storage System Modules has increased the heat loading in the Fuel Storage Pool. HOW may the normal Fuel Pool Cooling be supplemented during periods of high or excessive heat loads? (1.0)

B. What are three (3) methods to provide emergency makeup to the Fuel Pool Cooling system? Include which is LEAST desirable and WHY. (2.0)

QUESTION 2.02 (3.00)

During a reactor scram:

a. WHY does the on line flow control valve in the Control Rod Drive Hydraulic System go to its Minimum position and WHY is this DESIRABLE? (1.5)

b. HOW would a control rod respond if its HCU scram inlet valve sticks shut with the scram outlet valve open? (Consider reactor pressure both (1) high at 1000 psig and (2) low at 300 psig in your answer) (1.5)

QUESTION 2.03 (3.50)

The Core Spray System receives a valid initiation signal. One pump fails to start:

a. WHY must that core spray loop be isolated? (1.0)

b. HOW is the isolation accomplished (be specific)? (1.5)

c. If the system were to be manually initiated, WHY must the outboard isolation valve be opened first? (1.0)

QUESTION 2.04 (2.00)

Power is lost to CV-1478, which controls the plant instrument pneumatic system air to the MSIV's and the Auto Pressure Relief Valve Operators inside the drywell.

a. HOW does this affect the operation of the MSIV's? (1.0)

b. HOW does this affect the relief valve's ability to lift on overpressure? (1.0)

QUESTION 2.05 (3.50)

A. How is the HPCI Turbine exhaust line protected against overpressure? (Identify two means, include setpoints). (1.5)

B. Identify which of the following are direct HPCI turbine trips and which are HPCI system isolations: (2.0)

1. HPCI steam line low pressure
2. Reactor high water level
3. Pump suction low pressure
4. HPCI steam line area high temperature

QUESTION 2.06 (2.00)

BLEEDER TRIP VALVES on the extraction steam/feedwater heater system are designed to prevent reverse flow of steam from a feed heater to the turbine. EXPLAIN what would cause this reverse flow and WHY is it undesirable? (2.0)

QUESTION 2.07 (3.00)

A. The Steam Sealing System provides sealing for what components? (4 required) (2.0)

B. WHY is a Steam Seal System necessary? (1.0)

QUESTION 2.08 (2.50)

A. What conditions or interlocks must be satisfied to initiate Containment Spray following a LPCI initiation? Indicate which conditions/interlocks can be bypassed, if any. (1.5)

B. Where does the Containment Spray discharge to (2 areas required, include how the spray is dispersed)? (1.0)

QUESTION 2.09 (2.50)

A. Two sets of vacuum breaker valves are provided on the primary containment. One set relieves from the ---?--- to the ---?---. The other set relieves from the ---?--- to the ---?---. The set-points for each set is ---?--- and ---?--- respectively. (2.0)

B. Why are these vacuum breakers required? (.5)

QUESTION 3.01 (3.00)

Explain how RCIC turbine speed is controlled following an automatic initiation signal. Begin with the steam admission valve shut and continue until the system is injecting at rated flow. Include what signal is controlling speed initially and at rated flow. (3.0)

QUESTION 3.02 (3.00)

For each of the Radiation Monitoring Systems below, indicate what TYPE OF RADIATION DETECTOR is used and what AUTOMATIC ACTIONS occur, if any, on a trip of the system. Exclude alarms and annunciators.

a. Main Steam Line Radiation Monitor
b. RBCCW Radiation Monitor (3.0)
c. Control Room Ventilation Inlet Air Monitor

QUESTION 3.03 (2.00)

A. Where does the EPR/MPR sense steam pressure? (0.5)
B. If the EPR fails during power operation, how may it be removed from service? (1.0)
C. Why is the MPR used during turbine startups and shutdowns instead of the EPR? (0.5)

QUESTION 3.04 (1.50)

a. What conditions (list four) will automatically initiate the Standby Gas Treatment system? (1.0)

b. How is a SGTS system 'Test' different from an 'auto initiation'? (Other than the initiating event). (0.5)

QUESTION 3.05 (3.00)

Regarding the LPCI LOOP SELECT LOGIC:

a. HOW does the logic determine how many recirc pumps are running? (1.0)

b. HOW does the logic determine which is the UNDAMAGED recirc loop? (1.5)

c. If the logic determines that neither loop is damaged, WHICH LOOP WILL IT SELECT for LPCI injection? (0.5)

QUESTION 3.06 (2.50)

A. What are two (2) plant systems or components that receive rod position information from the RPIS, OTHER THAN the full core and 4 rod group displays? (1.0)

B. What action occurs automatically upon receipt of an RPIS INOP? (1.0)

C. With a selected rod at notch position 18, and its 02 notch position reed switch stuck shut, what will the 4 rod group display indicate for the selected rod's position? (0.5)

QUESTION 3.07 (3.00)

A. The reactor water level control system is programmed to provide a deviation from setpoint as a function of steam flow. As steam flow changes from ___?___% to ___?___%, the programmer changes the level setpoint from ___?___" to ___?___". (1.0)

B. Explain how going from a cold operating condition to a hot operating condition affects INDICATED reactor water level (LT 52 A&B). How is this effect minimized? (2.0)

QUESTION 3.08 (3.50)

A. What automatic actions occur directly as a result of an ATWS system trip? Be specific. (2 required) (2.0)

B. How is the ATWS trip on low-low level prevented from affecting the ECCS performance (level transient from the ATWS trip affecting the ECCS actuating levels)? (0.5)

C. How may the ATWS trip system be actuated, other than the low level trip mentioned above? (1.0)

QUESTION 3.09 (3.50)

A. What are four (4) conditions that will simultaneously remove all LPRM inputs to a RBM channel? (1.0)

B. What two (2) purposes does the .eference APRM serve to a RBM channel? (1.0)

C. Which APRM is associated with each RBM channel (as the reference APRM)? (1.0)

D. How can another APRM channel be used as a reference APRM if the primary reference APRM fails? (0.5)

QUESTION 4.01 (3.00)

What is the reason for each of the following precautions pertaining to the RHR (a and b) and Main Steam (c) systems?

a. When starting the RHR pumps in the shutdown cooling mode, the pumps should not be run with the discharge valve closed for extended periods of time. (1.0)

b. Do not control the rate of reactor cooldown during the shutdown cooling mode of RHR by alternately stopping and starting the RHR Service Water pumps. (1.0)

c. Before closing a MSIV for testing, reactor power must be reduced to 75%. (1.0)

QUESTION 4.02 (1.00)

The VIBRATION and ECCENTRICITY recorder indicates a marked deviation from the characteristic eccentricity pattern during a turbine startup.

a. This is indicative of WHAT CONDITION? (0.5)

b. What two (2) actions should be performed immediately? (0.5)

QUESTION 4.03 (3.50)

A. How is a control rod drive electrically disarmed? (1.0)

B. What are two (2)instances a control rod drive would be electrically disarmed? (1.5)

C. If more than ___?___ non-fully inserted rods are inoperable, the reactor should be shutdown using WHAT METHOD? (1.0)

QUESTION 4.04 (3.50)

The reactor is operating at high power when one recirculation pump trips. What actions should be taken and WHY (also assume the lower seal temperature increases to 193 degrees F). (3.5)

QUESTION 4.05 (3.00)

Explain why on a loss of stator cooling from 100% power, there is insufficient time to reduce power enough by inserting control rods to prevent a reactor scram on high reactor pressure. Include times and values in your answer as appropriate. Also include how power is reduced per the procedure. (3.0)

QUESTION 4.06 (2.50)

Concerning operation of the RWCU (Reactor Water Cleanup) system:

a. Why are you cautioned to closely monitor cleanup water temperature to the filter/demins during reactor startup? (1.0)

b. Why must the filter/demins be MANUALLY isolated prior to starting backwashing and precoating? (1.5)

