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

EXAMINATION REPORT NO.: 50-336/87-31 (OL)

FACILITY DOCKET NO.: 50-336

FACILITY LICENSE NO.: DPR-65

LICENSEE: Northeast Nuclear Energy Company
P.O. Box 270
Hartford, Connecticut 06141-0270

FACILITY: Millstone, Unit 2

EXAMINATION DATES: 1/11/88 - 1/14/88

CHIEF EXAMINER: David M Silk — 3/25/88
David M. Silk, Date
Operations Engineer (Examiner)

APPROVED BY: P W Eselgroth — 3/25/88
Peter W. Eselgroth, Chief Date
PWR Section, Operations Branch, DRS

SUMMARY: On the week of January 11, 1988, written and operating examinations were administered to six Reactor Operator and two instant Senior Reactor Operator candidates. All candidates passed all portions of the examination.

REPORT DETAILS

TYPE OF EXAMS: Replacement

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail
Written Exam	6/0	2/0
Oral Exam	6/0	2/0
Simulator Exam	6/0	2/0
Overall	6/0	2/0

1. CHIEF EXAMINER AT SITE: D. Silk

2. OTHER EXAMINERS: B. Norris
   P. Isakson (EG&G)
   F. Jagger (EG&G)

1. Summary of generic strengths or deficiencies noted on oral exams:

   SRO candidates did not know the definition of the word "clearance".

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

   This information is being provided to document areas of weakness which should aid the licensee in upgrading replacement training programs. No reply is required.

Reactor Operator Examination

Question No.	Subject
1.02	Xenon production and removal at different power levels.
2.04c	Reason for limit on load current if Bus 24E is supplied from its backup source
2.09a	Design basis for AFW flow time delay.
2.10b	Response of an CEA to a demand signal if the lift coil has failed.
3.09b	RPS response to the channel 'A' SG differential pressure failing high.
4.05	Conditions that allow the operator to leave the surveillance area of the control room according to ACP.6.01, Control Room Procedure.

Senior Reactor Operator Examination

5.01a	Effects of cooler feedwater on a secondary calorimetric.
6.06c	Effect of an RCP trip at 100% power on the Thermal Margin/Low Pressure trip setpoint.
7.05	Operator actions to be taken if all feedwater flow is lost for greater than 5 minutes and reactor power is greater than 5%.
8.06b	Operator actions prior to resetting protective relays following a reactor trip.
8.10	Conditions requiring both independent shutdown cooling loops to be operable.

3. Personnel Present at Exit Interview:

NRC Personnel

David Silk, Operations Engineer (Examiner)
Lynn Kolonauski, Resident Inspector, Millstone Unit 1

Facility Personnel

Stephen Scace, Millstone Station Superintendent
Brad Ruth, Manager, Operator Training
Mike Wilson, Supervisor, Operator Training, Millstone Unit 2
Joe Parillo, Supervisor, Simulator Training, Millstone Unit 2
Dan Pantalone, Instructor, Millstone Unit 2

4. Summary of NRC Comments made at exit interview:

The NRC recapped the events and personnel involved during the week. Appreciation was expressed to the training department for their support and to the operating crew in the control room for attempts to minimize the distractions to the candidates. Also, the NRC commended the performance of the simulator in that it ran without malfunctioning except for the spurious loss of a 4KV bus at the end of one scenario. The NRC commented that the candidates generally performed well during the simulator examination with the exception of vague communications.

The NRC mentioned that there appeared to be no set policy regarding the wearing of dosimetry because during the week plant personnel were observed with dosimetry attached to pants pockets, belts and shirt tails. The NRC also observed an instance where a worker improperly frisked out (picked up the detector without first checking his hand).

5. Summary of facility comments made at exit interview:

The licensee felt that the NRC written and simulator examinations were within the bounds of the enabling objectives and the scope of the emergency operating procedures.

Attachments:

1. Written Examination and Answer Key (RO)
2. Written Examination and Answer Key (SRO)
3. Resolution of Facility Comments for RO Exam Given January 11, 1988 at Millstone Unit 2
4. Resolution of Facility Comments for SRO Exam Given January 11, 1988 at Millstone Unit 2

Attachment 1

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: Millstone 2

REACTOR TYPE: PWR-CE

DATE ADMINSTERED: 88/01/11

EXAMINER: ISAKSEN, P.

CANDIDATE _____

MASTER COPY

INSTRUCTIONS TO CANDIDATE:

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	CANDIDATE'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
100.0		_____ Final Grade	_____%		Totals

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

MASTER COPY
_____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

3. Use black ink or dark pencil only to facilitate legible reproductions.

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only on one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination you shall:

a. Assemble your examination as follows:

(1) Exam questions on top.

(2) Exam aids - figures, tables, etc.

(3) Answer pages including figures which are part of the answer.

b. Turn in your copy of the examination and all pages used to answer the examination questions.

c. Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.

d. Leave the examination area, as defined by the examiner. If after leaving, you are found in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION 1.01 (1.00)

Increasing the boron concentration at low temperature has little effect on the Moderator Temperature Coefficient as compared to higher operating temperatures because: (choose the correct answer)

a. water density does not change as much at low temperature.

b. water density is greater at lower temperatures so neutron leakage is less.

c. water density is greater at lower temperatures so parasitic neutron absorption is greater.

d. boric acid is less soluable at lower temperatures.

QUESTION 1.02 (1.00)

Which one of the following statements concerning Xenon-135 production and removal is correct?

a. At full power, equilibrium conditions, about half of the Xenon is produced by Iodine decay and the other half is produced as a direct fission product.

b. Following a reactor trip from equilibrium conditions, Xenon peaks because delayed neutron precursors continue to decay to Xenon while neutron absorption (burnout) has ceased.

c. Xenon production and removal increases linearly as power level increases; i.e., the value of 100% equilibrium Xenon is twice that of 50% equilibrium Xenon.

d. At low power levels, Xenon decay is the major removal method. At high power levels, burnout is the major removal method.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.03 (1.00)

As the core ages, the ratio of PU239 atoms to U235 atoms increases. This changing ratio causes the:

a. Reactor startup rate (SUR) to increase, for the same reactivity addition.

b. Void Coefficient becomes less negative.

c. Moderator Temperature Coefficient to become less negative.

d. Delayed neutron fraction to increase.

QUESTION 1.04 (1.00)

Which one of the following statements concerning Shutdown Margin (SDM) is correct?

a. The maximum SDM requirement occurs at EOC and is based on a rod ejection accident.

b. The maximum SDM requirement occurs at EOC and is based on a steam line break accident.

c. The maximum SDM requirement occurs at BOC and is based on having a positive moderator temperature coefficient.

d. The maximum SDM requirement occurs at BOC and is based on a rod withdrawal accident while in the source range.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.05 (1.00) (NOTE: Power should be 10-5%, ADV vs PORV)

The reactor is critical at 10,000 cps when a S/G PORV fails open. Assuming BOC conditions, no rod motion, and no reactor trip, choose the answer below that best describes the values of Tavg and nuclear power for the resulting new steady state. (POAH = point of adding heat).

a. Final Tavg greater than initial Tavg, Final power above POAH.

b. Final Tavg greater than initial Tavg, Final power at POAH.

c. Final Tavg less than initial Tavg, Final power at POAH.

d. Final Tavg less than initial Tavg, Final power above POAH.

QUESTION 1.06 (1.50)

The reactor is taken critical with Xenon concentration at zero. Power is raised to 50% at 5%/min.. A trip occurs as power reaches 50%.

Use one of the following choices to describe how Xenon concentration will be trending for each of the following situations (a,b, and c .

Increasing
Decreasing
At equilibrium

a. One hour after the trip.

b. Four hours after the trip the reactor is taken critical and power raised back to 50%.

c. If the reactor had NOT tripped and power was level at 50% for one hour.

QUESTION 1.07 (2.00)

a. How is Shutdown Margin (SDM) affected (Increase, Decrease, or No change) by a 50 ppm boron addition while operating at 50% power? (0.5)

b. List THREE factors, other than RCS boron concentration and rod position which will affect SDM and are used in the SDM calculation. (1.5)

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.08 (1.50)

a. One reason for the CEA Insertion Limit is to ensure sufficient SDM is available. What are the other TWO reasons? (1.0)

b. The CEA Insertion Limit is a function of _____. (Fill in the blank, place your answer on your answer sheet.) (0.5)

QUESTION 1.09 (2.00) (NOTE: may could not to consider each separately)

a. Explain HOW and WHY ASI is expected to change as power is increased from 20% to 70%, during a normal power increase at EOC.

b. What TWO steps/methods are taken to maintain ASI within limit AND WHY these actions are effective.

QUESTION 1.10 (2.00)

At BOC, power is reduced from 100% to 50% and stabilized, briefly explain HOW and WHY each of the following plant parameters will be affected over the next 5 hours. Assume rod control is in manual sequential, all other systems are in automatic, and NO operator action is taken.

a. RCS temperature

b. RCS pressure

c. S/G pressure

d. Turbine Generator control valve position

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.11 (1.00)

Which one of the following conditions would cause a 1/M plot to be NON-conservative during fuel loading?

a. Fuel being loaded closer to a source range detector than to the neutron source.

b. Loading fuel in the order of high reactivity worth to low reactivity worth.

c. Loading poison rods between the source range detectors and spaces to be filled by fuel assemblies.

d. Increasing the boron concentration in the moderator.

QUESTION 1.12 (1.00)

A centrifugal pump is operating at rated flow when the discharge valve is throttled towards the shut direction. Which one of the following statements BEST describes the parameter changes that will occur ?

a. Flow constant, discharge pressure constant, motor amps increase, NPSH increases.

b. Flow decreases, discharge pressure increases, motor amps increase, NPSH increases.

c. Flow decreases, discharge pressure increases, motor amps increase, NPSH decreases.

d. Flow decreases, discharge pressure increases, motor amps decrease, NPSH increases.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.13 (1.00)

TRUE or FALSE

a. During a RCS heatup, as temperature gets higher, it will take a smaller letdown flow rate to maintain a constant pressurizer level. (0.

b. Increasing condensate depression (subcooling) will cause BOTH a decrease in plant efficiency AND an increase in condensate (hotwell) pump available NPSH. (0.

QUESTION 1.14 (2.00)

Assuming you are operating at 85% power indicate how the following changes in plant conditions would affect DNBR (increase, decrease, remain constant). Consider each case separately.

1. The operator withdraws control rods without changing turbine load.

2. ASI changes from 0% to -2%.

3. Steam Generator PORV fails open. (NOTE: should be ADV)

4. Pressurizer heaters are inadvertantly left on.

5. Reactor coolant pump speed decreases. [0.4 each] (2.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.15 (2.50)

a. What is the subcooling margin (SCM) of the RCS if the following conditions exist?

Th =580 F Pressurizer pressure =2185 psig
Tc =520 F Steam Generator Pressure =850 psig (1.0)

b. If power is raised from 50 to 100%, how AND why will SCM change (increase, decrease, stay the same)? (0.75)

c. Which of the following would give a smaller SCM? Briefly explain your choice. Assume identical RCS pressures. (0.75)

1. SCM during a controlled natural circulation cooldown immediately following a reactor trip from loss of flow.

2. SCM from continued operation at 5% power.

3. SCM produced when all RCP's are operated at normal no-load temperature after extended shutdown.

QUESTION 1.16 (2.00)

The plant is in a Natural Circulation Mode of core cooling. As the fission product heat decays away, describe HOW (increase, decrease or remain constant) and WHY you would expect the following RCS parameters to change. Assume that S/G pressure is being maintained constant at 900 psia.

a. Tcold

b. Thot

c. Loop transit time

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

QUESTION 1.17 (1.50)

At each of the following leak locations, indicate the state of the exiting fluid (subcooled, saturated, or superheated). Assume normal 100% power initial operating plant conditions.

a. PZR steam space to CTMT atmosphere.

b. Steam Dump to the condenser.

c. Main steam header to turbine building atmosphere.

(***** END OF CATEGORY 1 *****)

QUESTION 2.01 (1.00)

What TWO features ensure that the RWST cannot be siphoned below the minimum Technical Specification level if a rupture were to occur in the RWST recirculation system piping? Consider ruptures in both the suction and discharge piping of the recirculation pump.

QUESTION 2.02 (2.00)

The following questions concern the Containment Air Recirculation and Cooling System (CARCS) and its associated support systems.

a. What automatic actions should occur to the CARCS after an SIAS? Assume an initial normal lineup. TWO required. (1.0)

b. If 100% is defined as the heat removal capacity necessary to limit containment pressure to less than design pressure following an accident, what is the total heat removal capacity, in percent, of all CAR fans? (0.5)

c. What instrument system uses the Containment Air Recirculation and Cooling System as a means of normal cooling? (0.5)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

QUESTION 2.03 (3.00)

The following questions concern a loss of instrument air (assume normal, at power initial conditions):

a. How would a complete loss of instrument air outside containment immediately affect the following components/systems? Choose ONE of the following (A,B,C, or D) for each of the 8 component/systems:

A- fail open/flow maximum
B- fail closed/flow stopped
C- fail as is/flow cannot change
D- no effect/ system functions normally

1. Main Feedwater Regulating Valves
2. Pressurizer spray valves
3. S/G feed pump control
4. Letdown
5. Atmospheric Dump Valves
6. AFW flow control valves
7. EDG service water supply valves
8. MSIVs

(2.0)

b. Describe two means of interconnecting the IA system with backup sources of air pressure. Indicate automatic setpoints, if any. (1.0)

QUESTION 2.04 (3.00)

The following questions concern the operation of 4160V Bus 24E.

a. List THREE loads which are supplied directly from Bus 24E (other than electrical busses). (1.0)

b. Describe the Reactor Safety function of the Kirk Key interlock associated with Bus 24E. (1.0)

c. If Bus 24E is supplied from its backup source, a limit is placed on the load current supplied by that source. What is the reason for this limit? (1.0)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

QUESTION 2.05 (1.00)

What design feature of the clean liquid rad waste system ensures that waste additions are not made to a monitor tank which is being discharged?

QUESTION 2.06 (2.00)

The discharge of both LPSI pumps passes through valve 2-SI-306 "SDC flow control valve" during shutdown cooling.

a. What is the potentially adverse consequence of this valve being closed during power operation? (0.5)

b. What THREE PHYSICAL precautions are taken to ensure it remains open while the plant is at power? (1.5)

QUESTION 2.07 (1.50)

What are TWO conditions which will cause automatic transfer of the 120V vital instrument AC bus (VIAC) static transfer switch from normal to emergency power?

QUESTION 2.08 (3.50)

a. State TWO design features which serve to prevent the loss of water inventory in the Spent Fuel Pool (SFP). (1.0)

b. List THREE sources of makeup water to the SFP. (1.5)

c. If the SFP was filled with UNBORATED water will the Technical Specification required Keff of <0.95 still be satisfied? EXPLAIN your answer. (1.0)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

QUESTION 2.09 (4.00)

a. State the reasons/design basis for the incorporation of the AFW flow time delay. (1.0)

b. What is the basis for the minimum required CST inventory? (1.0)

c. What is the "alternate" source of water supply to the AFW pumps? (0.5)

d. What are the THREE modes of operation for the AFW Flow Control valves? INCLUDE the purpose for each of the three positions. (1.5)

QUESTION 2.10 (2.00)

The following concern the failure of a CEA lift coil with the affected CEA in a withdrawn configuration, assume the reactor remains at power.

a. Explain why the affected rod will/will not drop.

b. Explain why the affected rod will/will not move on a demand signal.

QUESTION 2.11 (2.00)

Describe what automatically happens in the Chemical and Volume Control system upon receiving a SIAS signal. Five separate actions required.

(***** END OF CATEGORY 2 *****)

QUESTION 3.01 (3.00)

The following questions concern the Control Element Drive and Position Indication System:

a. What regulating control rod interlocks/limits are in effect when in MANUAL INDIVIDUAL control? (1.5)

b. What system supplies rod position signals to the upper and lower CEA stops - (UCS, LCS)? (0.5)

c. What are the instrumentation signals/conditions that could provide a "Dropped Rod" annunciator? (TWO required) (1.0)

QUESTION 3.02 (2.50)

For the conditions listed below indicate the ESAS channels that should actuate. Consider the conditions in part a, of this question seperate from the conditions in part b.

a. S/G #1 pressure 800 psia
S/G #1 level 68%, narrow range
Pressurized pressure 1800 psia
Spent-fuel pool area rad. monitors 150 mr/hr
S/G #2 pressure 500 psia
S/G #2 level 45%, narrow range
Pressurizer level 20%, narrow range
(1.0)

b. S/G #1 pressure 900 psia
S/G #1 level 68%, narrow range
Pressurizer pressure 1500 psia
RWST level 8%
Spent-fuel building radiation sensor channels all reading 100 mr/hr
S/G #2 pressure 900 psia
S/G #2 level 68%, narrow range
Pressurizer level 33%
Containment pressure 30 psig
(1.5)

QUESTION 3.03 (1.50)

With Channel X selected for pressurizer level control, level instrument LT 110X fails low. What automatic actions and indication/alarms will initially result, including the effect on actual pressurizer level. With NO operator action?

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.04 (1.50)

What are THREE conditions which will actuate the individual channel Power Trip Test Interlock (PTTI)?

QUESTION 3.05 (3.00)

The following questions concern the Reactor Protection System:

a. Which reactor trip inhibits are automatically removed above 10E-4% power? (1.5)

b. Which reactor trips are automatically bypassed below 15% power? (1.0)

c. Which reactor power signal is used to bypass the trips below 15% power? (0.5)

QUESTION 3.06 (2.00)

Describe how AND why the Feedwater Control System (FWCS) reacts to the following TWO occurences. Assume an initial normal full power plant condition with the FWCS in MANUAL, and feed flow, steam flow, and level transmitter selector switches on BOTH for each occurrence and consider each separately.

a. Turbine Trip

b. The A S/G Alternate level transmitter fails high.

QUESTION 3.07 (2.00)

Which of the following monitor channels have automatic actions (other than indication and alarm) associated with them? Briefly describe the automatic actions, if any.

a. Spent fuel pool area monitor.

b. Radwaste Vent Monitor - Gaseous.

c. Condensate recovery tank monitor.

d. Clean radwaste monitor.

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.08 (3.00)

The power plant is operating at 85% of full power with ASI=0.0 and with the control rods at 110 steps on Group 7. Explain how AND why changes in the following parameters will affect the TM/LP pressure set point (increase pressure setpoint, decrease, or stay the same). Assume the operators take action to maintain a constant 85% electrical output and the operators maintain programmed operating limits. Consider each item separately.

a. Xenon buildup in bottom of core.

b. Tavg increasing.

c. RCS boration.

QUESTION 3.09 (2.50)

During equilibrium, full-power operation, describe how the RPS will respond to each of the following Channel 'A' input failures. Include meter response, alarms, channel pretrips and trips. Also, indicate the RPS channels that should be bypassed by the operator for each failure, consider each failure serarately.

a. Channel 'A' upper NI fails high. (1.7)

b. Channel 'A' Steam-Generator differential pressure fails high. (0.8)

QUESTION 3.10 (3.00)

The following concern the Steam Dump/Turbine Bypass System:

a. How many valves would open after a reactor trip from 75% power? Explain.

b. How many valves should be open 5 minutes after the reactor trip? Explain.

c. How would your answers to a and b, above, change if the reactor trip was caused by a loss of off-site power? Explain.

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

QUESTION 3.11 (1.00)

Match the Emergency Diesel Generator alarm condition in Column A with the proper action in Column B. Place answers on your answer sheet.

Column A	Column B
~~a. D/G 12U Trouble~~	1. None, D.G. will not Trip
b. Lube Oil Temp. High	2. D.G. will Trip
c. Jacket Coolant Press. Low	3. D.G. will Trip unless Emergency start signal is present
d. Engine Overspeed	
~~e. D. C. Control Power Failure~~	

(***** END OF CATEGORY 3 *****)

QUESTION 4.01 (2.00)

Indicate whether each of the following statements about the station tagging system is TRUE or FALSE, according to ACP 2.06, Station Tagging procedure.

a. Any number of Blue Tags may be attached to a switch or other device at any one time.

b. A Green Stripped Hold Tag may be attached to a device on which a Yellow Caution Tag is already attached.

c. Lifting of Tags in order to perform testing is permitted.

d. Any number of Red Tags may be attached to a switch or other device at any one time.

QUESTION 4.02 (2.00)

List FOUR of the six ications that are used to verify that Natural Circulation has been established, according to AOP 2553, Plant Cooldown using Natural Cooldown procedure.

QUESTION 4.03 (3.00)

One of the operator actions of the Electrical Emergency (Loss of Normal Power) procedure, EOP 2528 is to place the Enclosure Building Filtra ion System in service.

a. What are FOUR of the steps which must be taken to place the Enclosure Building Filtration System on tne line? (2.0)

b. Why must this system be placed in service? (1.0)

QUESTION 4.04 (4.00)

a. What are FOUR plant conditions, abnormalities, or emergencies which would require the Reactor Coolant System to be Emergency Borated, according to AOP 2558, Emergency Boration procedure?

b. List the steps required to be performed to initiate emergency boration (four required for full credit)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.05 (2.00)

What are the TWO conditions that allow the operator at the controls to leave the surveillance area of the control room, according to ACP 6.01, Control Room procedure?

QUESTION 4.06 (2.00)

A caution in the Emergency Diesel Operating procedure (OP 2346A) states:

"If a LNP is initiated, do not reset undervoltage relays at the ESAS Cabinet(s) until immediately prior to paralleling the Diesel Generator with the RSST during restoration per EOP 2528 (Electrical Emergency)."

Briefly explain the reason for this caution and the consequence of not following this precaution.

QUESTION 4.07 (2.00)

For EACH of the below conditions list FOUR parameters used in the immediate action steps of EOP 2525 - Standard Post Trip Actions to determine if the conditions exists.

a. PORVs and Pressurizer safeties are NOT open.

b. Normal containment conditions.

QUESTION 4.08 (1.00)

During a reactor shutdown from outside the control room, AOP 2551 Shutdow From Outside The Control Room directs that MSIVs are to be closed if plant cooldown exceeds a specified limit. If the control room is unavailable, how are the MSIV's closed? Switch or component numbers not required.

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

QUESTION 4.09 (3.00)

The following questions concern EOP 2532, Loss of Primary Coolant procedure:

a. What is the criteria to manually initiate SIAS? (1.0)

b. When are the RCP's required to be stopped? (0.5)

c. A caution in this procedure states that PZR level may not provide an accurate indication of ECS inventory. What other indication would validate that PZR level was an indication that the core was covered? (0.5)

d. How is boron precipitation control accomplished if the SDCS is not available? (1.0)

QUESTION 4.10 (3.00)

The following questions concern AOP 2556, Dropped CEA Recovery procedure:

a. What are FOUR indications that a CEA is misaligned? (1.0)

b. What single condition would require the turbine and reactor tripped, assume the reactor is at power and only one CEA is misaligned? (0.5)

c. After the misaligned CEA occurs and reactor power is stable at 90%, How far must power be reduced AND how is this power reduction accomplished? (1.0)

d. What action is required if two or more CEA's have dropped? (0.5)

QUESTION 4.11 (1.00)

a. What is the RCS leakage criteria which requires the reactor to be tripped, according to AOP 2568, RCS Leak procedure?

b. What would be an indication of RCS leakage into the Safety Injection system, according to the above referenced procedure?

(***** END OF CATEGORY 4 *****)
(********** END OF EXAMINATION **********)

EQUATION SHEET

$f = ma$

$w = mg$

$E = mC^2$

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$W = v\Delta P$

$\Delta E = 931\Delta m$

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

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

$P_{WT} = W_f \dot{m}$

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

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

$SUR = 26.06/T$

$T = 1.44\ DT$

$SUR = 26\left(\frac{\lambda_{eff}\rho}{\bar{\beta} - \rho}\right)$

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

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

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

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

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

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

$I = N\sigma$

$v = s/t$

$s = v_o t + \frac{1}{2}at^2$

$a = (v_f - v_o)/t$

$v_f = v_o + at$

$\omega = \theta/t$

Cycle efficiency = $\frac{\text{Net Work (out)}}{\text{Energy (in)}}$

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

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

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

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

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

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

$TVL = 1.3/\mu$

$HVL = 0.693/\mu$

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

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

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = (1 - K_{eff})_0/(1 - K_{eff})_1$

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

$\ell^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^2 = I_2 d_2^2$

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

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

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^2

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 Btu = 778 ft-lbf

1 inch = 2.54 cm

$^\circ F = 9/5\,^\circ C + 32$

$^\circ C = 5/9\ (^\circ F - 32)$

ANSWER 1.01 (1.00)

a.

REFERENCE

M2-OP-RO-FUND-2116E, p 18-22.
192004K106 ..(KA's)

ANSWER 1.02 (1.00)

d.

REFERENCE

M2-OP-RO-FUND-2116F, p 11-13.
192006K105 ..(KA's)

ANSWER 1.03 (1.00)

a.

(1.

REFERENCE

M2-OP-RO-FUND-2116C, p 8-11, 22-24.
192003K106 ..(KA's)

ANSWER 1.04 (1.00)

b.

REFERENCE

M2 TS, p. B 3/4 1-1; M2-OP-RO-FUND-2116G, p 35-38.
192002K114 ..(KA's)

ANSWER 1.05 (1.00)

d.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

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REFERENCE

M2-OP-RO-FUND-2116G, p 13-15, -2116E, p 24-28.
192008K114 ..(KA's)

ANSWER 1.06 (1.50)

a. Increasing.

b. Decreasing.

c. Increasing. [0.5 ea.] (1.

REFERENCE

M2-OP-RO-FUND-2116G, p 40-44 and TP-5.
192006K107 ..(KA's)

ANSWER 1.07 (2.00)

a. SDM is increased. [0.5]

b. [any 3, 0.5 each]

-RCS avg temp
-Fuel burnup
-Xenon concentration
-Samarium
-Power defect
-Power level

REFERENCE

M2-OP-RO-FUND-2116G, p 35-38.
192002K114 ..(KA's)

ANSWER 1.08 (1.50)

a. 1. Core design peaking factors are not exceeded (acceptable power distribution limits).

2. The reactivity associated with a CEA ejection accident is acceptable (within analysis). [0.5, each]

b. Core power. [0.5]

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2 TS 3.1.3.6 and bases (B3/4 1-3)
C-E Reactor Theory, pp 193-194.
M2-OP-RO-FUND-2117, p 52-54, EO 1h.
192005K115 ..(KA's)

ANSWER 1.09 (2.00)

a. Moderator density becomes less at the top of the core [0.3] causing the flux peak to move down in the core. [0.2] (Since ASI is 1-u/1+u) it will become more positive as the power is increased. [0.5]

b. 1. Reduce power which creates less restrictive limits. [0.5] (more neg. ASI due to density changes in moderator associated with delta-T and Tc program)

2. Use rods to change flux shape which changes the value of ASI.[0.5]

(Also accept rod withdrawal or insertion with explanation for both cases)

REFERENCE

M2-OP-RO-FUND-2117, EO 1e and 22; TS p 3/4 2-5.
192005K110 192005K114 ..(KA's)

ANSWER 1.10 (2.00)

a. Decreases [0.25] due to buildup of Xe [0.25]
b. Held constant [0.25] by PPCS spray and heaters [0.25]
c. Decreases [0.25] due to the decrease of Tavg [0.25] [graded based upon answer in a, above]
d. Remains the same [0.25] since load is lowered on valve position limiter and no operator action is assumed. [0.25] [2.0]

REFERENCE

M2-OP-RO-2117, EO 7;-2116G.
192006K106 ..(KA's)

ANSWER 1.11 (1.00)

a or c

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2-OP-RO-FUND-2116G, p 11-23.
192008K106 192002K114 ..(KA's)

ANSWER 1.12 (1.00)

d. (1.

REFERENCE

GP HTFF p.328
M2-OP-RO-FUND-2121E, p 19-23.
193006K105 ..(KA's)

ANSWER 1.13 (1.00)

a. FALSE (0.
b. TRUE (0.

REFERENCE

General Physics, HT&FF, pp. 155 and 320 and Subcooled Liquid Density Tables
M2-OP-RO-FUND-2121H, p 7,24,25.
193004K111 193005K103 ..(KA's)

ANSWER 1.14 (2.00)

1. DNBR decreases
2. DNBR decreases
3. DNBR decreases
4. DNBR increases
5. DNBR decreases [0.40 each] (2.

REFERENCE

M2-OP-RO-FUND-2121I, p 19-21.

193008K105 ..(KA's)

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

ANSWER 1.15 (2.50)

a. From the C-E Stm Tables,

Tsat for 2200 psia= 649.5 F
SCM= Tsat-Th= 649.5-580= 69.5 F +/-1 F [0.5 ea] (1.0)

b. decrease [0.25]
Th increases (as unit delta T increases with power) [0.5] (0.75)
(~~pressure maintained constant~~)

c. 1 [0.25]
Core delta T during natural circulation cooldown will approach ~~full load delta Tc~~ 20-25 degrees F Thot is greater than in the other 2 cases.[0.5] (0.75)

REFERENCE

M2-OP-RO-FUND-2121C, Objective 5. -2121 J, p 4-13.
GP HTFF pp.356; Steam Tables
193008K115 ..(KA's)

ANSWER 1.16 (2.00)

a. Tcold will remain constant[0.16] Since it follows S/G saturation temperature. [0.5]

b. Thot will decrease[0.16] since less fission product heat is being produced than is being removed by the steam generators. [0.5]

c. Loop transit time will increase [0.16] since the driving head for flow (core delta T) is decreasing. [0.5]

REFERENCE

M2-OP-RO-FUND-2121J, p 6-13,18.
193008K122 ..(KA's)

ANSWER 1.17 (1.50)

a. Saturated.

b. Superheated.

c. Superheated.