QUESTION 4.07 (2.50)

A condition in the control room requires immediate evacuation. No actions are taken prior to the evacuation.

a. How is the reactor scrammed in this case? (1.0)

b. How is the scram verified? (1.0)

c. If a relief valve is actuated by using the appropriate jumper, how long should the operator wait (minimum) prior to reopening the relief valve? (0.5)

QUESTION 4.08 (4.00)

A. Following a pipe break inside the primary containment, is is permissible to exceed the maximum reactor cooldown rate if it appears that WHAT CONDITION will be exceeded? (1.0)

B. What are four (4) available high pressure systems that can be used to try and maintain reactor vessel level following the LOCA? (1.0)

C. If vessel level cannot be maintained by the high pressure systems, what two (2) conditions should be verified prior to using the TURBINE BYPASS VALVES and main condenser to depressurize the reactor? (2.0)

QUESTION 4.09 (2.00)

A. What is the maximum allowable emergency whole body exposure for a worker to receive (per the emergency exposure guidelines, A.2-401) in each of the following situations:

1. Performing search and removal of injured personnel from a high radiation area? (0.5)

2. Personnel decontamination? (0.5)

B. What are three (3) conditions/considerations that should be met/made prior to allowing the above exposure? (1.0)

# EQUATION SHEET

$F = ma$

$v = s/t$

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

$w = mg$

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

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

$A = \lambda N$

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

$PE = mgh$

$V_f = V_o + at$

$w = \theta/t$

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

$W = v\ \Delta P$

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

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

$\Delta E = 931\ \Delta m$

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

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

$\dot{Q} = \dot{m} C p \Delta t$

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

$Pwr = W_f \Delta h$

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

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

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

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

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

$SUR = 26.06/T$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$I_1 d_1 = I_2 d_2$

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

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

$\Sigma = \sigma N$

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

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

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

| QUESTION | VALUE | REFERENCE |
|---|---|---|
| 01.01 | 2.00 | DNG0000176 |
| 01.02 | 2.00 | DNG0000178 |
| 01.03 | 1.00 | DNG0000179 |
| 01.04 | 2.00 | DNG0000180 |
| 01.05 | 1.00 | DNG0000182 |
| 01.06 | 1.50 | DNG0000183 |
| 01.07 | 2.00 | DNG0000184 |
| 01.08 | 2.00 | DNG0000185 |
| 01.09 | 3.00 | DNG0000205 |
| 01.10 | 3.00 | DNG0000206 |
| 01.11 | 1.50 | DNG0000207 |
| 01.12 | 2.00 | DNG0000208 |
| 01.13 | 2.00 | DNG0000209 |
| | 25.00 | |
| 02.01 | 3.00 | DNG0000167 |
| 02.02 | 3.00 | DNG0000168 |
| 02.03 | 3.50 | DNG0000169 |
| 02.04 | 2.00 | DNG0000170 |
| 02.05 | 3.50 | DNG0000171 |
| 02.06 | 2.00 | DNG0000172 |
| 02.07 | 3.00 | DNG0000173 |
| 02.08 | 2.50 | DNG0000174 |
| 02.09 | 2.50 | DNG0000175 |
| | 25.00 | |
| 03.01 | 3.00 | DNG0000186 |
| 03.02 | 3.00 | DNG0000188 |
| 03.03 | 2.00 | DNG0000189 |
| 03.04 | 1.50 | DNG0000190 |
| 03.05 | 3.00 | DNG0000191 |
| 03.06 | 2.50 | DNG0000192 |
| 03.07 | 3.00 | DNG0000193 |
| 03.08 | 3.50 | DNG0000194 |
| 03.09 | 3.50 | DNG0000195 |
| | 25.00 | |
| 04.01 | 3.00 | DNG0000196 |
| 04.02 | 1.00 | DNG0000197 |
| 04.03 | 3.50 | DNG0000198 |
| 04.04 | 3.50 | DNG0000199 |
| 04.05 | 3.00 | DNG0000200 |
| 04.06 | 2.50 | DNG0000201 |
| 04.07 | 2.50 | DNG0000202 |
| 04.08 | 4.00 | DNG0000203 |
| 04.09 | 2.00 | DNG0000204 |
| | 25.00 | |
| | 100.00 | |

ANSWERS -- MONTICELLO -84/06/26-GRAVES, D.

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ANSWER 1.01 (2.00)

A. Keff decreases due to fission product buildup [0.5] and fuel burnup [0.5]. (1.0)

B. Burnable poison is burning out(.5) and Pu-239 is building in (.5). (1.0)

REFERENCE
NEUTRON KINETICS LP, pg 12

ANSWER 1.02 (2.00)

A. Delayed neutrons are born at lower energies thus requiring fewer collisions to become thermalized. (1.0)

B. NO, they are the same. (1.0)

REFERENCE
NEUTRON KINETICS, pg 28

ANSWER 1.03 (1.00)

More(.25) Density change of water per degree is greater at higher temperatures(.75) (1.0)

REFERENCE
BWR INHERENT REACTIVITY COEFFICIENTS LP, pg 8

ANSWER 1.04 (2.00)

A. To return to steady state at 50%, reactivity must return to 0. Part of the negative contribution that terminates the power rise is due to the Doppler Coefficient. The negative contribution due to voids can not be as large at 50% as at 40%. (1.0)

B. The change would be smaller(.5), because the magnitude of the Doppler Coefficient is less at higher temperature(.5) (1.0)

REFERENCE
BWR INHERENT REACTIVITY COEFFICIENTS, pg 28

ANSWER 1.05 (1.00)

Changing power with recirculation flow changes total core power while keeping the flux profile relatively unchanged. (1.0)

REFERENCE
REACTOR PHYSICS TRANSIENT ANALYSIS LP, pg 14

ANSWER 1.06 (1.50)

a. 3
b. 1
c. 3 (.5 each) (1.5)

REFERENCE
STEAM TABLES

ANSWER 1.07 (2.00)

1. The bubbles serve to stir up and agitate the stagnant fluid film, improving the thermal conductivity of the film.(1.0)

2. As the fluid changes phase, it removes more heat than is possible by natural convection(1.0) (2.0)

REFERENCE
GE THERMODYNAMICS HT & FF, pg 9-8

ANSWER 1.08 (2.00)

If the reactor was shut down by 1% k/k as measured at the time of peak xenon, then SDM will decrease as xenon decays. Since xenon (peak) is greater than the 1% k/k, a inadvertent criticality could result. (2.0)

REFERENCE
BWR Technology EDH-308

ANSWER 1.09 (3.00)

A. The pump will eventually add a sufficient amount of heat to the fluid to cause cavitation. Also will accept overheating of the pump. (1.0)

B. Could cause excessively long starting currents or water hammer if the downstream piping was not filled. (1.0)

C. Causes excessive motor amps to be drawn and the high current could cause damage to the motor windings. (1.0)

REFERENCE
GE THERMO HT & FF pg 7-123, 124

ANSWER 1.10 (3.00)

A. Decrease(.5) due to increased void content in the core as flow decreases(.5). (1.0)

B. Increase(.34) due to increased voiding in the core(.33) and recirc pump no longer taking a suction on t' › annulus(.33) (1.0)

C. Decrease(.34) due to steam flow decrease(.33) and level increase(.33) (1.0)

REFERENCE
BWR TRANSIENT ANALYSIS

ANSWER 1.11 (1.50)

a. Increases (0.5)

b. Decreases (0.5)

c. Increases (0.5)

REFERENCE
Thermodynamics, Heat Transfer and Fluid Flow
pg. 9-85 to 9-89

ANSWER 1.12 (2.00)

a. Plant efficiency is reduced (0.5)
b. NPSH increases (0.5)
c. Reduce turbine load, Increase circ water flow, raise condenser pressure, Decrease circ water temp., Increase hotwell level. CAF (2 required) (1.0)