(***** CATEGORY 1 CONTINUED ON NEXT PAGE *****)

REFERENCE

Steam Tables, Molier diagram
M2 Exam bank EO RO-05, item 1090, lesson plan 2121G.
193004K115 ..(KA's)

(***** END OF CATEGORY 1 *****)

ANSWER 2.01 (1.00)

Siphon breaker in suction line of recirculation pump.(is located at 91.4% level).[0.5] Recirculation Pump discharges to top of tank. [0.5]

REFERENCE

Dwg No. 25203-26015 and HPSI S.D. p 4.
MP2 question 382
002000G007 ..(KA's)

ANSWER 2.02 (2.00)

a. Idle CAR fan starts on low speed
Operating CAR fans switch from hi to low speed
10 inch RBCCW valves on cooler outlets open [2 required, 0.5 each]

b. 133% [0.5]

c. Nuclear Instruments [0.5]

REFERENCE

M2-OP-RO-PRI-2313, p 41-47.(Cont Ventilation S.D.)
022000A301 ..(KA's)

ANSWER 2.03 (3.00)

a.

1.	MFWRV	C- fail as is
2.	pzr spray valves	D- no effect (cntmt air rcvr charged)
3.	S/G feed pump control	C- fail as is
4.	Letdown	B- system flow stopped
5.	ADVs	B- fail closed
6.	AFW flow control valves	A- fail open
7.	EDG service water supply	A- fail open [0.25 each]
8.	MSIVs	D- no effect (independent air reciever)

b. 1) Auto valve to station air compressor X-ties SA to IA at 85 (~~7~~ 3) psig IA pressure [0.5]

2) Manual X-tie valve to Unit 1 station air via Unit 2 station air [0.5]

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2-OP-RO-SEC-2332 A/B, EO 4,9,11. (Instrument Air S.D)
M2-OP-SEC-2322, p 3. (AFW S.D)
ESAS handout Appendix A pg 10 (EDG SW valves)
078000K402 078000K302 ..(KA's)

ANSWER 2.04 (3.00)

a. Swing (6) Service water pump, swing (6) HPSI pump, swing (6) RBCCW pump [0.33 each]

b. Prevents tieing both 4160 emergency busses together through Bus 24E. [1.0]

c. Prevents exceeding load limits on RSST ~~breaker~~ (15G-21S) and its associated bussing. [1.0]

REFERENCE

M2-OP-ELECT-2342, p 3,4 & fig. 1. (Elect Dist SD), OP 2343 p 17.
062000A404 062000A206 062000K401 ..(KA's)

ANSWER 2.05 (1.00)

Inlet and outlet valves are interlocked [0.5] so that the discharge valve may be opened only if the corresponding inlet valve is shut.[0.5]

REFERENCE

M2-OP-NLCT-PRI-2335A, p 29. (Radwaste SD)
068000K401 ..(KA's)

ANSWER 2.06 (2.00)

a. The inability of the LPSI pumps to inject water into the core followin a LOCA. [0.5]

b. 1) keylock switch to SI position [0.5]
2) Remove fuseblock for 2-SI-306 [0.5]
3) Isolate air supply [0.5]
4) Manual operator on the opposite side of the valve shaft is pinned and locked to the handwheel. [0.5]
5) Handwheel is locked in position. [0.5]
(any 3 at 0.5 each)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2-OP-PRI-2307, p 9.(LPSI SD) and OP2310 Rev 8 Section 7.6.8
002000K108 ..(KA's)

ANSWER 2.07 (1.50)

1. Inverter output voltage low.

2. Inverter failure.

3. Inverter load overcurrent. [two required, 0.75 each]

REFERENCE

M2-OP-ELECT-2345, p 3.
062000A304 ..(KA's)

ANSWER 2.08 (3.50)

a. 1- Stainless steel liner.
2- No penetrations in pool wall below the normal water level. (except the fuel transfer tube)
3- Siphon breakers for penetrations above the the normal level.
4- Seismic qualified components and equipment.
[2 required, 0.5 each]

b. 1- Primary makeup water system.
2- RWST(via bypass and purification system)
3- RWST(via LPSI system.)
4- AFW system. [3 required, 0.5 each]

c. Yes [0.5], the center to center distance (spacing) between spent fuel assemblies is sufficient to maintain TS Keff requirements with unborated water [0.5].

REFERENCE

M2-OP-PRI-2305, p 8,9,16,17.
192002K110 192002K112 059000K405 033000K401 ..(KA's)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

ANSWER 2.09 (4.00)

a. To prevent a return to power situation from occurring during a DBA MSLB accident. [1.0]

b. To remove decay heat for 10 hours with steam discharge to atmosphere [1.0]

OR
Sufficient water available for cooldown of RCS <300-F within 6 hours, in the event of a total loss of off-site power. [1.0]

c. Plant fi e system. [0.5]

d. NORMAL [0.25]- allows the valve to be open fully for auto actuation. [0.25]
OVERRIDE [0.25]- allows manual control of the valve after an auto actuation. [0.25]
RESET [0.25]- to return the mode of operation back to normal.[0.25]
(also accept auto, manual and local manual for full credit)

REFERENCE

M2-OP-SEC-2322, p 2,3,6,10,11. (AFW SD); TS B3/4 7-2. OP2322, AOP2579B
061000G007 061000K411 061000K401 ..(KA's)

ANSWER 2.10 (2.00)

a. The rod will NOT drop [0.5] due to the action of the ~~lower~~ grippers[0.5].

b. The rod will NOT move (up or down) [0.5] since the lift coil is used to raise the upper gripper in either direction [0.5].

REFERENCE

M2-OP-SO-I&C-2302A, p 20-23.
001000K402 ..(KA's)

(***** CATEGORY 2 CONTINUED ON NEXT PAGE *****)

ANSWER 2.11 (2.00)

a. 1. Boric acid pumps start [0.4]

2. Charging pumps start [0.4]

3. Boric acid storage tank is lined up to inject boric acid direct/gravity [0.4]

4. Boric acid storage tank is lined up through MOV to charging pump suction. [0.4]

4. VCT makeup stop valve shuts [0.4]

5. VCT outlet valve shuts [0.4]

6. Letdown line loop isolation valves shut [0.4]

7. RCP bleed off to VCT shuts. [0.4] [five required, 0.4 each]

REFERENCE

M2-OP-PRI-2304, fig. 2a. (CVCS SD)
004010A205 ..(KA's)

8. PMW to charging pump suction (2-CH-196) shuts.

9. Chemical metering discharge valves (Precise reactivity control isolation valves) (2-CH-909-910) shut

10. Boric acid pump recirc. isolations shut (2-CH-510,-511)

(***** END OF CATEGORY 2 *****)

ANSWER 3.01 (3.00)

a. 1. Upper and lower electrical limits
2. CEA withdrawal prohibit
3. CEA motion prohibit [0.5 each] 3 required

b. Computer position indication [0.5]

c. 1. Rod drop from reed switch
2. NI negative rate of power change from NI system [0.5 each]

REFERENCE

M2-OP-SO-I&C-2304A, (CEDS SD), attachment A.
MP2 question 704
000003G203 001050A204 061000K401 ..(KA's)

ANSWER 3.02 (2.50)

a. AEAS [+0.5]
MSI [+0.5]

b. SIAS CSAS
EBAS SRAS
CIAS

[+0.3] each

REFERENCE

M2-OP-RO-I&C-2384 (ESAS SD), TP 6&7.
006050A401 ..(KA's)

ANSWER 3.03 (1.50)

1. Letdown to minimum
2. Both backup charging pumps start
3. Channel X PZR level Hi/Lo annunciator
4. Actual PZR level increases
5. PZR level Lo/Lo annunciator
6. All heaters de-energize
7. Selected controller (X) output signal to minimum [any 5, 0.3 each]

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2_OP-I&C-2304A (PZRLC SD), p 5-10 and fig 3.
000028G005 ..(KA's)

ANSWER 3.04 (1.50)

1. Linear power channel summer control switch out of the (A + B)/2 position. [0.5]

2. Linear power channel high voltage bistable tripped [0.5]

3. Reactor protection system calibrate and indication panel Delta T power calculator test switch out of the operate position. [0.5 (or RPSCIP calibrate switch)

4. Zero-operate-calibrate switches (2) on NI Linear Power Channels out of operate [0.5]

5. Trip Test switches (2) on NI Linear Power Channels out of off [0.5]

[any 3, 0.5 each]

REFERENCE

M2-OP-RO-I&C-2380-2 (NI SD), p 21,35-38.
015000A302 ..(KA's)

ANSWER 3.05 (3.00)

a. RC flow
RCP speed
Thermal Margin/Low pressure [0.5 each]

b. Loss of turbine
Local Power Density [0.5 each]

c. Linear safety channel [0.5]

REFERENCE

M2-OP-RO-I&C-2380-1 (RPS SD) fig. 29,16.
NI S.D. Power Range Linear Channel para J.
012000K406 ..(KA's)

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

ANSWER 3.06 (2.00)

a. MFWRV ramps shut (for 30 sec & should fully close) and MFW Bypass valve ramps to 75% open (5% flow) [0.5] to help match feed flow with the reduced steam flow [0.5]
b. No effect [0.5] since the BOTH position low selects the level signal to be used. [0.5]

REFERENCE

M2-OP-SEC-2385 (FWCS SD), p 4-7,9.9
059000A104 059000K402 ..(KA's)

ANSWER 3.07 (2.00)

a. Initiate an AEAS (to minimize the radioactivity released to atmosphere) [0.5]

b. none [0.5]

c. High alarm shifts condensate recovery tank discharge from aux stm feedwater surge tank to the aerated waste system which is isolated. [0.5]

d. High alarm closes two discharge isolation valves (to stop discharge flow) [0.5]

REFERENCE

M2-OP-RO-I&C-2383 (RMS SD), and OP2383.
073000G008 073000K401 ..(KA's)

ANSWER 3.08 (3.00)

a. Increase [0.5] because ASI is decreasing (becoming negative) and that will increase a penalty factor in the TM/LP calculation [0.5]

b. Increase [0.5] because increasing Tavg means (increasing S/G pressure and) a higher Tc [0.5].

c. Increase [0.5] due to change in ASI caused by rod withdrawal [0.5].

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2-OP-RO-I&C-2380-1 (RPS SD), p 26-31 and fig. 26.
012000K611 ..(KA's)

ANSWER 3.09 (2.50)

a. Power range subchannel deviation alarm [0.25]
TM/LP trip [0.3] - bypass [0.1]
High-power trip [0.3] - bypass [0.1]
LPD trip [0.3] - bypass [0.1]
High power reading for upper NI [0.25]

b. No alarms [0.4]
Bypass low reactor coolant flow [0.4]

REFERENCE

M2-OP-RO-I&C-2380-1 (RPS SD)
012000A205 ..(KA's)

ANSWER 3.10 (3.00)

a. Six valves, - 2 atm. dumps & 4 TBV's due to QO signal [TT & Tavg > 557 degrees F]

b. Only one - after the reactor trip core decay heat will drop rapidly, one valve has the capacity to remove the amount of decay heat after 5 minutes.

c. Loss of offsite power will render condenser dumps inoperative.
answer for a) is two and b) is two since both ADV's have same S.P.

REFERENCE

M2-OP-I&C-2386 (RRS SD), p 10-15.
041020K417 ..(KA's)

ANSWER 3.11 (1.00)

~~a. 1~~ deleted
b. 3
c. 3
d. 2
~~e. 2~~ deleted [0.33 each]

(***** CATEGORY 3 CONTINUED ON NEXT PAGE *****)

REFERENCE

M2-OP-RO-ELECT-2346 (EDG SD), p 109-115.
062000K302 ..(KA's)

(***** END OF CATEGORY 3 *****)

ANSWER 4.01 (2.00)

a. FALSE
b. FALSE
c. TRUE
d. TRUE [0.5 each]

REFERENCE

M2 ACP 2.06A, p 12,13.
194001K102 ..(KA's)

ANSWER 4.02 (2.00)

1. PZR level at least 20%
2. Heat removal from at least one S/G
3. RCS Subcooling >30-F
4. Loop delta-T between 10 and 45-F
5. Tc const. or decreasing
6. Th const or decreasing [four required, 0.5 each]

REFERENCE

M2 AOP 2553, p 2.
C00017K101 ..(KA's)

ANSWER 4.03 (3.00)

a. 2. Open Enclosure Building exhaust to EBFAS (2-EB-50(-40))
1. Open EBFS fan suction dampers (2-EB-~~50~~ 51 (41) ~~51~~) ~~or 2-EB-40 + 41~~)
~~23~~ Start EBFS fan A or B.
~~24~~ Close Cond. Air Removal Fan Discharge to Unit 1 stack (1-EB-55 and 56).
~~45~~ Close Cond. Air Removal to U-2 stack (2-EB-57)
~~56~~ Stop Cond. Air Removal Fans F55 A and B.
[four required, 0.5 each]

b. This prevents back draft of Unit 1 stack gases into Unit 2. [1.0]

REFERENCE

M2 EOP 2528, p 12.
000055K302 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.04 (4.00)

a. 1. Exceeding PDIL.
2. Two or more CEA's do not move into the core following a reactor tr
3. Unanticipated reactor cooldown
4. Unexplained increase in reactivity when shutdown or refueling.
[0.5 each] (2.0)

b. 1. Open boric acid pump discharge (2CH-514)
2. Start both boric acid pumps.
3. Close boric acid pump recirc valves (1CH-510 and 511).
4. Establish max. charging flow. [0.5 each]

REFERENCE

M2 AOP 2558, p 2,3.
000024K302 000024K301 004000K015 ..(KA's)

ANSWER 4.05 (2.00)

1. Verify receipt of annunciators.
2. Initiate corrective actions resulting from an emergency. [1.0 each]

REFERENCE

M2 ACP 6.01, p 5.
194001A103 013000K001 ..(KA's)

ANSWER 4.06 (2.00)

If the U/V relays are reset when the EDGs are operating in a LNP condition and a SIAS subsequently occurs [1.0], all ESF loads required by SIAS initiation will be energized simultaneously rather than sequentially and overload the respective EDG. [1.0]

REFERENCE

M2 OP 2346A, p 6.
064000A010 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.07 (2.00)

a. 1. QT level (5. ~~Abnormal~~ Normal tailpipe temperature)
   2. QT pressure
   3. QT temperature
   4. Acoustic monitor

b. 1. containment pressure (<2 psig)
   2. containment temperature (<120-F)
   3. containment radiation
   4. containment sump level [0.25 each]

REFERENCE

M2 ECP 2525, steps 3.3d,3.5.
000007K301 ..(KA's)

ANSWER 4.08 (1.00)

By opening the 125vdc supply breaker to the solenoid operated air valves (allowing the MSIV to fail shut).(#18 in 201A/B-IV(DV-20)) [1.0]
also accept either closing MSIV's from battle up panels (C704 area) or locally ~~using~~ instrument air at MSIV's and bleeding off the air pressure.