REFERENCE
GE Thermodynamics, Heat Transfer and Fluid Flow

ANSWER 1.13 (2.00)

a. Using P = Po e to the t/T then P = 75 e to 60/-80
P = 75 e to -0.75 = 35 on Range 4 [1.0]

b. After the initial prompt drop, power cannot decrease faster than the longest lived delayed neutron appears, which has about a 55.6 sec half life.[1.0]

REFERENCE
GE reactor fundamentals

ANSWER 2.01 (3.00)

A. The Fuel Pool Cooling System may be tied to the RHR System to assist cooling. (1.0)

B. -Filter/demin backwash connection(.5)
-condensate service station(.5)
-fire hose station(.5)

fire hose station is least desirable because it is untreated river water(.5) (2.0)

REFERENCE
FUEL POOL COOLING AND CLEANUP SYSTEM, pg 9,54

ANSWER 2.02 (3.00)

a. The flow controller sees a high flow from the flow element which is sensing charging flow to the accumulators(.75). This directs most of the pump discharge to recharge the scram accumulators faster(.75) (1.5)

b. 1. At high reactor pressure the rod will still scram but at slower rate than normal(.75)
2. At low reactor pressure the control rod would not scram(.75) (1.5)

REFERENCE
CRD HYDRAULIC SYSTEM, B.1.3

ANSWER 2.03 (3.50)

a. To maintain primary containment integrity (1.0)

b. Close the inboard isolation valve(.5), position the outboard isolation valve bypass switch to bypass(.5), then close the outboard isolation valve(.5) (1.5)

c. The outboard valve can't be opened if the inboard isolation valve is open without an automatic initiation signal. (1.0)

REFERENCE
CORE SPRAY, pg 4a

ANSWER 2.04 (2.00)

a. The inboard MSIV's will go shut on loss of air. (1.0)

b. The relief valves will still operate on overpressure. Air is not required for an overpressure actuation. (1.0)

REFERENCE
MAIN STEAM

ANSWER 2.05 (3.50)

A. 1. Rupture dics on the exhaust line(.6) at 175 psig(.15)
2. Turbine trip(.6) at 150 psig(.15) (1.5)

B. 1. Isolation
2. Turbine trip
3. Turbine trip
4. Isolation (.5 each) (2.0)

REFERENCE
HPCI SYSTEM

ANSWER 2.06 (2.00)

On a turbine trip, the entire turbine drops to a low pressure. This low pressure causes the hot condensate in the feed heater to flash to steam, forcing the steam back into the turbine(1.0). This could cause turbine overspeeding(1.0). (2.0)

REFERENCE
CONDENSATE AND FEEDWATER, pg 0014

ANSWER 2.07 (3.00)

A. - main turbine shaft
- stem sealing for the control vlaves
- stem sealing for the bypass valves
- stem sealing for the intermediate valves
- stem sealing for the stop valves (4 required at .5 each)

B. Prevents air leakage into the condenser(.5) and prevents radioactive steam outleakage to the atmosphere(.5) (1.0)

REFERENCE
TURBINE SYSTEM, pg B.6.1-39,40

ANSWER 2.08 (2.50)

A. -reactor water level must be > 2/3 core height(.5)
-DW pressure > 1 psig(.5)
-the low reactor water level may be bypassed(.5) (1.5)

B. 2 spray ring headers in the DW(.5)
1 spray ring header in the Torus(.5)
(number of spray rings not required) (1.0)

REFERENCE
RHR SYSTEM, pg 4,14,15

ANSWER 2.09 (2.50)

A. Torus to the Drywell (.8)
Reactor Building Atmosphere to the Torus (.8)
0.5 psid and 10" water (.4)

B. The primary containment is not designed for a negative pressure differential. (.5)

REFERENCE
Primary Containment pg 30,31

ANSWER 3.01 (3.00)

When the steam admission valve starts to open(.375), a ramp generator is triggered(.375). A low signal selector selects whichever signal is lower(.375), either the flow signal or the ramp generator(.375). This signal is compared to actual turbine speed(.375) and a signal is generated to be sent to the control valve actuator to adjust turbine speed accordingly(.375). The ramp generator signal will be the controlling signal(.375) until the flow controller output drops below it. At rated flow, the flow signal will be the controlling signal(.375). (3.0)

REFERENCE
RCIC System pg 7a,b

ANSWER 3.02 (3.00)

a. Ion chamber(0.33). Initiates a reactor scram(0.4), Group 1 closure(0.4), mechanical vacuum pump stops(0.1), and mechanical vacuum pump line suction valve shuts(0.1)
b. Scintillation detector(0.33). No automatic actions(0.5)
c. ~~G-M detector(0.33). Initiates automatic closure of the control room outside air inlet damper(0.5)~~ (3.0)

REFERENCE
Process Radiation Monitors pg 7,34,41

ANSWER 3.03 (2.00)

A. Pressure is sensed at the averaging manifold between the steam lines and the turbine stop valves. (0.5)
B. OFF is selected on the ON/OFF switch for the EPR in the control room. (1.0)
C. The MPR has a wider range of control (0.5)

REFERENCE
Main Steam Pressure Control pg 2,3

ANSWER 3.04 (1.50)

a. 1. Reactor Building ventilation plenum high radiation
   2. Refueling floor radiation
   3. Drywell pressure
   4. Low reactor water level
      (4 required @ .25 each) (1.0)

b. The partial Group II isolation will not occur in the "test" mode. (0.5)

REFERENCE
MNGP Vol. B.4.2-9,12 EDH-324

ANSWER 3.05 (3.00)

a. By monitoring the differential pressure across each recirc pump for a 2 psid or greater dp, indicating the pump is running. (1.0)

b. By comparing the pressure in the riser pipes on one recirc loop with the pressure in the riser pipes of the other loop. The undamaged loop will have a higher pressure than the damaged loop. (1.5)

c. Loop #12 (0.5)

REFERENCE
MNGP Ops. Manual, B.3.4 - 10 & 11.

ANSWER 3.06 (2.50)

a. RWM and process computer (1.0)
b. Rod select block (1.0)
c. Display will indicate 02 and 18 (0.5)

REFERENCE
RPIS pg 1,8,11

ANSWER 3.07 (3.00)

a. 10% to 100%
40° to 37° (1.0)
(0.25 each)

b. As the reactor heats up, the density of the water in the vessel decreases(0.5). The density of the water in the reference leg remains fairly constant(0.5). The net result of the density change is a lowering in indicated level(0.5) due to the increase in sensed dp. To minimize the effect, the level signal is summed with a reactor pressure signal(0.5). (2.0)

REFERENCE
Reactor Level Control pg 4,8

ANSWER 3.08 (3.50)

a. Both recirc MG sets will have their field breakers tripped(1.0) and the scram air header will be vented through the ARI valves causing a scram(1.0). (2.0)

b. A 9 second time delay is provided for the low-low level ATWS trip. (0.5)

c. Manually by depressing the appropriate two pushbuttons in the control room(0.5) or high reactor vessel pressure(0.5). (1.0)

REFERENCE
Plant Protection System, Part III ATWS

ANSWER 3.09 (3.50)

A. Edge rod selected
No rod selected
RBM channel bypassed
Reference APRM downscale
Null sequence-no balance
(4 at .25 each) (1.0)

B. When the reference APRM is < 10%, its associated RBM channel is auto bypassed(0.5). Reference APRM provides a comparison signal to the RBM averaging amplifier output for nulling(0.5). (1.0)

C. RBM channel 7 - APRM channel 3(0.5)
RBM channel 8 - APRM channel 4(0.5) (1.0)

D. Bypassing the failed APRM automatically substitutes in the backup reference APRM. (0.5)

REFERENCE
Power Range Monitors, RBM Section

ANSWERS -- MONTICELLO -84/06/26-GRAVES, D.