REFERENCE

M2 AOP [illegible] 5 step 4.13., AOP 2579 A step 4.5, DWG 28202; 26002
039000A01[illegible] ..(KA's)

ANSWER 4.09 (3.00)

a. PZR press decreasing to 1600 psia [0.5] OR cont. press increasing to 5 psig [0.5]
b. PZR press decreasing to 1600 psia [0.5]
c. Subcooled RCS [0.5]
d. Via PZR aux. spray AND HPSI pump (facility 1) [1.0]

REFERENCE

M2 EOP 2532.
011000A101 013000A201 ..(KA's)

(***** CATEGORY 4 CONTINUED ON NEXT PAGE *****)

ANSWER 4.10 (3.00)

a. 1. Rod dropped NI alarm
   2. Rod dropped Reed switch alarm
   3. Green or yellow light on the core mimic display
   4. Metrascope
   5. PDIL alarm [four required, 0.25 each]

6. Rod drop alarm on RPS
7. CEA group deviation alarm
8. CEA group zone deviation alarm
9. CEA group deviation b/u
10. CEA motion prohibit
11. Current discussion of Primary and Secondary plant parameter changes

b. PZR level decreases below 20% [[0.5]
c. <70%, reducing turbine load and boration (NO rod motion allowed)[1.0]
d. Commence an orderly shutdown per plant procedures (OP 2205&2206)[0.5]

REFERENCE

M2 AOP 2556, p 2,3.
000003K304 ..(KA's)

ANSWER 4.11 (1.00)

a. Exceeding the capacity of the CVCS to maintain PZR level [0.5]
b. Level increasing in one or more of the SIT's ~~[0.25]~~ OR High pressure alarm on SIT side of a loop check valve [0.5].

REFERENCE

M2 AOP 2568, p 3.
004000K015 002000K405 ..(KA's)

(***** END OF CATEGORY 4 *****)
(********** END OF EXAMINATION **********)

Attachment 2

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

FACILITY: MILLSTONE 2

REACTOR TYPE: PWR-CE

DATE ADMINISTERED: 88/01/11

EXAMINER: SILK, D.

CANDIDATE: Master Copy

INSTRUCTIONS TO CANDIDATE:

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	CANDIDATE'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		Final Grade	%		Totals

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

Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

3. Use black ink or dark pencil only to facilitate legible reproductions.

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only on one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

a. Assemble your examination as follows:

(1) Exam questions on top.

(2) Exam aids - figures, tables, etc.

(3) Answer pages including figures which are part of the answer.

b. Turn in your copy of the examination and all pages used to answer the examination questions.

c. Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.

d. Leave the examination area, as defined by the examiner. If after leaving, you are found in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION 5.01 (1.50)

How will each of the following affect the results of a secondary calorimetric power calculation? Limit your answer to CALCULATED LOWER THAN ACTUAL, CALCULATED HIGHER THAN ACTUAL, or CALCULATED THE SAME AS ACTUAL. Consider each case separately.

a. Measured feed water temperature is 10 degrees lower than actual feed water temperature.

b. Measured steam generature pressure is 30 psig lower than actual steam generator pressure.

c. Measured feed water flow is 1E5 lbm/hr higher than actual feed water flow.

QUESTION 5.02 (2.00)

Answer the following questions TRUE or FALSE.

a. Without reducing turbine load, machine heating on the main generator can be reduced by reducing VAR loading on the generator.

b. When paralleling two AC power sources, the synchroscope should be moving slowly in the FAST direction.

c. While in parallel operations, if the diesel voltage is raised to a higher value, the diesel generator will pick up a larger share of the reactive load.

d. If the diesel generator is carrying an isolated vital bus, the governor control is used to adjust bus load.

QUESTION 5.03 (1.50)

Stable natural circulation conditions exist within the RCS with the following parameters:

Thot - Tcold = 25 F
SG pressure = 685 psig
Thot Subcooled Margin indicates 40 F subcooled

Determine RCS pressure.

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

QUESTION 5.04 (3.00)

HOW would the fuel center line temperature change (INCREASE, DECREASE, or REMAIN THE SAME) in each of the following situations? Justify your answer. Consider each situation separately.

a. Power decreases with constant Tave
b. Tave increases with constant power
c. Core age increases with constant power
d. PZR pressure increases with constant power

QUESTION 5.05 (.75)

For an unrodded, uninstrumented fuel assembly, the hold down force of the fuel alignment plate is transmitted to the core support as described by which ONE of the following:

a. Fuel alignment plate to flower assembly, to hold down springs, to upper end fitting, to fuel pins, to lower end fitting, to core support plate.

b. Fuel alignment plate to upper end fitting posts, to upper end fitting, to guide tubes, to core support plate

c. Fuel alignment plate to flower assembly, to hold down springs, to guide tubes, to core support plate

d. Fuel alignment plate to flower assembly, to hold down springs, to upper end fitting, to guide tube, to lower end fitting, to core support plate

QUESTION 5.06 (2.50)

a. WHAT TWO RCS conditions must be present for the value of MTC most to be positive? (1.0)

b. HOW does the value of MTC change as reactor power is increased? Provide TWO reasons and EXPLAIN each reason. (1.5)

QUESTION 5.07 (1.25)

WHAT is "split enrichment" and WHY is it used in fuel assemblies?

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

QUESTION 5.08 (2.50)

a. WHAT FOUR factors determine whether a Xenon oscillation will be convergent or divergent? (1.0)

b. HOW does an operator dampen a Xenon oscillation? Include how ASI and ESI are used. (1.5)

QUESTION 5.09 (3.00)

The plant is at end of cycle operation, the reactor at 100% power, all rods are all the way out, boron concentration at 10 ppm in the RCS, and T(avg) 10 degrees less than Treference.

EXPLAIN HOW and WHY reducing the power to 95% would affect ASI for the following means of reducing power. Consider each case separately.

1. Control rod insertion (1.0)

2. Boron addition (1.0)

3. Raising T(avg) (1.0)

QUESTION 5.10 (3.00)

Millstone Unit 2 is in Mode 3, BOC, boron concentration is 900 ppm, all shutdown groups are withdrawn, and the actual reactivity present in the core is minus 4% delta-k/k. A dilution of the boron concentration increases source range counts from 100 CPS to 196 CPS. Concurrent with the dilution, Xenon reactivity changes have added + 1000 pcm to the core. CALCULATE the new boron concentration. Assume a constant differential boron worth of 10 pcm/ppm. State all assumptions and show all work.

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

QUESTION 5.11 (2.00)

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

Deleted ~~a. One reactor coolant pump is stopped two minutes prior to criticality~~

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

c. The condenser steam dump pressure setpoint is increased 25 psig

d. Condenser vacuum is reduced by 3 inches of mercury

e. All steam generator levels are being raised by 5%

QUESTION 5.12 (2.00)

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

a. Flow in the reactor coolant loops with the RCPs still running

b. Reactor vessel delta P

c. Core delta T

d. The steam flow in the steam generator on the other side

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

QUESTION 6.01 (2.50)

a. WHAT FOUR (4) regulating control rod interlocks/limits are in effect when the system is in MANUAL INDIVIDUAL control? (1.2)

b. WHAT are the two (2) instrumentation signals/conditions that could provide a DROPPED ROD annunciator? (0.8)

c. If a loss of 125 VDC control power to the trip circuit breakers (TCBs) occurs, what component, if any, will ensure that the TCBs open if a trip signal is generated? (0.5)

QUESTION 6.02 (2.80)

The plant is at 100% power and all controls systems are in automatic. The controlling pressurizer level channel fails low. What system responses will occur and what reactor trip signal, if any, will be generated if no operator action is performed. Setpoints are not required.

QUESTION 6.03 (2.00)

a. In the event of a loss of coolant accident (LOCA) that gradually depressurizes the RCS, STATE the order in which the emergency core cooling systems (ECCS) will inject into the RCS. Setpoints are not required.

b. During a LOCA, all automatic ECCS function properly, pressurizer level stabilizes at 30% and the RCS pressure stabilizes at 1000 psig. WHAT is the approximate break flow rate? Justify your answer using Figure 1.

QUESTION 6.04 (2.00)

a. What conditions must exist for the Reactor Regulating System (RRS) signal to control the condenser steam dump and turbine bypass valves? (0.5)

b. When is the quick open permissive switch used to prevent a quick open signal from opening the atmospheric dump valves? (0.5)

c. In regard to the steam dump / turbine bypass valve operation, why is RRS Channel X selected while passing through 557 F during either an increase or decrease in power? (1.0)

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

QUESTION 6.05 (1.50)

The feedwater control system is in manual with the plant holding at 80% power. The feedwater regulating bypass valve for Steam Generator Number 2 drifts fully open. Assuming no operator action, explain the feedwater system response until equilibrium conditions are reached. State what reactor trip, if any, would occur.

QUESTION 6.06 (2.40)

What effect (INCREASE, DECREASE, NO EFFECT) will the following events have on the Thermal Margin / Low Pressure Trip Setpoint. Consider each separately. Assume the plant is at 100% power.

a. Tcold Loop 1 fails LOW
b. ASI changes from 0.0 to -0.1
c. A RCP trips
d. RCS pressure increases 25 psig
e. A Linear Power Range Channel (Safety) fails high
f. Delta-T PWR Calibrate pot is reduced

QUESTION 6.07 (2.00)

As a result of a complete loss of instrument air, how will the following valves respond (FAIL OPEN, FAIL CLOSED, NO EFFECT).

a. Service Water Outlet Valves on the RBCCW heat exchangers(2-RB-13.1A/B)
b. Atmospheric Dump Valves (2-MS-190A/B)
c. Containment Isolation Valve (2-CH-515)
d. Charging Header Supply Valves (2-CH-518,519)
e. Primary Makeup Water Valve (2-CH-210X)
f. Boric Acid Makeup Valve (2-CH-210Y)
Deleted ~~g. Main Steam Isolation Valves (2-MS-64A/B)~~
h. RCP Control Bleedoff Valve (2-CH-506)

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

QUESTION 6.08 (2.30)

a. If the seal flow reaches 10 gpm on one RCP, WHY will the bleedoff excess flow check valve close? (0.5)

b. Fill in the approximate values for pump seal pressures while at normal operating temperature and pressure in the RCS (No. 1 seal is the lower seal). (1.8)

	Lower Seal Fails	Middle Seal Fails	Upper Seal Fails
Presure Below Middle Seal			
Pressure Below Upper Seal			
Pressure Below Vapor Seal			

QUESTION 6.09 (2.50)

Answer the following questions TRUE or FALSE regarding the Inadequate Core Cooling System.

a. The delta T between the heated and the unheated thermocouple decrease if they are surrounded by steam.

b. A shorted thermocouple, regardless of plant power, will provide a reading of approximately the normal 100% power reading.

c. An unheated thermocouple at 600 F will generate a low level alarm.

d. With two phase mixture in the RCS, indicated level will be greater than actual level if an RCP is running.

e. A pressure margin display with a negative (-) sign indicates superheat.

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

QUESTION 6.10 (2.00)

a. LIST FOUR (4) independent components which could potentially leak radioactive water in the Reactor Building Closed Cooling Water (RBCCW) System. (1.0)

b. WHAT TWO (2) indications would the operator have available to identify a leak into the RBCCW system? (0.5)

c. WHAT TWO (2) sets of valves in the RBCCW system open on an SIAS signal? (0.5)

QUESTION 6.11 (3.00)

Answer the following questions regarding the containment spray system.

a. A large break LOCA occurs. Containment pressure quickly reaches 35 psig but no CSAS signal was generated. Assuming no operator action, WHAT system or components are used to reduce containment pressure? ~~(0.5)~~ (0.6)

b. After a large break LOCA, why are the containment spray minimum flow valves (SI-659,660) closed? ~~(0.5)~~ (0.6)

Deleted

~~c. "A" containment spray pump is being tested to ensure operability while the plant is at 100% power. A loss of normal power (LNP) occurs and a minute later a CSAS signal is generated. EXPLAIN WHY the tested pump WILL or WILL NOT start from the CSAS signal. (1.0)~~

d. WHAT valve realignments automatically occur when a Sump Recirc Actuation Signal is initiated? ~~(1.0)~~ (1.5)

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

QUESTION 7.01 (1.00)

Answer the following question in accordance with AOP 2551, Shutdown From Outside the Control Room.

While shutting down from outside the control room and with automatic boration unavailable, WHAT is the source of makeup to the RCS and WHY is this source selected?

QUESTION 7.02 (1.00)

Answer the following question in accordance with OP 2201, Plant Heatup.

While placing the volume control system in service during a plant heatup, the operator is cautioned to maintain the RCS pressure below 265 psia by operation of the back pressure control valves. EXPLAIN WHY this is required.

QUESTION 7.03 (1.50)

In accordance with AOP 2553, Plant Cooldown Using Natural Circulation, assume during a natural circulation cooldown that auxiliary spray becomes inoperable. GIVE three (3) alternate methods of depressurizing the RCS.

QUESTION 7.04 (2.50)

Answer the following questions regarding OP 2207, Plant Cooldown.

a. Over a two hour period, the RCS steadily cooled down from 350 F to 280 F. Explain whether or not a cooldown limit has been exceeded. ~~(1.0)~~ (1.5)

Deleted ~~b. If only three RCPs are running, which combination of three will afford the greatest pressurizer spray capability? (0.5)~~

c. Prior to initiating auxiliary spray, why is letdown flowrate maximized while charging flow is minimized? ~~(0.5)~~ (1.0)

Deleted ~~d. When securing auxiliary spray, WHY must Charging Header Supply Valves (2 CH 510 or 2 CH 519) be closed? (0.5)~~

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

QUESTION 7.05 (2.00)

Answer the following questions regarding OP 2203, Plant Startup.

a. With the reactor at 530 F, an inadvertant opening of the condenser steam dump valves occurs resulting in a 20 F cooldown of the RCS before the valves are closed. One of two actions must be taken. WHAT are the TWO (2) actions?

b. Reactor power is 6% when all feedwater flow was lost for 8 minutes. When re-establishing feedwater, flow is to be limited to less than 600 gpm if steam generator temperature is greater than 212 F and and level is less than 45%. What operator action should be taken, if any, and what adverse plant condition may result, if any, if maximum feedwater flow is initiated?