ANSWER 4.01 (3.00)

a. The minimum flow valve opens and reactor water is pumped to the torus. (1.0)
b. The RHR service water pumps must be in continuous operation to ensure no leakage of potentially radioactive water to the RHRSW system. (1.0)
c. To avoid a reactor scram from high flux, high reactor pressure, or high flow on the remaining steam lines. (1.0)

REFERENCE
RHR B.3.4-33, Main Steam B.2.4-25

ANSWER 4.02 (1.00)

a. bowed shaft or rotor (0.5)
b. shutdown the turbine(0.25) and place it on the turning gear(0.25) (0.5)

REFERENCE
B.6.1 Turbine pg 149

ANSWER 4.03 (3.50)

a. The amphenol plugs to the directional control solenoid valves are removed. (1.0)
b. If a rod is found to be uncoupled(.75), or a control rod cannot be moved with control rod drive pressure(.75) (1.5)
c. 6(0.5), using normal shutdown procedure(0.5) (1.0)

REFERENCE
CRD Hydraulic System B.1.3-62,63

ANSWER 4.04 (3.50)

Close the discharge valve(0.5) and the discharge valve bypass(0.5) on the tripped pump. This is to allow the pump to stop and prevent reverse rotation(0.5). Shut the seal injection valve(0.5) to prevent overpressurizing the pump(0.5) when the suction valve is shut(0.5) to isolate the pump(0.5). (3.5)

REFERENCE
Recirculation System, Recovery from Trip of One Pump B.1.4-51

ANSWER 4.05 (3.00)

On the loss of stator cooling, a generator runback to 17% of rated load occurs in 3 minutes. Allowing 15% for BPV capacity, the max tolerable power level following the runback is ~ 32%. Reducing recirc flow or tripping the recirc pumps reduces power to ~ 50% faster than driving rods. (3.0)

REFERENCE
Stator Cooling System B.6.2.4-22

ANSWER 4.06 (2.50)

a. RWCU high temperature isolation can occur due to lack of cooling flow through the regenerative heat exchanger. (1.0)

b. To prevent high pressure reactor water from leaking past the air operated filter/demin inlet and outlet valves into the low press. backwash and precoat piping. (1.5)

REFERENCE
MNGP Vol. B.2.2 EDH-334

ANSWER 4.07 (2.50)

a. By isolating and venting the scram air header manually. (1.0)
b. By observing each scram valve in the open position. (1.0)
c. 10 seconds (0.5)

REFERENCE
Plant Shutdown Outside the Control Room C.4-0100,101,103

ANSWER 4.08 (4.00)

a. If it appears that the suppression pool temperature will exceed 160 deg F. (1.0)

b. Feedwater,HPCI,RCIC,CRD Hydraulics (0.25 each) (1.0)

c. No fuel damage exists(1.0)
A low pressure ECCS pump or condensate pump is running(1.0) (2.0)

REFERENCE
C.4 Loss of Coolant Accident pg 112,113,116

ANSWER 4.09 (2.00)

a. 1. 75 REM(0.5)
2. 3 REM(0.5) (1.0)

b. o Personnel should be volunteers or professional rescue personnel
o Personnel should be familiar with the consequences of any exposure received
o Women in their reproductive years should not take part
o Exposures of this nature should be limited to once in a lifetime
o Internal exposure should be minimized by the use of respiratory equipment
o Contamination should be controlled by the use of protective clothing
o Volunteers above the age of 45 are recommended
(3 at .33 each) (1.0)

REFERENCE
Emergency Exposure Guidelines A.2-401 pg 3,5

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

FACILITY: _MONTICELLO_______________

REACTOR TYPE: _BWR____________________

DATE ADMINISTERED: _84/06/26________________

EXAMINER: _HILL, D._______________

APPLICANT: _________________________

INSTRUCTIONS TO APPLICANT:

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

| CATEGORY VALUE | % OF TOTAL | APPLICANT'S SCORE | % OF CATEGORY VALUE | CATEGORY |
|---|---|---|---|---|
| 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 |
| 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

QUESTION 5.01 (2.00)

For each condition (a-d) given below, indicate whether it will cause an INCREASE, a DECREASE, or have NO EFFECT on CRITICAL POWER:

a. Increasing fuel bundle flow (0.5)

b. Increasing coolant pressure (0.5)

c. Increasing inlet subcooling (0.5)

d. Increasing magnitude of axial power peak (0.5)

QUESTION 5.02 (1.00)

The 8x8 fuel has a thermal time constant of approximately 5 to 6 seconds. This means that in 5 to 6 seconds following a sudden power increase: (Choose ONE answer below) (1.0)

a. The fuel centerline temperature will reach its maximum (final) value.

b. Clad surface temperature will reach its final value.

c. Fuel centerline temperature will reach approximately 2/3 of its final value.

d. Fuel centerline temperature, clad surface temperature and coolant temperature have each reached their equilibrium (final) values.

e. Clad surface temperature will reach approximately 63% of its final value.

QUESTION 5.03 (2.00)

Your reactor has just scrammed from extended full power operation. Ten (10) hours later cooldown is complete, and the SDM is measured at that time to be 1% k/k. Describe the changes, if any, to the SDM for the NEXT 20 hours. (Include in your discussion any adverse conditions). (2.0)

QUESTION 5.04 (2.50)

The reactor operator has just made a rod notch with the reactor critical. The count rate of the SRM's increased from 2500 cps to 4700 cps in 80 seconds. The moderator temperature is 140 deg. F.

a. Determine the notch worth of this control rod pull. (1.5)

b. Assuming no other actions are taken and an infinite period is re-established when the moderator temperature reaches 162 deg. F., WHAT is the value of the moderator temperature coefficient. (1.0)

(Note: State any assumptions you make and show all work)

QUESTION 5.05 (3.00)

a. Determine the condenser hotwell subcooling (condensate depression) if the condenser vacuum is 27.9" Hg. and the condensate temperature is 90 degrees F. (1.0)

b. What is one disadvantage of condensate depression? (0.5)

c. How does increased condensate depression affect condensate pump net positive suction head? (0.5)

d. Give two (2) examples of factors that can increase condensate depression. (1.0)

QUESTION 5.06 (2.00)

Explain WHY it is desirable to maintain the axial flux peak low in the core during BOL and WHAT can happen if this is not done. (2.0)

QUESTION 5.07 (2.00)

For each of the events listed below, state which reactivity coefficient will respond first, why it responds first, and whether it adds positive or negative reactivity.

a. SRV opening at 100% power (1.0)

b. Rod drop from 100% power (1.0)

QUESTION 5.08 (2.00)

a. What is decay heat and how is it produced? (1.0)

b. Does this power INDICATE on the SRM instrumentation? WHY or WHY NOT? (1.0)

QUESTION 5.09 (3.00)

Following an auto initiation of RCIC at a reactor pressure of 800 psig, reactor pressure decreases to 400 psig. HOW are the following parameters affected (INCREASES, DECREASES, REMAINS CONSTANT) by the change in reactor pressure? BRIEFLY EXPLAIN YOUR CHOICE.

ASSUME the RCIC System is operating as designed.

a. RCIC flow to the reactor (1.0)

b. RCIC pump discharge head (assuming NPSH remains constant) (1.0)

c. RCIC turbine RPM (1.0)

QUESTION 5.10 (2.50)

Tube flow through a feedwater heater is 4.0 x 10E6 lbm/hr feedwater flow which enters at 150 deg. F. and exits at 200 deg. F. The shell side is supplied with extraction steam at 30 psig which leaves the shell side as drain water at 150 deg. F. What EXTRACTION STEAM FLOW is required? (Note: Show all calculations you may use and state any assumptions you make.) (2.5)

QUESTION 5.11 (2.00)

a. Power level is increased from 40 to 50 percent by increasing recirculation flow. HOW and WHY does the steady state negative reactivity contribution due to voids change between these two power levels. EXPLAIN. (1.0)

b. If the change was from 90 to 100 percent, HOW and WHY would it affect the magnitude of the change discussed in part 'a' above? (1.0)

QUESTION 5.12 (1.00)

When conducting the core SDM test at the beginning of core life, the margin must be at least R+0.25% delta K. What is R? (1.0)

QUESTION 6.01 (3.00)

With regard to the Main Steam System:

a. Explain what physically causes the MSIV closing speed during EXERCISING to be much slower than the normal closing speed? Your answer should include HOW the valve is closed (motive force). (1.5)

b. Explain HOW/WHY a relief valve discharge pipe (tail pipe) could be damaged due to its vacuum breakers sticking shut during repeated actuation (lifting) of the relief valve. (1.5)

QUESTION 6.02 (2.50)

a. List two conditions that will cause the RWCU Excess Flow Control Valve (CV-2403) to AUTO CLOSE. Include setpoints. (1.0)

b. Should the RWCU Excess Flow RO Bypass valve (MO-2401) be open at high pressure? Explain your answer. (1.0)

c. What problem, if any, is associated with the RWCU Holding Pumps re-starting automatically after a loss of power for greater than 5 seconds to MCC's 22 and 32? (0.5)

QUESTION 6.03 (3.00)

a. What signals (including setpoints) will automatically start the Core Spray Pumps? (1.5)

b. What protection to the Core Spray pump is provided until injection into the vessel takes place? (0.5)

c. If a Core Spray loop is to be isolated, following an initiation and a pump failure, why does the Outboard Isolation Bypass switch have to be taken to 'Bypass' before closing the Outboard Isolation valve? (0.5)

d. How can the Core Spray pump be stopped if the initiation signal is still present? (0.5)

QUESTION 6.04 (4.00)

For each of the HPCI (High Pressure Coolant Injection) System component failures listed below, STATE WHETHER OR NOT HPCI WILL AUTO INJECT into the reactor vessel, IF IT WILL NOT INJECT WHY, AND IF IT WILL INJECT, provide ONE POTENTIAL ADVERSE EFFECT OR CONSEQUENCE of system operation with the failed component.
Assume NO OPERATOR ACTION, and the component is in the failed condition at the time HPCI receives the auto initiating signal.

a. The GLAND SEAL EXHAUSTER fails to operate. (1.0)

b. The turbine AUXILIARY LUBE OIL PUMP fails to operate. (1.0)

c. The MINIMUM FLOW VALVE fails to auto open (STAYS SHUT) when system conditions require it to be open. (1.0)

d. The HPCI PUMP DISCHARGE FLOW ELEMENT output signal to the HPCI flow controller is failed at its maximum output. (1.0)

QUESTION 6.05 (2.50)

The plant is at 50% power when an instrument technician requests permission to perform a FUNCTIONAL CHECK on the YARWAY -50 to +50" RPS level indicating switch LIS 2-3-57A. Assuming that work on more that one plant instrument at a time IS PERMISSIBLE, which of the following would you NOT ALLOW to be performed in conjunction with this work? EXPLAIN YOUR ANSWER FULLY.

a. CALIBRATION of the Reactor Level Control System GEMAC LEVEL TRANSMITTER 'B'. (Assume level transmitter 'A' is selected for input to the Feedwater Level Control System.)

b. FUNCTIONAL CHECK of the MAIN STEAM LINE RADIATION Monitor CHANNEL 'D'.

c. FUNCTIONAL CHECK of the YARWAY -50 to +50" ECCS level indicating switch LIS 2-3-72A.

QUESTION 6.06 (4.00)

Concerning the Recirculation Flow Control System:

a. What are two of the three speed control components that use the speed signal from the MG set techometer? (1.5)

b. What are two of the three conditions that will PREVENT a signal mismatch scoop tube lock? Include applicable setpoints. (1.5)

c. With the plant operating at 23% power and minimum flow, an operator inadvertantly shifts the M/A transfer station for recirc. pump 'A' from 'Manual' to 'Auto'. Assuming NO further operator action, BRIEFLY EXPLAIN what will happen to the speed of 'A' recirc. pump. Continue your discussion to the final steady state speed. (1.0)

QUESTION 6.07 (2.50)

a. Explain the operation of the Feed Heater Level Control system for an Increasing Level in High Inter. Pressure Heater E-14A. Assume the level increase continues to the high level setpoint. (1.5)

b. Why are the condensate feedwater block valves interlocked to open the spill valves when the block valve is not fully opened? (1.0)

QUESTION 6.08 (1.50)

a. What conditions (list four) will automatically initiate the Standby Gas Treatment system? (1.0)

b. How is a SGTS system 'Test' different from an 'auto initiation'? (Other than the initiating event). (0.5)

QUESTION 6.09 (2.00)

Regarding the LPCI Loop Select Logic:

a. How does the logic determine how many recirc. pumps are running? (1.0)

b. How does the logic determine which is the UNDAMAGED recirc. loop? (1.0)

QUESTION 7.01 (2.50)

During Power Operation:

a. What actions must be taken upon receipt of an AGAF alarm? (1.0)

b. What are three instances when a TIP scan should be performed?(1.5)

QUESTION 7.02 (3.50)

Assume a pipe break INSIDE the CONTAINMENT:

a. What are the five immediate actions to be performed to initiate a RHR loop into the LPCI mode from the shutdown cooling mode? Valve numbers NOT required. (2.0)

b. Which Reactor Vessel Level indicators should an operator use during a rapid depressurization? (List two and be specific) (1.0)

c. If APRS does NOT automatically initiate on low-low reactor level AND CANNOT be manually initiated, HOW many relief valves should be opened to depressurize the reactor? (0.5)

QUESTION 7.03 (3.50)

a. List the conditions that will initiate an ATWS trip and the action(s) it produces. (1.0)

b. The ATWS event procedure instructs the LPE&RO to initiate the SBLC system if certain conditions exist. What are these conditions? (1.5)

c. Once SBLC is initiated when can you terminate the injection? WHY? (1.0)

QUESTION 7.04 (3.00)

List the two reasons that prolonged operation in HOT STANDBY is undesirable AND EXPLAIN WHY each IS NOT a problem during power operations. (3.0)

QUESTION 7.05 (2.00)

Regarding the Recirculation System:

a. Operational Limitations on the recirc pumps are maintained to enhance the capability of the LPCI Loop Select Logic. When DON'T these limitations apply? (0.5)

b. What are the three operational limitations concerning ONE-PUMP OPERATION? (1.5)

QUESTION 7.06 (3.00)

With regard to the main turbine:

a. Why should operation below 5% load be held to a minimum? (0.5)

b. What action must you take if ROTOR LONG as indicated on the red band on recorder 1717 is exceeded? (1.0)

c. What is the limiting parameter when making load changes from one steady state load to another? Include in your answer any alternative parameters that you are allowed to use. (1.5)

QUESTION 7.07 (3.00)

You are the Emergency Director during a radiological accident and have decided to use the Emergency Exposure Guidelines during the corrective actions. What are four of the criteria you would use to select the personnel for the job, all other things being equal ie. skill and job familiairity? (3.0)

QUESTION 7.08 (2.50)

Concerning operation of the RWCU (Reactor Water Cleanup) system:

a. Why are you cautioned to closely monitor cleanup water temperature to the filter/demins during reactor startup? (1.0)

b. Why must the filter/demins be MANUALLY isolated prior to starting backwashing and precoating? (1.5)

QUESTION 7.09 (2.00)

What is the reason for each of the following precautions pertaining to the RHR system?

a. When starting the RHR pumps in the shutdown cooling mode, the pumps should not be run with the discharge valve closed for extended periods of time. (1.0)

b. Do not control the rate of reactor cooldown during the shutdown cooling mode of RHR by alternately stopping and starting the RHR Service Water pumps. (1.0)

QUESTION 8.01 (2.00)