QUESTION 7.06 (2.50)

a. In accordance with AOP 2564, Loss of RBCCW, if a service water header rupture nas resulted in a loss of cooling water to the RBCCW heat exchangers, WHAT THREE (3) conditions may develop which require a reactor trip? (1.5)

b. The "A" service water header becomes inoperable and is removed from service. Appropriate RBCCW component realignments are being made to allow the "B" service water header to act as the heat sink. In accordance with Technical Specifications, WHAT restrictions, if any, are placed upon plant operation in Mode 1 while in this configuration if the "B" diesel generator was out of service for maintenance before the "A" service water header became inoperable? (1.0)

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

QUESTION 7.07 (3.50)

Answer the following questions regarding AOP 2569, Steam Generator Tube Leak.

a. If a tube leak has occurred, WHAT FOUR valves (sets of valves) will close? (1.0)

b. WHEN during a tube leak should the reactor be tripped? (0.5)

c. WHAT TWO (2) limits, as verified by Chemistry Personnel, require a unit shutdown to commence? (1.0)

d. If the turbine driven auxiliary feedwater pump or the steam generator atmospheric dump valve for the affected steam generator are operated during a tube leak, WHY must the duration of operation of these systems be recorded? (0.5)

e. If operation with a tube leak continues long term, WHY must the number of circulating pumps and blowdown flowrate be checked? (0.5)

QUESTION 7.08 (2.00)

Answer the following questions regarding AOP 2571, Inadvertent ECCS Initiation.

a. If an actuation occurs during solid condition in the pressurizer, WHY must the charging pumps be secured?

b. If an ESAS Signal has been overridden by use of the equipment hand-switch, WHAT effect, if any, will future ESAS Signals have on that equipment?

c. WHY should the TBCCW heat exchanger manual inlet valves be throttled prior to overriding an SIAS Signal?

d. After resetting an SIAS Signal and restoring the safety injection systems, WHY must the RWST recirculation header drain valve to the PDT (2-SI-661) be opened?

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

QUESTION 7.09 (3.50)

Answer the following questions regarding EOP 2532, Loss of Primary Coolant.

a. Provide the SIX (6) checks that the operator uses to verify natural circulation flow. (1.5)

b. WHAT FOUR (4) conditions must exist before a HPSI pump can be stopped? (1.0)

c. If voids exist in the reactor vessel during natural circulation, HOW will pressurizer level and pressure respond if an RCP is started? (0.5)

d. WHAT personnel hazard exists while performing boron precipitation control? (0.5)

QUESTION 7.10 (3.50)

Answer the following questions regarding EOP 2525, Standard Post Trip Actions.

a. EXPLAIN HOW the operator would manipulate the controls of the CVCS to perform a boration if two CEAs failed to insert. (1.0)

b. After checking pressurizer level, WHY does the operator check RCS subcooling? (0.4)

c. GIVE TWO (2) indications HOW an operator verifies that a PORV or pressurizer safety is not open? (0.8)

d. If, after tripping the turbine generator megawatts does not go to zero, WHAT action should the operator perform? (0.4)

e. Provide THREE (3) reasons WHY feedwater should be added slowly during low steam generator water level. (0.9)

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

QUESTION 7.11 (2.00)

Answer the following questions regarding EOP 2540 D, Functional Recovery of Heat Removal.

a. When, if at all, is it permissible to NOT isolate a ruptured steam generator? (0.75)

b. WHY will restarting the RCPs cause pressurizer level and pressure to decrease? (0.75)

c. To establish heat removal using Once Through Cooling, WHY are two high pressure trip bistables pulled and one bypass key installed? (0.5)

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

QUESTION 8.01 (2.20)

Discuss the relationship between Limiting Conditions for Operations (LCO), Limiting Safety System Settings (LSSS), and Safety Limits in terms of preventing release of radioactivity to the environment.

QUESTION 8.02 (1.00)

Below are the dates of the Quarterly Battery Surveillence (2736B-1):

7/6/86 10/5/86 1/5/87 5/6/87

EXPLAIN WHETHER OR NOT a surveillance interval has been exceeded, and if so, WHICH ONE.

QUESTION 8.03 (2.00)

With the plant at 100% power, a re-analysis of steam generator tube examination data, collected from the last refueling outage, identifies that one tube which had contained a repairable defect had not been repaired prior to declaring the steam generator operable. WHAT action, if any, is required in regard to plant operating mode and WHY? Refer to the attached Technicial Specification.

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

QUESTION 8.04 (3.00)

Answer the following questions TRUE or FALSE with respect ACP-QA-206A, Station Tagging.

a. If the "Operator in Attendance" must leave for a duration of 30 minutes, the valves and breakers shall be tagged as listed on the Tag Log Sheet, SF 210.

b. Valves are red tagged shut and breakers are red tagged open unless the tag position is written on the red tag.

deleted ~~c. The "Restoration Performed" block may be filled in when tags are issued as in the case if no restoration is required (i.e. extended outage on systems not in service or refueling outage) and the SS checks the "No" block and the reason is given in the "Restoration Performed" block.~~

d. A blue tag and a red tag may be attached to the same piece of equipment at the same time.

e. Any number of red tags may be attached to the same piece of equipment at the same time.

f. Restoration involving switch or breaker position will always be in the "AUTO" or "OPEN" position respectively.

QUESTION 8.05 (1.50)

WHAT actions and notifications must be completed if Unit 2, while in Mode 3, is experiencing a pressure of 2775 psig due to equipment malfunctions and operator neglect?

QUESTION 8.06 (3.00)

Answer the following questions regarding ACP 6.01, Control Room Procedure.

a. Following a refueling outage, WHAT THREE individuals (by position) may give authorization to take the reactor critcal? (1.5)

b. Prior to resetting protective relays following a reactor trip, WHAT TWO (2) precautionary actions should be performed? (1.0)

c. With only one operator at the controls, WHEN, if at all, may the operator leave the surveillance area during Mode 1 operations? (0.5)

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

QUESTION 8.07 (2.00)

At 0930, with the plant at 85% power, the B HPSI pump was taken out of service for maintenance. At 1315 an uncomplicated reactor trip occurs because an I&C technician tripped an incorrect bistable. The HPSI pump is expected to be back in service within three hours. EXPLAIN WHETHER OR NOT a reactor startup may be commenced.

QUESTION 8.08 (2.00)

In accordance with Technical Specifications, temporary changes to procedures at Unit 2 may be made if WHAT THREE provisions are met?

QUESTION 8.09 (2.00)

An I&C technician has been trouble-shooting a problem with the rod control system. The PPO requests permission from the SCO to allow the technician to insert Group 7 rods one step to test the rod control system. With the plant at 90% power, SHOULD the SCO allow the technician to operate the controls? Justify WHY or WHY NOT.

QUESTION 8.10 (2.40)

While in Mode 6, WHAT conditions would require both independent shutdown cooling loops to be operable?

QUESTION 8.11 (2.40)

According to Technical Specifications, WHEN does containment integrity exist?

QUESTION 8.12 (1.50)

WHAT is the Technical Specification bases for establishing a limit for the minimum temperature for criticality?

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

EQUATION SHEET

$f = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

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

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

$Pwr = W_f \Delta h$

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

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

$SUR = 26.06/T$

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

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

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

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

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

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

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

$\Sigma = \sigma N$

$v = s/t$

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

$a = (V_f - V_o)/t$

$w = \theta/t$

Cycle efficiency = (Network out)/(Energy in)

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

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

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

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

$I = I_o e^{-ux}$

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

$TVL = 1.3/u$

$HVL = -0.693/u$

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

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

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

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

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

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

$\ell^* = 10^{-5}$ 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/$in.^2$

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

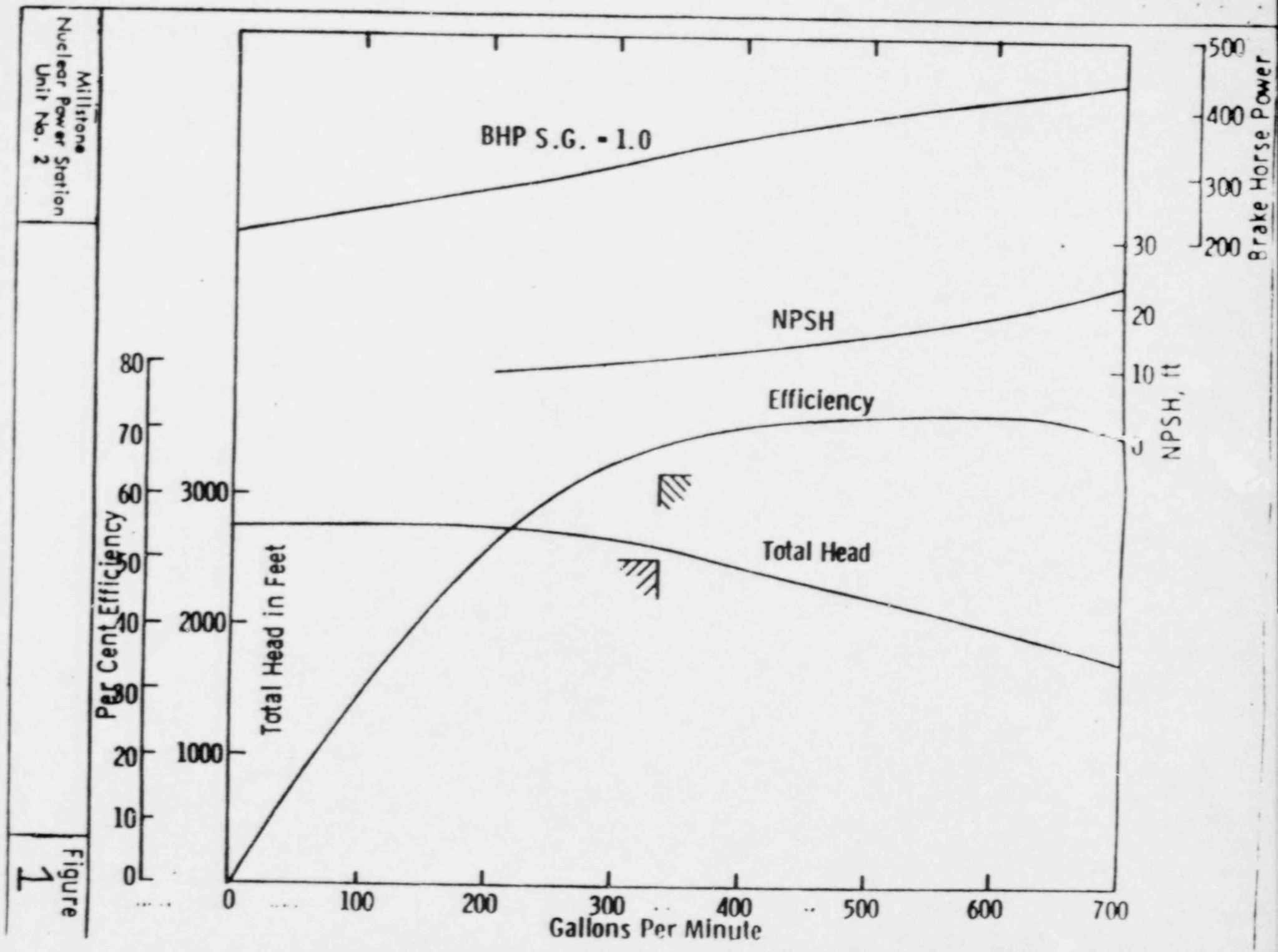
Millstone
Nuclear Power Station
Unit No. 2
BHP S.G. = 1.0
NPSH
Efficiency
Total Head
Per Cent Efficiency
Total Head in Feet
NPSH, ft
Brake Horse Power
Gallons Per Minute
0
10
20
30
40
50
60
70
80
1000
2000
3000
100
200
300
400
500
600
700

Figure 1

REACTOR COOLANT SYSTEM

STEAM GENERATORS

LIMITING CONDITION FOR OPERATION

3.4.5 Each steam generator shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

With one or more steam generators inoperable, restore the inoperable generator(s) to OPERABLE status prior to increasing T_{avg} above 200°F.

SURVEILLANCE REQUIREMENTS

4.4.5.0 Each steam generator shall be demonstrated OPERABLE by performance of the following Augmented Inservice Inspection Program.

4.4.5.1 Augmented Inservice Inspection Program

4.4.5.1.1 Steam Generator Sample Selection and Inspection - Each steam generator shall be determined OPERABLE during shutdown by selecting and inspecting at least the minimum number of steam generators specified in Table 4.4-5.

4.4.5.1.2 Steam Generator Tube Sample Selection and Inspection - The steam generator tube minimum sample size, inspection result classification, and the corresponding action required shall be as specified in Table 4.4-6. The inservice inspection of steam generator tubes shall be performed at the frequencies specified in Specification 4.4.5.1.3 and the inspected tubes shall be verified acceptable per the acceptance criteria of Specification 4.4.5.1.4. The tubes selected for each inservice inspection shall include at least 3% of the total number of tubes in all steam generators; the tubes selected for these inspections shall be selected on a random basis except:

a. Where experience in similar plants with similar water chemistry indicates critical areas to be inspected, then at least 50% of the tubes inspected shall be from these critical areas.

b. The first sample of tubes selected for each inservice inspection (subsequent to the preservice inspection) of each steam generator shall include:

SURVEILLANCE REQUIREMENTS (Continued)

1. All nonplugged tubes that previously had detectable wall penetrations (>20%).

2. Tubes in those areas where experience has indicated potential problems.

3. A tube inspection (pursuant to Specification 4.4.5.1.4.a.8) shall be performed on each selected tube. If any selected tube does not permit the passage of the eddy current probe for a tube inspection, this shall be recorded and an adjacent tube shall be selected and subjected to a tube inspection.

c. The tubes selected as the second and third samples (if required by Table 4.4-6) during each in-service inspection may be subjected to a partial tube inspection provided:

1. The tubes selected for these samples include the tubes from those areas of the tube sheet array where tubes with imperfections were previously found.

2. The inspection include those portions of the tubes where imperfections were previously found.

The results of each sample inspection shall be classified into one of the following three categories:

Category	Inspection Results
C-1	Less than 5% of the total tubes inspected are degraded tubes and none of the inspected tubes are defective.
C-2	One or more tubes, but not more than 1% of the total tubes inspected are defective, or between 5% and 10% of the total tubes inspected are degraded tubes.
C-3	More than 10% of the total tubes inspected are degraded tubes or more than 1% of the inspected tubes are defective.