For each of the following conditions, STATE WHETHER YOU WOULD CONSIDER THE APPLICABLE SYSTEM OPERABLE OR INOPERABLE per the tech. specs. AND for each you consider inoperable, briefly STATE WHY you determined the system to be INOPERABLE (i.e., why it cannot perform its intended function).

a. The condensate pressurizing station for a LPCI loop is out of service. (1.0)

b. The HPCI suction valves will not automatically shift to the Suppression Pool from the CST fon high suppression pool level. They will shift automatically on low CST level. (1.0)

QUESTION 8.02 (1.50)

While performing a routine periodic surveillance, your plant operator informs you that a required fire barrier seal appears to have been damaged and, in his opinion, needs to be replaced. What action(s) must you take prior to repair of the fire seal? (1.5)

QUESTION 8.03 (3.00)

Concerning the use of Safety Tags:

a. What criteria is used to determine whether a HOLD card or a SECURE card should be used for a clearance? (1.0)

b. Is an OCB (oil circuit breaker) in the OPEN position adequate for CLEARANCE FOR WORK? EXPLAIN your answer. (1.0)

c. What two conditions must be met before a person requesting a clearance for work can work under ANOTHER persons HOLD card? (1.0)

QUESTION 8.04 (3.00)

a. What are the control room minimum staffing requirements (per Tech. Specs.) during NORMAL OPERATIONS AND COLD SHUTDOWN? (2.0)

b. What provisions are made to accomodate an unexpected absence of a duty shift crew member? (1.0)

QUESTION 8.05 (2.50)

Concerning reportable event notifications, what are the differences between an IMMEDIATE NRC notification (10 CFR 50.72) and a PROMPT NRC notification with written followup (Technical Specifications)? (2.5)

QUESTION 8.06 (2.00)

List four scrams which must be OPERABLE when the reactor is subcritical, irradiated fuel is in the vessel, and the reactor temperature is less than 212 degrees F. Include any applicable setpoints. (2.0)

QUESTION 8.07 (2.50)

a. What are two reasons ERO (Emergency Response Organization) tag boards are used? (1.0)

b. Who, in order of succession, can assume the duties of OPERATIONS GROUP LEADER? (Five required) (1.5)

QUESTION 8.08 (3.50)

a. List two conditions where a Plant Restart Checklist may be used. (1.5)

b. How are changes to the Control Rod Withdrawal Sequence implemented? (0.5)

c. If criticality WAS NOT achieved during a reactor startup and subsequent shutdown; under what condition would a startup NOT be assigned a new number? (0.5)

d. If a Reactor Protection System checklist for a specific reactor startup was STARTED at 0800, COMPLETED at 1500, and the REACTOR STARTUP COMMENCED at 2200; would the checklist be valid? EXPLAIN your answer. (1.0)

QUESTION 8.09 (2.00)

According to Administrative Control Directive 4 ACD-3.6, Work Request Authorization:

a. What are CRITICAL SYSTEMS? (1.0)

b. For work on Critical Systems, what two individuals must give approval prior to work on the Critical System? (1.0)

QUESTION 8.10 (3.00)

In regard to MNGP Technical Specifications for Refueling:

a. What is an alteration of the core? (.75)

b. Is it allowable to use 'Dunking' chambers during major core alterations? EXPLAIN your answer. (.75)

c. List the two conditions that must be fulfilled before the requirement that 'the SRM have a minimum of 3 cps with all rods fully inserted' is waived. (1.5)

# EQUATION SHEET

$f = ma$

$v = s/t$

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

$w = mg$

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

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

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

$PE = mgh$

$V_f = V_o + at$

$w = \theta/t$

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

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

$W = v\ \Delta P$

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

$\Delta E = 931\ \Delta m$

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

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

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

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

$Pwr = W_f \Delta h$

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

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

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

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

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

$SUR = 26.06/T$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$I_1 d_1 = I_2 d_2$

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

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

$\Sigma = \sigma N$

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

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

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

ANSWER 5.01 (2.00)

a. Increases (0.5)

b. Decreases (0.5)

c. Increases (0.5)

d. Decreases (0.5)

REFERENCE
Thermodynamics, Heat Transfer and Fluid Flow
pg. 9-85 to 9-89 EDH-306

ANSWER 5.02 (1.00)

Clad surface temperature will reach approximately 63% of its final value. (e) (1.0)

REFERENCE
Thermodynamics, Heat Transfer and Fluid Flow
pg. 9-102 EDH-307

ANSWER 5.03 (2.00)

If the reactor was shut down by 1% k/k as measured at the time of peak xenon, then SDM will decrease as xenon decays. Since xenon (peak) is greater than the 1% k/k, a inadvertent criticality could result. (2.0)

REFERENCE
BWR Technology EDH-308

ANSWER 5.04 (2.50)

a. $P=P_0 e^{t/T}$
T=t/ln (P/Po)
T=80/ln (4700/2500) = 126.73 sec.
$T=\beta-\rho/\lambda\rho$ (assume beta=.007, lambda=.1sec
$\rho=\beta/1+\lambda T$ =.007/1+.1(126.73)=.00051 dk/k per notch (1.5)

b. $\alpha_{Tmod}\,\Delta T_{mod} = -\alpha_{rod}\,\Delta(notch)$
$\alpha_{Tmod} = \alpha_{rod}\,\Delta(notch)/\Delta T_{mod}$
= - .00051/162-140 = -2.32E-5 dk/k per deg. F. (1.0)

NOTE: Answers graded independently.

REFERENCE
BWR Technology, Equation Sheet EDH-309

ANSWER 5.05 (3.00)

a. 29.9" - 27.9" = 2" Hg absolute (0.25)
2" Hg absolute = .98 psia (0.25)
Tsat for .98 psia = 100 F (0.25)
100 F - 90 F = 10 F condensate depression (0.25) (1.0)

b. Plant efficiency is reduced (0.5)

c. NPSH increases (0.5)

d. Reduce turbine load, Increase circ water flow, raise condenser pressure, Decrease circ water temp., Increase hotwell level. CAF (2 required) (1.0)

REFERENCE
Steam Tables, Thermodynamics, Heat Transfer and Fluid Flow EDH-310

ANSWER 5.06 (2.00)

Keeping the peak low in the core decreases peaking problems at EOL [0.5]. At EOL all control rods are fully withdrawn and large flux peaks occur. Without proper burnout, the bottom would be excessively reactive and rods would have to be inserted to control peaking. These rods would be very difficult to withdraw later[1.5] (2.0)

REFERENCE
BWR Inherent Reactivity Coefficients, pg. 50 EDH-311

ANSWER 5.07 (2.00)

a. Decreased pressure causes increased voids [0.5], void coefficient [.25] would add negative reactivity [.25] first. (1.0)

b. The rapid addition of positive reactivity due to rod removal causes power to increase, and fuel temperature to increase [0.5]. Fuel temperature coefficient [.25] would respond first by adding negative reactivity [.25]. (1.0)

REFERENCE
BWR Technology

ANSWER 5.08 (2.00)

a. Heat produced at some time after the fission event [0.5] is decay heat. It is produced by the radioactive decay of the fission products [0.5] (1.0)

b. No.[0.25] The nuclear instrumentation indicates neutrons, while the decay heat power is from beta & gamma decay of the fission fragments [0.75] (1.0)

REFERENCE
GE Rx Fundamentals CED 223

ANSWER 5.09 (3.00)

a. Remains constant [.25]. Flow is controlled by the RCIC flow controller which will attempt to maintain a constant output flow regardless of reactor pressure [.75]. (1.0)

b. Decreases [.25]. The flow controller functions to maintain a constant flow, thus pump discharge pressure is decreased along with the decreasing reactor pressure to maintain constant flow. OR Since the flow controller maintains a constant flow to the reactor, as reactor pressure decreases, the pump discharge head must decrease to maintain a constant flow (constant NPSH) [.75]. (1.0)

c. Decreases [.25]. Since pump discharge head is decreasing to maintain a constant flow, turbine RPM must also decrease [.75]. (1.0)