Note: In all inspections, previously degraded tubes must exhibit significant (>10%) further wall penetrations to be included in the above percentage calculations.

4.4.5.1.3 Inspection Frequencies - The above required inservice inspections of steam generator tubes shall be performed at the following frequencies:

a. The first inservice inspection shall be performed after 6 Effective Full Power Months but within 24 calendar months of initial criticality. Subsequent inservice inspections shall be performed at intervals of not less than 12 nor more than 24 calendar months after the previous inspection. If two consecutive inspections following service under AVT conditions, not including the preservice inspection, result in all inspection results falling into the C-1 category or if two consecutive inspections demonstrate that previously observed degradation has not continued and no additional degradation has occurred, the inspection interval may be extended to a maximum of once per 40 months.

b. If the results of the inservice inspection of a steam generator conducted in accordance with Table 4.4-6 at 40 month intervals fall into Category C-3, the inspection frequency shall be increased to at least once per 20 months. The increase in inspection frequency shall apply until the subsequent inspections satisfy the criteria of Specification 4.4.5.1.3.a; the interval may then be extended to a maximum of once per 40 months.

c. Additional, unscheduled inservice inspections shall be performed on each steam generator in accordance with the first sample inspection specified in Table 4.4-6 during the shutdown subsequent to any of the following conditions:

1. Priamry-to-secondary tubes leaks (not including leaks originating from tube-to-tube sheet welds) in excess of the limits of Specification 3.4.6.2.

2. A seismic occurrence greater than the Operating Basis Earthquake.

3. A loss-of-coolant accident requiring actuation of the engineered safeguards.

4. A main steam line or feedwater line break.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.5.1.4 Acceptance Criteria

a. As used in this Specification

1. Imperfection means an exception to the dimensions, finish or contour of a tube from that required by fabrication drawings or specifications. Eddy-current testing indications below 20% of the nominal tube wall thickness, if detectable, may be considered as imperfections.

2. Degradation means a service-induced cracking, wastage, wear or general corrosion occurring on either inside or outside of a tube.

3. Degraded Tube means a tube containing imperfections ≥20% of the nominal wall thickness caused be degradation.

4. % Degradation means the percentage of the tube wall thickness affected or removed by degradation.

5. Defect means an imperfection of such severity that it exceeds the plugging limit. A tube or sleeve containing a defect is defective.

6. Plugging Limit means the imperfection depth at or beyond which the tube or sleeve shall be repaired because it may become unserviceable prior to the next inspection and is equal to 40% of the nominal tube wall thickness for tubes.*

7. Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss-of-coolant accident, or a steam line or feedwater line break as specified in 4.4.5.1.3.c, above.

8. Tube Inspection means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U - Bend to the top support of the cold leg.

b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug or sleeve all tubes exceeding the plugging limit and plug all defective sleeves) required by Table 4.4-6.

*The plugging limit for sleeves will be determined prior to next refueling outage.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.5.1.5 Reports

a. Following each inservice inspection of steam generator tubes, the number of tubes plugged in each steam generator shall be reported to the Commission within 15 days.

b. The complete results of the steam generator tube inservice inspection shall be included in the Annual Operating Report for the period in which this inspection was completed. This report shall include:

1. Number and extent of tubes inspected.

2. Location and percent of wall-thickness penetration for each indication of an imperfection.

3. Identification of tubes plugged or sleeved.

c. Results of steam generator tube inspections which fall into Category C-3 shall be reported pursuant to 10 CFR 50.72. In lieu of any report required pursuant to Specification 6.6.1, a Special Report pursuant to Specification 6.9.2 shall be submitted prior to resumption of plant operation and shall provide a description of investigations conducted to determine the cause of the tube degradation and corrective measures taken to prevent recurrence.

TABLE 4.4-5

MINIMUM NUMBER OF STEAM GENERATORS TO BE
INSPECTED DURING INSERVICE INSPECTION

Preservice Inspection	Yes
No. of Steam Generators per Unit	Two
First Inservice Inspection	One
Second & Subsequent Inservice Inspections	One[1]

Table Notation:

1. The inservice inspection may be limited to one steam generator on a rotating schedule encompassing 3 N % of the tubes (where N is the number of steam generators in the plant) if the results of the first or previous inspections indicate that all steam generators are performing in a like manner. Note that under some circumstances, the operating conditions in one or more steam generators may be found to be more severe than those in other steam generators. Under such circumstances the sample sequence shall be modified to inspect the most severe conditions.

TABLE 4.4-6

STEAM GENERATOR TUBE INSPECTION

1ST SAMPLE INSPECTION			2ND SAMPLE INSPECTION		3RD SAMPLE INSPECTION	
Sample Size	Result	Action Required	Result	Action Required	Result	Action Required
A minimum of S tubes per S.G.	C-1	None	N/A	N/A	N/A	N/A
	C-2	Repair defective tubes and inspect additional 25 tubes in this S.G.*	C-1	None	N/A	N/A
			C-2	Repair defective tubes and inspect additional 45 tubes in this S.G.*	C-1	None
					C-2	Repair defective tubes*
					C-3	Perform action for C-3 result of first sample
			C-3	Perform action for C-3 result of first sample	N/A	N/A
	C-3	Inspect all tubes in this S.G., repair defective tubes and inspect 25 tubes in each other S.G.* Prompt notification to NRC pursuant to 10 CFR 50.72	All other S.G.s are C-1	None	N/A	N/A
			Some S.G.s C-2 but no additional S.G. are C-3	Perform action for C-2 result of second sample	N/A	N/A
			Additional S.G. is C-3	Inspect all tubes in each S.G. and repair defective tubes.* Prompt notification to NRC pursuant to 10 CFR 50.72	N/A	N/A

$S = 3\frac{N}{n} - 1$ Where N is the number of steam generators in the unit, and n is the number of steam generators inspected during an inspection

* Repair of defective tubes shall be limited to plugging with the exception of those tubes which may be sleeved. Tubes with defective sleeves shall be plugged.

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 5.01 (1.50)

a. Calculated higher than actual [0.5]
b. Calculated higher than actual [0.5]
c. Calculated higher than actual [0.5]

REFERENCE
HTFF 2121 B pg 17, 18
EO 5

Heat transfer 191003 K 1.06 3.1/3.3
K 1.08 3.1/3.4
3.2 002 020 K 5.01 3.2/3.6
193007K106 002020K501 193007K108 ...(KA'S)

ANSWER 5.02 (2.00)

a. TRUE
b. TRUE
c. TRUE
d. FALSE [0.5 pts each]

REFERENCE
Question Bank pg 112
Electrical Theory 2131 pg 43-63

EO 6,9,10

2.7/2.9 3.1/3.1
064000A203 0640002020 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 5.03 (1.50)

Tcold = 503 F corresponding to saturation temperature for 700 psia [0.25]

Thot = Tcold + 25 = 528 F [0.5]

40 F subcooled = 528 + 40 = 568 F [0.5]

568 F corresponds to 1207.72 psia [0.25]

REFERENCE
Question Bank pg 91
HTFF 2121 J pg 18
EO 11
HTFF 2121 C pg 9,10
EO 5

2.8/3.1 3.6/3.8
193003K124 193008K115 ...(KA'S)

ANSWER 5.04 (3.00)

a. Decrease [0.25] Smaller delta T required to transfer heat to RCS [0.5]

b. Increase [0.25] Center line temperature responds to RCS temperature in order to maintain a constant delta T for heat transfer [0.5]

c. Decrease [0.25] Fuel swelling and clad creep reduces clad gap which improves the heat transfer across the gap and lowers fuel temp [0.5]

d. Remains the same [0.25] Pressure has little effect on heat transfer in subcooled fluids [0.5]

REFERENCE
Question Bank pg 87
HTFF 2121 B pg 3-8
EO 2

2.5/2.5 2.4/2.6
193007K101 193008K116 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 5.05 (.75)

d. [0.75]

REFERENCE
Question Bank pg 75,76
Fuel Design / Core Power Distribution 2117 pg 11
EO 3

2.5/3.2
034000K101 ...(KA'S)

ANSWER 5.06 (2.50)

a. High boron concentration [0.5]
Low moderator temperature [0.5]

b. MTC becomes less positive (or more negative) [0.5]
A decrease in boron concentration [0.25] deminishes the positive component of MTC [0.25]
As moderator temperature increases [0.25], its density decreases and tends to increase reasonance absorption OR neutron leakage [0.25]

REFERENCE
Question Bank pg 61
Characteristics pg 11-23
EO 3

2.9/3.1 3.1/3.1
192004K103 192004K106 ...(KA'S)

ANSWER 5.07 (1.25)

"Split enrichment" refers to using lower enrichment in the fuel pins surrounding the CEA guide tubes than is used in the rest of the assembly [0.5]. This is done to lower power peaking (peaking factors) caused by "water hole" peaking at the CEA guide tubes [0.75]

REFERENCE
Question Bank pg 75
Fuel Design / Core Power Distribution 2117 pg 16-20
EO 2

2.9/3.1

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

192005K112 ...(KA'S)

ANSWER 5.08 (2.50)

a. Core size *or CEA position*
Core age
Value of MTC
Value of FTC [0.25 pts each]

b. As power shifts to the top of the core, insert Group 7 CEAs
As power shifts to the bottom of the core, withdraw Group 7 CEAs
CEAs will be moved when ASI crosses the ESI (Equilibrium Shape Index)
[0.5 pts each]

REFERENCE
Characteristics, 2116 F, pg 22,27
EO 6,7

3.4/3.4
192006K106 ...(KA'S)

ANSWER 5.09 (3.00)

1. Adding negative reactivity to the top of the core [0.5] causes the ASI to become more positive (power is driven to the bottom of the core) [0.5].

2. As power decreases, the change in T h is greater than the change in T c [0.25]. With a -MTC, less negative reactivity is inserted in the top of the core than the bottom due to positive reactivity feedback [0.25]. Also, the MTC is more negative at the temperatures at the top of the core [0.25]. ASI becomes negative [0.25].

3. As SG steam flow is decreased, T c increases and the hotter T c entering the core reduces reactor power [0.2]. At the lower reactor power there is a smaller delta T across the core [0.2]. The net result is that T c increases more than T h [0.2]. But MTC is more negative at the top of the core than at the bottom [0.2] so the effects are approximately off-setting and ASI does not significantly change [0.2].

REFERENCE
Characteristics 2116 G pg 40-43
EO 9

3.3/3.5 3.2/3.5
004000K515 192005K114 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 5.10 (3.00)

Rho1 = (K1 -1)/K1 = -0.04
K1 = 1/((1 - (-0.04)) = 0.9615 [0.5]
100(1 - 0.9615) = 196(1 - K2), K2 = 0.9804 [0.5]
Rho2 = (0.9804 - 1)/0.9804 = -0.02 [0.25]
Rho2 - Rho1 = -0.02-(-0.04) = 0.02 = 2000 pcm [0.5]
1000 pcm is due to Xenon, thus the remaining 1000 pcm is due to boron[0.5]
1000 pcm = 1000 pcm /(10 pcm/ppm) = 100 ppm [0.5]
900 ppm - 100 ppm = 800 ppm new boron concentration [0.25]

REFERENCE
Characteristics 2116 B pg 9,10
EO 4

3.5/3.8 3.8/3.8
001000K528 192008K104 ...(KA'S)

ANSWER 5.11 (2.00)

~~a. SAME~~ Deleted
b. HIGHER
c. HIGHER
d. SAME
e. LOWER [~~0.4~~ 0.5 pts each]

REFERENCE
Characteristics 2116 G pg 3,4,8,9
EO 4, 10b

3.4/3.5
192008K101 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 5.12 (2.00)

a. INCREASE
b. DECREASE
c. INCREASE
d. INCREASE [0.5 pts each]

REFERENCE
HTFF 2121 J pg 20-22
EO 7
HTFF 2121 E pg 17-22
EO 6

2.4/2.5 3.6/3.8
191004K109 192008K121 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 6.01 (2.50)

a. Upper and Lower electrical limit
CWP CEA withdrawal prohibit
CMI CEA motion prohibit [0.3 pts each]

b. 1. Rod drop from Reed switch
2. NI negative rate of power change from NI system. [0.4 pts each]

c. UV trip devices [0.5]

REFERENCE
CEDS pg 8,36,37 Fig 30
CRAB Panel C05 AA-24,AB-24

TPG CEDS EO 6,13
RPS EO 1e,1f

3.4/3.6 4.5/4.4 3.7/3.8 2.4/2.8 2.9/3.1
001000K103 001000K105 001000K407 001000K604 063000K201
...(KA'S)

ANSWER 6.02 (2.80)

PZR heaters deenergize
Letdown flow control valves close to minimum
Both backup pumps start
Auto makeup to VCT initiates (due to charging/letdown mismatch)
Sprays initiate (to reduce pressure from compressing the vapor space)
Reactor trips on high PZR pressure
PORVs open [0.4 pts each]

REFERENCE
PZR P&L Control System pg 4-21
RPS pg 19,20

TPG PZR L&P Control EO 6,7,9

3.6/3.9 3.1/3.8 3.7/4.0 3.8/3.9 3.2/3.4 3.3/3.7
011000K101 011000K102 011000K103 011000K104 011000K301
011000K401 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 6.03 (2.00)

a. Charging pumps, HPSI, SIT, LPSI [0.2 pts each, 0.2 pts for order]

b. (Leakage would be the sum of the HPSI and PDPs)

HPSI:	2	X	4500gpm	=	9000gpm [0.5]
PDP:	3	X	44gpm	=	132gpm [0.5]
					1032 ~~1132~~gpm

(Will accept + or - ~~50~~ 100 gpm for the HPSI pumps)

REFERENCE
SIT system pg 4
LPSI system pg 6
HPSI system pg 12, FIG 6
PZR P&L Control pg 8

TPG ECCS EO 12c,12d,14,18a,18c

4.0/4.3	4.3/4.6	3.6/3.9	3.5/3.9	3.4/3.9	3.0/3.5
006000K605	006000K602	006000K506	006000K108	006000K103	
006000A101	...(KA'S)				

ANSWER 6.04 (2.00)

Tave > 540°F [.15]

a. Turbine tripped [0.2]
Normal vacuum [.15] ~~[0.25 pts each]~~

b. ~~When there might be radioactivity in a SG [0.5]~~ To protect personnel when draining condensation from the valves and mufflers [0.5]

c. Prevents electronic noise generated by the quick open relay of Channel Y [0.5] from causing inadvertant and undesirable equipment and instrument response [0.5].

REFERENCE
RRS pg 10,11,12,14

TPG MSS EO 6a,6i

3.3/3.3	3.1/3.0	2.9/3.3	
039000K102	039000K106	041020K401	...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 6.05 (1.50)

Steam generator level increases until the "Hi level override" [0.5] sends a signal to close the feed reg valve and feed reg bypass valve of the No. 2 SG [0.5]. With SF > FF a reactor trip from Lo SG level will occur. [0.5]

REFERENCE
FW Control System pp. 9,10
TPG MFW/FW Control EO 4c,5j

3.1/3.3 3.4/3.4 3.3/3.5
059000K103 059000K104 059000K402 ...(KA'S)

ANSWER 6.06 (2.40)

a. No effect
b. ~~Decrease~~ Increase
c. Decrease (Just considering the change in flow will have No Effect on setpoint)
d. No effect
e. ~~Decrease~~ Increase
f. No effect [0.4 pts each]

REFERENCE
RPS Description pp. 28,29,30, FIG 24
TPG RPS EO 3b

3.9/4.3 3.3/3.8 2.9/2.9
012000K402 012000K501 012000K611 ...(KA'S)

ANSWER 6.07 (2.00)

a. FO
b. FC
c. FC
d. FO
e. FC
f. FC
~~g. NO Effect~~ Deleted.
h. FC [~~0.25~~ 0.28 pts each]

REFERENCE
AOP-2563 pp. 4,5
CVCS pp. 6,17,23
MSS pp. 8,9

TPG Compressed Air EO 11a,11d

2.9/3.4 3.4/3.5 3.4/3.6
000065K303 078000K105 078000K302 ...(KA'S)

ANSWER 6.08 (2.30)

a. To prevent blockage of bleedoff flow from other RCPs [0.5]

b. 2250±100 1100 1100
1100±100 1100 60
60±15 60 60 [0.2 pts each]

REFERENCE
Question Bank p. 5
RCS p. 35

TPG RCS EO 5,6

3.7/4.0 4.1/4.2
002000K106 002000K113 078000K302 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 6.09 (2.50)

a. FALSE
b. FALSE
c. FALSE
d. TRUE
e. TRUE [0.5 pts each]

REFERENCE
ICC LP pp. 4,7,12,17
TPG ICCS EO 1,4,5,6

4.2/4.4 4.3/4.6 2.5/2.7
000074A101 000074A113 000074K208 ...(KA'S)

ANSWER 6.10 (2.00)

a. 1. RCP thermal barrier/ seal coolers
2. Letdown heat exchanger
3. Shutdown cooling heat exchangers
4. Primary system sample coolers [0.25 pts each]

b. Radiation Monitor increase (or alarm)
Surge tank level increase [0.25 pts each]

c. ESF room air cooling coil outlet valves
CAR cooling unit 10" outlet valves [0.25 pts each]

REFERENCE
RBCCW system pp. 3,11
TPG BRCCW system EO 9,11

3.6/3.9 3.3/3.3
000026K302 008000K104 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 6.11 (3.00)

a. CAR Units ~~[0.5]~~ [0.6]

b. To prevent transferring the water in the sump to the RWST (and possibly causing an unmonitored release via the RWST vent) ~~[0.5]~~ [0.6]

Deleted ~~c. The "A" CSP will not respond [0.5] because the LNP locked out the breaker [0.5] (The breaker must be reset before the CSP will start)~~

d. Sump outlet valves (CS-16.1A/B) open ~~[0.3]~~
Minimum flow valves (SI-659,660) close ~~[0.3]~~
Outlet valves on the shell side of the SDC Hx open ~~[0.4]~~ [0.6pts each]

REFERENCE
CSS pp.4,6,7,11
TPG ECCS EO 5,10
AC Distr. EO 8b

3.4/3.6 3.9/4.1 4.2/4.3 4.1/4.3 3.7/4.1
026000K201 026000K301 026000K401 026020K403 026020K404
...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 7.01 (1.00)

or Boric acid storage tanks

Makeup to the RCS must be from the RWST [0.5]
To insure that the boron concentration is greater than or equal to that of the RCS. [0.5]

REFERENCE
AOP 2551, step 4.20.4 p. 7
TPG 2551 EO 3

3.1/3.4 3.4/3.7
004000G10 004000K123 ...(KA'S)

ANSWER 7.02 (1.00)

Prevents the shutdown cooling system from isolating [0.5] and the safety injection tank outlet valves from auto opening [0.5].

REFERENCE
OP 2201, step 5.1.3, p. 9
TPG 2201 EO 3

3.5/3.8 3.1/3.4 3.4/3.9 2.9/3.?
004000K102 004010G10 004010K101 010000K106 ...(KA'S)

ANSWER 7.03 (1.50)

Fill and drain the pressurizer to cooldown and thereby depressurize the RCS. [0.5]

Depressurize the pressurizer by ambient cooling. [0.5]

Open a PORV as needed to reduce RCS pressure. [0.5]

REFERENCE
AOP 2553, step 4.6, p. 6
TPG 2553 EO 2f, 3

3.7/4.1
000027K303 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 7.04 (2.50)

a. No ~~(0.25)~~ [0.5]. Even though the RCS was cooling down at a rate of 35 F/hr, while below 300 F the RCS temperature did not exceed the ~~20~~ 30 F/hr cool-down limit ~~(0.75)~~. [1.0]

Deleted ~~b. ABC or ABE (0.5)~~

c. To minimize thermal shock when aux spray is initiated ~~(0.5)~~ [1.0]

Deleted ~~d. To provide a flow path for the charging pumps to prevent damage to the pumps (0.5)~~

REFERENCE
OP 2207 pp. 3,6,7,10,13,15
TS 3.4.9.1

TPG 2207 EO 1

3.3/3.6 3.2/3.5
010G10 035G5 ...(KA'S)

ANSWER 7.05 (2.00)

a. Restore Tavg > 515 F [0.5] or be in hot standby within 15 minutes [0.5]

b. Trip the reactor ~~(0.5)~~ [0.5] and Reduce feedwater flow [0.25]
Water hammer [0.25] ~~(0.5 pts each)~~

REFERENCE
OP 2203 pp. 4,5,7
TPG 2203 EO 3b,3u

3.6/4.2 4.1/4.4 3.6/4.1
000054K101 000054K301 002000G5 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11- ILK, D.

ANSWER 7.06 (2.50)

a. RCP seal temperature exceeds 250 F
RCP bearing oil temperature exceeds 195 F
RCP controlled bleedoff temperature exceeds 195 F [0.5 pts each]

b. ~~the unit shall be in cold shutdown within 24 hours due to TS 3.05~~ [1.0]
Continued operation in mode 1 is not permitted

REFERENCE
AOP 2564 pp. 2,3
AOP 2565 p.2
OP 2326 pp. 16,17
TS 3.7.4.1
TS 3.05

TPG 2564 EO 1b
TPG 2565 EO 4

4.0/4.2 3.4/3.5 2.8/3.2 3.4/3.3
000026K303

ANSWER 7.07 (3.50)

a. 1. SGBD isolation valves close (2-MS-220A,B)
2. BD tank discharge valve to circ water closes (2-MS-15)
3. BD quench tank discharge valves to circ water closes (2-MS-135)
4. SGBD sample discharge valves to secondary sample sink close (HV-4287,4288) [0.25 pts each]

b. If leakage exceeds the capacity of the CVCS to maintain PZR level [0.5]

c. SG leakage > 0.15 gpm
Dose equivalent I-131 > 0.1 uCi/gm [0.5 pts each]

d. To allow estimation of any release [0.5]

e. To ensure consistency with chemistry discharge calculations [0.5]

REFERENCE
AOP 2569 pp. 2,4,5,6
TPG 2569 EO 1a,b,c,d; 5

3.7/4.0 4.2/4.4 3.6/3.9 4.0/4.3
000037K305 000037K307 073000K101 073000K401 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 7.08 (2.00)

a. To prevent exceeding the RCS pressure/temperature limits [0.5]

b. None [0.5]

c. To prevent run out of the service water pumps [0.5]

d. To bleed off excessive pressure in the injection headers [0.5]

REFERENCE
AOP 2571 pp.2,3,5
TPG 2571 EO 1b,2,5

2.4/3.4 3.9/4.2
000G4 006050K401 ...(KA'S)

ANSWER 7.09 (3.50)

a. PZR level > 20%
Heat removal from at least one SG
P/T limit of Fig 4.2 satisfied for Thot
Loop Delta T between 10 and 45 F
Tcold constant or decreasing
Thot constant or decreasing [0.25 pts each]

b. PZR level > 35% and constant or increasing
P/T limit of Fig 4.2 satisfied for Thot
Heat removal from at least one SG
Rx vessel level above the top of hot leg (> 43%) [0.25 pts each]

c. Both decrease [0.5]

d. High radiation exposure [0.5]

REFERENCE
EOP 2532 pp. 8,9,10,16
TPG 2532 EO 4a,4e,6b,12

4.4/4.6
000011K312 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

Alternative to a). Open gravity feed valves (2-CH-508,509) [0.35]
- Close VCT outlet valve (2-CH-501) [0.3]
- Start all available charging pumps [0.35]

ANSWER 7.10 (3.50)

a. Open BAP discharge valve to charging pumps (2-CH-514)
Start both BAPs
Close BAP recirc valves (2-CH-510,511)
Start all available charging pumps [0.25 pts each]

b. To ensure PZR level is valid (and voids are not forming in another portion of the RCS) [0.4]

c. Normal quench tank level, pressure, and temperature
No acoustic monitor alarms [Any two, 0.4 pts each]

d. Close the MSIVs [0.4]

e. To avoid: excessive PZR level and pressure transient
excessive cooldown rate
overfilling the SG [0.3 pts each]

REFERENCE
EOP 2525 pp. 3,4,5,8,11
Intro to EOPs p. 12
TPG 2525 EO 4a,4b,6b
TPG Intro to EOPs EO 11,15,16,20

3.9/4.2 4.1/4.6 4.0/4.4
000005K306 000008K303 000074K311 ...(KA'S)

ANSWER 7.11 (2.00)

a. If the ruptured SG is the only one available for heat removal [0.75]
or If RCS T_H is not below 520°F to minimize the potential for lifting the steam generator safety valves

b. Void collapse may be large enough to drain the PZR [0.75]

c. Control ~~Open~~ the PORVs [0.5]

REFERENCE
EOP 2540D pp.4,9,11,15,19
TPG 2540D EO 5

4.4/4.6 4.6/4.7
000054K304 000054K305 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 8.01 (2.20)

LCO's indicate lowest performance level of equipment required for safe operation of the facility [0.75]. If improper automatic action occurs prior to reaching an LSSS, then Safety Limits will not be exceeded [0.7]. If Safety Limits are not exceeded then fuel and RCS integrity will be maintained [0.75].

REFERENCE
10CFR50.36.c.1,2
TPG TS EO 5

3.6/4.1 2.6/3.8
002020G6 002020G5 ...(KA'S)

ANSWER 8.02 (1.00)

The surveillance interval between 1/5/87 and 5/6/87 exceeds the required interval plus 25% [0.5] or ~~The 5/6/87 date [0.5] exceeded the required interval plus the 25% [0.5]~~
The interval from 7/6/86 to 5/6/87 (for three consecutive surveillance intervals) [0.5] exceeds the required 3.25 times the surveillance interval [0.5].

REFERENCE
LER 87-008
TS 4.02
TS 3.8.2.3
TS 6.6
ACP-QA-10.01 p. 5
TPG TS EO 8a

2.4/3.4 3.0/3.6
063000G5 063000G3 ...(KA'S)

ANSWER 8.03 (2.00)

A plant shut down [0.5] should be started within one hour ~~[1.0]~~ [0.5] as required by TS 3.03 [0.5] with the plant in cold shutdown (within 24 hours) [0.5].

REFERENCE
LER 87-003
TS 3.03
TS 3.4.5
TPG TS EO 12, 15a

3.2/3.8 2.6/3.6
010G6 010G5 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 8.04 (3.00)

a. FALSE
b. TRUE
Deleted ~~c. TRUE~~
d. FALSE
e. TRUE
f. FALSE [~~0.5~~ 0.6 pts each]

REFERENCE
ACP-QA-206A pp. 6,9,10,12,24,25

3.7/4.1
194001K102 ...(KA'S)

ANSWER 8.05 (1.50)

Restore RCS pressure within its limits within 5 minutes [0.5] [0.25]
Notify NRC (within one hour) [0.75] ~~pts each~~]

REFERENCE
TS 2.1.2
TS 6.7.1
ACP 6.01 p. 12

2.5/3.6 3.2/3.8
010000G5 010000G3 ...(KA'S)

ANSWER 8.06 (3.00)

a. Station Superintendent
Unit Superintendent
Operations Supervisor [0.5 pts each]

b. Understand the cause of the trip
Ensure no abnormal conditions exists that preclude reset
Record relay position (for further investigation)
[Any two, 0.5 pts each]

c. Verify the receipt of annunciators [0.5]

REFERENCE
ACP 6.01 pp. 5,6,7

2.8/4.1

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

194001A111 ...(KA'S)

Alternate for 8.07: The startup can be commenced [1.0] because the ECCS is operable provided both A and C HPSI pumps are properly aligned [1.0]

ANSWER 8.07 (2.00)

The startup should not commence [1.0] because a mode change cannot occur with reliance upon the action statement for the HPSI pump [1.0].

REFERENCE
TS 3.5.2
TS 3.04

3.4/3.8 3.4/3.4
194001K109 00300005 ...(KA'S)

ANSWER 8.08 (2.00)

The intent of the original procedure is not altered [0.6]

The change is approved by two ~~members of the plant management staff, at least one of whom holds an SRO license [0.7]~~ licensed SROs from the unit involved, at least one of whom shall be the on duty SS [0.7]

The change is documented, review by the PORC/SORC, and approved by the Unit Superinten[illegible] / Station Superintendent within 14 days of implementation [0.7]

REFERENCE
TS 6.8.3
ACP-QA-3.02 section 6.9.1
3.3/3.4
194001A116 ...(KA'S)

ANSWER 8.09 (2.00)

The SRO should not grant permission [0.5] because only licensed operators [0.5] or individuals in training [0.5] under direct supervision of a licensed operator can operate the controls [0.5].

REFERENCE
ACP 6.01 pp. 10,11
10 CFR Part 55.4, 55.9

2.5/3.4
194001A103 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 8.10 (2.40)

Whenever all of the following conditions are not satisfied:
Reactor vessel water level at or above the vessel flange
Reactor vessel pit seal installed
Combined available volume of water in the refuel pool and RWST exceeds 370000 gallons
One LPSI pump not in shutdown cooling service and aligned to take suction from the RWST and deliver flow to the RCS is operable OR
One HPSI pump aligned to take suction from the RWST and deliver flow to the RCS is operable

[0.6 pts each]

REFERENCE
TS 3.9.8.2
TPG ~~EO 11~~ SOCS EO11

3.2/3.8
005000G5 ...(KA'S)

ANSWER 8.11 (2.40)

All penetrations required to be closed during accident conditions are either: [0.4]
Capable of being closed by an operable containment isolation valve system [0.5]
Closed by manual valves, blind flanges or deactivated automatic valves secured in their closed positions [0.5]

The equipment hatch is closed and sealed [0.5]
The airlock is operable pursuant to TS 3.6.1.3 [0.5]

~~[0.6 pts each]~~

REFERENCE
TS p.1-2
TS 3.6.1.3
TPG EO 13a

3.3/4.1
103000G5 ...(KA'S)

ANSWERS -- MILLSTONE 2 -88/01/11-SILK, D.