REFERENCE
NUS Pumps and Fluid Flow, and MNGP Ops, Manual, B.2.3 EDH-314

ANSWER 5.10 (2.50)

Qfeed = Mf x c x dT, Qstm = Ms x dh, Qfeed = Qstm (1.0)
30psig = 44.7psia
4.0 E06 x 1.0 x (200 - 150) = Ms x (1172 - 118) (0.5)
Ms = 4.0 E06 x 50/(1172 - 118)
= 1.9 E05 lbm/hr (1.0)

REFERENCE
Thermodynamics, Heat Transfer and Fluid Flow, pg. 8-62,8-63 EDH-315

ANSWER 5.11 (2.00)

a. To return to steady state at 50%, reactivity must return to zero. Part of the negative contribution that terminates the power rise is due to the Doppler Coefficient. The negative contribution due to voids cannot be as large at 50% as at 40%. (1.0)

b. The change would be smaller, because the magnitude of the Doppler Coefficient is less at higher temperatures. (1.0)

REFERENCE
BWR Inherent Reactivity Coefficients, pg. 28 EDH-316

ANSWER 5.12 (1.00)

R is the difference between the calculated value of maximum core reactivity during the operating cycle and the calculated BOL core reactivity. (1.0)

REFERENCE
MNGP Technical Specifications, 3.3/4.3-8, pg.84 EDH-345

ANSWER 6.01 (3.00)

a. The air supply to the MSIV air cylinder is interrupted [0.5] and the air cylinder vents through an exhaust restrictor [0.5]. Since no air pressure is applied to the top of the air cylinder, the valve closing springs provide the main closing force [0.5]. (1.5)

b. Following the first actuation of the relief, the steam in its discharge line would condense causing a vacuum in the line [0.5]. This would result in torus water being drawn up into the line [0.5] which could cause overpressurization of the line on the next actuation [0.5]. (1.5)

REFERENCE
MNGP Vol. B.2.4-12,13 EDH-317

ANSWER 6.02 (2.50)

a. Low Pressure upstream @ 5 psig decreasing OR (0.5)
High Pressure downstream @ 140 psig increasing (0.5)

b. No [.25], the orifice bypass valve is opened when the influent pressure is low. This would increase the flow rate [.75]. The purpose of the orifice is to limit flow rates to the condenser or radwaste when the influent pressure is high. (1.0)

c. Since the filter cake falls off the tubes on a loss of flow; when flow resumed, migration of the filter cake would take place and contaminate the system. (0.5)

REFERENCE
MNGP Vol. B.2.2-3,14,23,42 EDH-318

ANSWER 6.03 (3.00)

a. High Drywell Pressure @ 2 psig OR Low Low Reactor Water Level @ 6'7" above TAF AND Low Reactor Vessel Pressure @ 450 psig. (1.5)

b. Each loop includes an orificed minimum flow pump discharge line back to the suppression pool. (0.5)

c. Bypass cancels the automatic signal to that valve. (0.5)

d. By placing the control switch in P-T-L. (0.5)

REFERENCE
MNGP Vol. B.3.1-2,4-6 EDH-319

ANSWER 6.04 (4.00)

a. Will inject [0.25]. Turbine seal leakage resulting in potential air-borne activity in the HPCI room [0.75]. (1.0)

b. Will not inject [0.25]. Turbine stop and control valves will not open [0.75]. (1.0)

c. Will inject [0.25]. Pump overheating and seal damage may result during low or no flow conditions [0.75]. (1.0)

d. Will not inject [0.25]. Maximum signal from the flow element will cause the controller to keep turbine speed at minimum [0.75]. (1.0)

REFERENCE
MNGP Ops Manual, B.3.2

ANSWER 6.05 (2.50)

b is the correct answer [0.5].

YARWAY LIS 2-3-57A gives a half Group 1 isolation signal [0.75]. Main Steam Line Radiation Monitor 'D' would trip the remaining half of the isolation logic causing the MSIVs to close [0.75]. This in turn would cause a full scram as the plant mode switch is in 'RUN' [0.5].

-OR-

YARWAY LIS 2-3-57A gives half scram on +9" low level and MSL Rad channel 'D' provides the half scram on RPS channel 'B' for a full scram.

REFERENCE
MNGP Ops. Manual, B.1.1 & B.5.6

ANSWER 6.06 (4.00)

a. 1. M/A Transfer Station
   2. Mismatch Summer
   3. Error Signal Limiting Network
      (2 required @ .75 each) (1.5)

b. 1. Recirc. Pump discharge valve shut
   2. Feedwater flow <20%
   3. Output of M/A Transfer station <25%
      (2 required @ .75 each) (1.5)

c. Pump speed will increase to 45% at which time the Master Controller low speed limiter will be limiting. (1.0)

REFERENCE
MNGP Vol. B.1.4-3, B.5.8-2,4,9 EDH-322

ANSWER 6.07 (2.50)

a. The level controller will first open the heater drain (CV-1017) [0.5]. As level continues to increase, the heater dump valve (CV-1018) will open draining the heater to the condenser[0.5]. At the high level alarm point, the bleeder trip valve (BTV-10) will close[0.5]. (1.5)

b. This insures continuous removal of moisture from the turbine extraction stages when feedwater heaters are out of service. (1.0)

REFERENCE
MNGP Vol. B.6.5-14,16,21 EDH-323

ANSWER 6.08 (1.50)

a. 1. Reactor Building ventilation plenum high radiation
   2. Refueling floor radiation
   3. Drywell pressure
   4. Low reactor water level
      (4 required @ .25 each) (1.0)

b. The partial Group II isolation will not occur in the 'test' mode. (0.5)

REFERENCE
MNGP Vol. B.4.2-9,12 EDH-324

ANSWER 6.09 (2.00)

a. By monitoring the differential pressure across each recirc pump for a 2 psid or greater dp, indicating the pump is running. (1.0)

b. By comparing the pressure in the riser pipes on one recirc loop with the pressure in the riser pipes of the other loop. The undamaged loop will have a higher pressure than the damaged loop. (1.0)

REFERENCE
MNGP Vol. B.3.4-10,11 EDH-325

ANSWER 7.01 (2.50)

a. 1. Demand OD-3 to determine which APRM'S caused the alarm
   2. Increase the gain of the deficient APRM'S
   3. Re-demand OD-3 to verify that all APRM'S are reading properly
   4. Control Room Log entry stating which APRM gains were adjusted and why.
      (Must have at least 1 and 2 for full credit) (1.0)

b. 1. Approximately once a month
   2. Immediately following a rod sequence exchange
   3. Upon request of the Nuclear Engineer
   4. Following a detector replacement (to calibrate the detector)
      (3 required @ 0.5 each) (1.5)

REFERENCE
MNGP Vol. C.2-3,32 EDH-326

ANSWER 7.02 (3.50)

a. 1. Open RHR cross-tie valve (MO-2033) (0.4)
   2. Close shutdown cooling suction valve (MO-1988/89) (0.4)
   3. Open torus suction valve (MO-1986/87) (0.4)
   4. Reset S/D Cooling Group 2 Isolation (0.4)
   5. Open LPCI injection valves (MO-2012 to 2015) (0.4)

b. 1. Core Flooding, 400 inch, Yarway (0.5)
   2. Operating Range, 60 inch, GE/MAC (0.5)

c. As many as possible, up to the number used for APRS (0.5)

REFERENCE
MNGP Vol. C.4-0109,0111,0113 EDH-327

ANSWER 7.03 (3.50)

a. 1135 psig[0.25] or Low-Low Rx water level after a 9 second time delay.[0.25] The ATWS trip opens the recirc MG field breakers [0.25] and opens the ARI valves[0.25] (1.0)

b. Unable to maintain the reactor subcritical[0.5] and
   1. RPV water level cannot be maintained[0.5] OR (1.0)
   2. Suppression pool water temperature cannot be maintained less than 110 deg.F[0.5] (0.5)

c. Once SBLC is initiated the complete charge is to be injected.[0.5] To ensure S/D margin maintained as C/D, dilution, poison decay and reactivity coefficient feedback take place.[0.5] (1.0)

REFERENCE
NSP OP MAN. C.4.I-11 & B.3.5 CED 250

ANSWER 7.04 (3.00)

1. Buildup of oxygen in the reactor coolant due to radiolytic decomposition of water. Oxygen is removed at high steaming rates (deaeration by boiling). High oxygen concentration at high temperature is conducive to stress corrosion. (1.5)

2. Increased feedwater nozzle thermal fatigue cycling due to low feedwater temperatures, cycling of feed flow due to minimum resolution of the Feedwater Control System at low flows, incomplete mixing, and 'unstable flow cycling' within the sparger. During power operations, feed flows and temperatures are increased. (1.5)

REFERENCE
MNGP Vol. 6.1-0062 EDH-330

ANSWER 7.05 (2.00)

a. Transient periods of pump startup or one loop restart. (0.5)

b. 1. Idle pump shall not be started unless the active pump speed is reduced to less than 50% of rated speed.
2. Power operation with one recirculation pump and equalizer valve closed is limited to 24 hours. Under no circumstances shall equalizer valves be open during power operation.
3. The reactor thermal power should be limited to 68% of rated (1135.6 MWT) during one pump equalizer valves closed operation.
(3 required @ 0.5 each) (1.5)

REFERENCE
MNGP Vol. 5.1.4-42,43 EDH-331

ANSWER 7.06 (3.00)

a. Because of increased rates of erosion on the later stage buckets. (0.5)

b. Shutdown the turbine and place on the turning gear to allow temperatures to equalize. (1.0)

c. First stage bowl metal temperature differential OR the temerature difference on the control valve casing. (1.5)

REFERENCE
MNGP Vol. B.6.1-136,137 EDH-332

ANSWER 7.07 (3.00)

1. Personnel receiving increased exposure should be volunteers or professional rescue personnel.
2. Personnel should be broadly familiar with the consequenses of exposures received under emergency conditions.
3. Women in their reproductive years should not take part.
4. Exposures under these conditions should be limited to once in a lifetime.
5. Internal exposure should be minimized by the use of appropriate respiratory equipment, and contamination should be controlled by the use of appropriate protective clothing.
6. Volunteers above the age of 45 are recommended.
(4 required @ .75 each) (3.0)

REFERENCE
MNGP Vol. V.2.401 EDH-333

ANSWER 7.08 (2.50)

a. RWCU high temperature isolation can occur due to lack of cooling flow through the regenerative heat exchanger. (1.0)

b. To prevent high pressure reactor water from leaking past the air operated filter/demin inlet and outlet valves into the low press. backwash and precoat piping. (1.5)

REFERENCE
MNGP Vol. B.2.2 EDH-334

ANSWER 7.09 (2.00)

a. The minimum flow valve opens and reactor water is pumped to the torus. (1.0)
b. The RHR service water pumps must be in continuous operation to ensure no leakage of potentially radioactive water to the RHRSW system. (1.0)
c. To avoid a reactor scram from high flux, high reactor pressure, or high flow on the remaining steam lines. (1.0)

REFERENCE
RHR B.3.4-33, Main Steam B.2.4-25

ANSWER 8.01 (2.00)

a. Inoperable LPCI loop [0.33]. Potential for water hammer in discharge piping and possible discharge piping damage as a result [0.67]. (1.0)

b. Inoperable HPCI [0.33]. HPCI suction must automatically transfer to the Suppression Pool on high level to maintain an adequate air space in the Suppression Pool [0.67]. (1.0)

REFERENCE
MNGP Tech. Specs.

ANSWER 8.02 (1.50)

With a fire barrier penetration fire seal not intact, a continuous fire watch shall be established on at least one side of the affected penetration within one hour. (1.5)

REFERENCE
MNGP T.S.,3.13.6, pg. 227b EDH-336

ANSWER 8.03 (3.00)

a. Hold cards are used when human life or injury are involved. Secure cards are not. (1.0)

b. No, because the contacts of these switches are not visible and might have in some way malfunctioned and still be closed. (1.0)

c. 1. With the knowledge and approval of the original card holder (0.5)
   2. Must either place his Hold card with the first Hold card or ascertain that his Hold is properly logged under the first person's clearance. (0.5)

REFERENCE
MNGP Vol. B.9.1-0006,0007,0009 EDH-337

ANSWER 8.04 (3.00)

a.

| | NORMAL OPERATION | COLD SHUTDOWN |
|---|---|---|
| LSO | 1 | 1 |
| LSO&LO | 3 | 2 |
| Lic.&Unlic. | 5 | 3 |
| STA | 1 | 0 |

(2.0)

b. Shift crew composition may be less than minimum for a period of time not to exceed two hours provided immediate action is taken to restore crew composition to minimum. (1.0)

REFERENCE
MNGP T.S. Table 6.1.1., pg.236 EDH-338

ANSWER 8.05 (2.50)

Immediate: NRC notified within one hour. (0.5)
Prompt: NRC notified within 24 hours by telephone and confirmed by telegraph, mailgram, or facsimile transmission to the NRC Regional Administrator no later than the first working day following the event, with a written followup within two weeks. (2.0)

REFERENCE
MNGP T.S., pg. 250, 50.72 (9/30/83) EDH-339

ANSWER 8.06 (2.00)

1. Mode Switch in Shutdown
2. Manual Scram
3. High Flux IRM (120/125)
4. Scram Discharge Volume High Level (56 gal.)
(4 required @ 0.5 each) (2.0)

REFERENCE
MNGP T.S. Table 3.1.1 and Notes pg. 28,29 EDH-340

ANSWER 8.07 (2.50)

a. 1. Speedy personnel duty assignments during the initial stage of an emergency
2. Insure qualified personnel fill the positions in the ERO
3. Insure that the more important positions in the ERO are filled first.
(2 required @ 0.5 each) (1.0)

b. D. Antony
Senior Site Superintendent present, not on duty shift
Senior Shift Supervisor present, not on duty shift
Duty Site Superintendent
Duty Shift Supervisor
(5 required @ 0.3 each) (1.5)

REFERENCE
MNGP Vol. A.2-001, pg. 1,6 EDH-341

ANSWER 8.08 (3.50)

a. 1. When plant is expected to be restarted after a short duration shutdown when no major maintenance has been performed. (.75)
2. After a scram, if the nature of the scram is known and the cause remedied. (.75)

b. By a Management Memo (0.5)

c. If rod withdrawal is re-initiated within 4 hours after reaching the all-rods-in condition. (0.5)

d. No, the elapsed time from start of performance to initial rod withdrawal exceeds the 12 hour time limit. (1.0)

REFERENCE
MNGP Vol. C.1-1,3 EDH-342

ANSWER 8.09 (2.00)

a. Systems or equipment that are required to be operable by Technical Specifications or are critical to continued operation of the plant. (1.0)

b. WRA coordinator and the superintendent, operations (1.0)

REFERENCE
4 ACD-3.6 EDH-343

ANSWER 8.10 (3.00)

a. The act of moving any component in the region above the core support plate, below the upper grid and within the shroud. (.75)

b. Yes, provided the detector is connected into the normal SRM circuit. (.75)

c. 1. No more than two fuel assemblies are present in the core quadrant associated with the SRM. (.75)
   2. While in the core, these fuel assemblies are in locations adjacent to the SRM. (.75)

REFERENCE
MNGP T.S. 3.10.B, pg. 207 EDH-344
Definitions, pg. 1