ANSWER 8.12 (1.50)

At BOC MTC may be slightly positive at operating conditions [0.5] and since it will become more positive at lower temperatures [0.5], the limit is provided to restrict reactor operation when Tavg is significantly below normal operating temperatures [0.5].

REFERENCE
TS 3.1.1.5
TS p. B 3/4 1-2

2.9/3.8
001G6 ...(KA'S)

"ATTACHMENT 3"

RESOLUTION OF FACILITY COMMENTS
FOR RO EXAM GIVEN JANUARY 11, 1988
AT MILLSTONE UNIT 2

FACILITY COMMENT 1.05-1,2:

We cannot currently read 10,000 cps on our Excore NIs. The circuitry is designed to shift power indication to % power whenever countrate goes above 1000 cps. References are provided.

There are no PORVs on the S/G. There are Secondary Safety Valves, Atmospheric Dump Valves and Steam Dump and Bypass Valves.

NRC RESOLUTION:

Comment noted, however, does not affect the candidates ability to correctly answer the question. A note will be added to the question for future reference to make the question more technically correct.

FACILITY COMMENT 1.05-3:

If the student assumes a +MTC at BOC conditions, then the cooldown will add negative reactivity. The resulting condition when equilibrium is reached would be: Final Tavg less than Initial Tavg, Final Power below POAH. This means that no correct choice was given in the question.

Based on this above, credit should be given for any written answers which assume a +MTC, as well as for key answer "d" which presupposes a negative MTC.

FACILITY COMMENT 1.09B:

The candidates may assume based on part a, that 70% power is to be maintained or that power is being increased to 70%. As such, reducing power to control ASI within limits may not be recognized as an option by the candidates.

The answer key should accept for full credit two of the following three steps/methods for ASI control:

1. Rod Insertion
2. Rod Withdrawal
3. Power Reduction

REFERENCE:

OP 2393, Xenon Oscillation Band Control

NRC RESOLUTION:

Disagree. The question does not state power is to be maintained in part A. Technical Specifications (TS) may require a power decrease and candidates don't have the option to not comply with TS action statements. However, will accept the reference and modify the answer key to accept 2 of the 3 steps/methods for full credit.

FACILITY COMMENT 1.11:

The students are only required to discuss the effect of source-detector geometry on the 1/m plot. They are not required to know how fuel loading, fuel enrichment or poison loading affects the 1/m plot. (Theory objectives related to 1/m plots are attached).

There are <u>two</u> correct answers to this question. Both a. and c. can be correct.

The key answer, "c", is technically a correct response. However, this choice describes an evolution which is not done at MP2.

Based on these comments it is recommended that full credit be given for either "a" or "c".

NRC RESOLUTION:

Comment accepted. Answer key modified to accept a or c for full credit.

FACILITY COMMENT 1.14(3):

There are no S/G PORV's on Millstone Unit 2.

NRC RESOLUTION:

Same as comment 1.05-1,2.

FACILITY COMMENT 1.15c:

The answer states that the core delta T during Natural Circulation approaches full load delta T. This is incorrect. The Natural Circulation delta T will be approximately one-half of full power delta T (this assumes maximum possible decay heat). (Reference attached).

Based on this, the phrase "Core delta T during natural circulation cooldown will approach full load delta T." should be removed from the answer key.

NRC RESOLUTION:

Answer key will be modified from "full core delta T" to "20-25 degrees -F" as indicated in your reference and pages 4 and 10 of OP-RO-FUND-2121J.

FACILITY COMMENT 2.04c:

The reference given (M2-OP-ELECT-2342, p. 3 & 4) does not state a specific reason for the 460 amp limit on bus 24E when it is being supplied from 24F. Procedure OP 2343 (reference book 4, section 14), step 7.22, caution #1 states, "Do not exceed load limits on RSST 15G-21S or its busing 3.0 MVA 460 amps." The identifier "15G-21S" is the designation for the Unit 1 RSST, not a breaker or disconnect. As the Unit 1 RSST is not limited to 460 amps and the Unit 2 operators have no real indication or control of the total load on the Unit 1 RSST, the 460 amp limit is understood to be based on the bus connecting the Unit 1 RSST to 24E. (Reference excerpts are attached).

NRC RESOLUTION:

Comment noted. The suggested revision is not clear, but the procedure is. The answer will be modified to remove the word "breaker".

FACILITY COMMENT 2.08b:

The question asks for three (3) sources of SFP makeup water but does not solicit a system flow path.

Therefore an answer stating the RWST as a possible source should be fully accepted as one of the three required answers.

NRC RESOLUTION:

As explained during the exam review the RWST has two flow paths as a possible source and if the candidate uses the RWST as two sources then it was necessary to include the path. This was identified during the review and the answer key was modified to place the flow paths in parenthesis.

FACILITY COMMENT 2.09d:

The AFW Flow Control Valves have three modes of operation as stated in both OP 2322 (ref. book 4) and AOP 2579B (ref. book 7). These modes are Auto, Manual and Manual (Local). If an Automatic Feedwater Actuation Signal (AFAS) is present then the "Reset-Normal-Override Switch" has three modes of selection which allow the operator additional modes of operation (AFW SD & OP 2322). As the question did not mention the switch by any name, nor indicate that an AFAS had occurred, it is impossible for an examinee to determine which "modes of operation" the question is attempting to solicit. Therefore, discussion in either area of AFW Valve control should be accepted for full credit.

NRC RESOLUTION:

Comment accepted. Answer key modified to accept additional correct answer. However, the original references uses the words "modes of operation" when referring to Reset-Normal-Override Switch.

FACILITY COMMENT 2.10a:

The CEA, upon loss of the lift coil, will be held in place by the Upper gripper and/or the Lower gripper coils.

The key answer should be changed to allow full credit for mentioning either the upper gripper or the lower gripper.

NRC RESOLUTION:

Comment accepted. Answer key was modified during the exam review to eliminate the word "lower".

FACILITY COMMENT 2.11:

The following CVCS components also receive a signal on SIAS according to reference M2-OP-PRI-2304 Fig. 2a. (CVCS SD): (# 1-7 given in answer key).

8. PMW to charging pump suction (2-CH-196)

9. Precise reactivity control isolates (2-CH-909, CH-910)

10. Boric acid pump recirc. isolations close (2-CH-510, CH-511)

NRC RESOLUTION:

The precise reactivity control valve is 2-CH-936 and does not isolate on SIAS. However, valves 2-CH-909/-910 are the chemical metering discharge valves, they do shut on SIAS and are in the flow path for precise reactivity control. Answer key was modified to include the three additional correct answers, with correction to No. 9.

FACILITY COMMENT 3.02a:

Examinees may assume a cause for the given plant conditions (i.e. Excess Steam Demand Event in containment), in which case a SIAS, CIAS, and EBFAS could also occur on a high containment pressure.

As an EBFAS would override the AEAS signal, credit should be given if these actuations are assumed to occur.

NRC RESOLUTION:

Disagree. Containment pressure was not given as a condition to be evaluated in part a, which would not support a MSLB inside containment. However, candidates will be graded for assumptions given and no change will be made to the answer key.

FACILITY COMMENT 3.07:

The question did not clearly solicit a reason for each of the automatic actions, but the answer key requires a reason for full credit. Therefore, the reason part of the key answer should not be required for full credit.

NRC RESOLUTION:

Comment accepted. The reasons in part a and d of the answer key were modified by placing the reasons in parenthesis during the exam review.

FACILITY COMMENT 3.08b:

The phrase "increasing S/G pressure" in the key answer should not be required for full credit. Steam Generator pressure is not an input used to TM/LP calculations.

NRC RESOLUTION:

Comment accepted. The answer key was already modified during the exam review to have parenthesis around "increasing S/G pressure".

FACILITY COMMENT 3.10b:

An explanation that deals with the actual system response that will close the other five steam dump valves, should also be accepted for full credit. This includes Tavg less than the setpoint for the B, C, and D steam dumps or steam pressure less than the atmospheric dump setpoint.

NRC RESOLUTION:

Comment noted. The actual system response was not required for full credit, however, it would also support the response in lower decay heat removal requirement and will be considered as additional correct information, if supplied, no change in the answer key.

FACILITY COMMENT 3.11a. and e.:

The D/G 12 U Trouble Annunciator will result from any one of 30 different conditions (reference attached). Depending on which condition caused the Annunciator to alarm, any one of the answers given in Column B could be correct.

Example:

1. If the annunciator alarms due to a "Lube Oil Level Low" condition, the D/G will not trip and answer number 1. is correct.

2. If the annunciator alarms due to an "Engine Overspeed" condition, the D/G will trip under any condition and answer number 2. is correct.

3. If the annunciator alarms due to a "Lube Oil Temp. High" condition, the D/G will trip, unless it had received an Emergency Start signal, and answer number 3. is correct.

Based on this, it is recommended that part a. be deleted.

3.11 e.

A DC Control Power Failure will either 1) Not Trip the D/G, 2) Trip the D/G unless an Emergency Start Signal is present or 3) Cause the D/G to come up to speed on the mechanical governor with no trip protection (except overspeed). What will happen depends upon what portion or portions of DC Control Power is lost.

To determine what will happen to the D/G, refer to the circuit diagrams supplied.

1. Figure 8.3-2 Sheet 12 shows that the "Loss of Control DC," Annunciator is caused by one of four relays: CR1, CR2, CR3, and CF4.

2. Identifying each one of these relays we find that:

   a. CR1 is the relay that indicates a loss of power to the starting portion of the D/G Control Circuitry. Refer to Figure 8.3-2 Sheet 3.

   b. CR2 is the relay that indicates a loss of power to the shutdown and local starting portion of the D/G Control Circuitry. Refer to Figure 8.3-2 Sheet 4.

   c. CR3 is the relay that indicates a loss of power to the automatic tripping and emergency shutdown portion of the D/G Control Circuitry. Refer to Figure 8.3-2 Sheet 5.

   d. CF4 is the relay that indicates a loss of power to the Exciter Control Circuitry. Refer to Figure 8.3-2 Sheet 10.

3. A loss of power to CR1, CR2 or CF4 will produce a D/G Trip signal. Refer to Figure 8.3-2 Sheet 6. Note that a loss of power to CR4 will not produce a DG trip signal since the trip circuitry must be de-energized for this relay to lose power. A loss of CF3 will produce a "Loss of DC Control Power" annunciator, however, as shown on Figure 8.3-2 Sheet 12.

4. A Loss of power to CR1, CR2 or CF4 will not produce a D/G trip if an Emergency Start Signal is present. This is shown on Figure 8.3-2 Sheet 7. On an Emergency Start, the indicated ESS contact opens which prevents the Loss of DC Power Trip Signal from energizing the Shutdown Relay (SDR).

5. In addition to the above, a loss of power to the circuitry monitored by either CR1 or CR2 will fail open the Air Start Valves and roll the D/G with air. If the Trip Circuitry (CR3) also loses power, the D/G will come up to speed and run with no trip protection available (except the overspeed trip) and the "Loss of DC Control Power" Annunciator in alarm.

6. The difference in response of the D/G to partial loss of control power vice total loss of control power is covered on pages 106 and 107 of the D/G Instructor Guide (lesson plan excerpts attached).

Based on the above information it is recommended that part e. be deleted.

NRC RESOLUTION:

Comment accepted. The answer key and questions were deleted and points for b, c & d revalued to 0.33 each.

FACILITY COMMENT 4.03a:

The question requires the candidate to state four of the steps which must be taken to place the Enclosure Building Filtration Systems (EBFS) in service during an Electrical Emergency. The guidance for performing this is contained in EOP 2528, Electrical Emergency, step 3.11, Contingency Actions. As such, it is not expected that licensees perform this step from memory. The answer key lists five steps; the procedure lists six steps. Steps four and five of the key answer (EOP 2528 steps 3.11 e and 3.11 f) describe actions that remove the Condenser Air Removal System from Service.

Full credit should be given for describing actions taken which will start EBFS.

NRC RESOLUTION:

Comment noted. Candidates are required to have system knowledge on design intent, construction, operation and interrelationships in accordance with NUREG 1021, ES-202, B-2 Page ES-202 page 2 of 6. The difference in the number of steps is due to the dampers being operated, the answer key will be modified to include "open enclosure building exhaust to EBFS" as an additional step. Credit will still be given for removing the Condenser Air Removal System from service since this is part of the action required in placing the EBFS system in service which is done to prevent back draft of Unit 1 stack gases into Unit 2.

FACILITY COMMENT 4.04b:

The key answer contains four steps which are performed to initiate emergency boration. In addition to these steps, credit should be given for stating that:

- o If the boric acid pumps fail to start, open the gravity feed valves.
- o If the gravity feed valves are being used, close the volume control tank outlet valve.

These steps are performed if the boric acid pumps fail to start during emergency boration.

REFERENCE

AOP 2558, Rev. 0, steps 4.3 and 4.4

NRC RESOLUTION:

Comment not accepted. The question does not solicit response not obtained or contingency information. The additional steps referred to are contingency actions implying that an attempt has been made to start the boric acid pumps etc., a primary action which is required for full credit. The additional information, if given by the candidate is not required for full credit and if correct will not count against the candidates score, no change to answer key.

FACILITY COMMENT 4.08:

The key answer states the guidance that is contained in AOP 2551 for closing the MSIV's from outside the control room. In that the candidate did not have this procedure available when answering the question, full credit should be given for describing alternatives which result in MSIV closure. Two alternatives include:

- o closing the MSIV's from the bottle on panels, C70A and B (The bottle up panels are located outside of the control room)

REFERENCE:

AOP 2579A, Rev. 2, step 4.5

- o locally isolating instrument air at the MSIV's and then bleed the air pressure from the operating cylinders and accumulators

REFERENCE:

Drawing attached

NRC RESOLUTION:

Comment accepted. Answer key modified to reflect the two additional ways which result in MSIV closure from outside the control room.

FACILITY COMMENT 4.10a:

The key answer lists five indications of a misaligned CEA which are found in the Entry Conditions to AOP 2556, Dropped CEA Recovery. Additional indications, not used as Entry Conditions, should also receive credit. These include:

1. Rod drop alarm on the RPS.

2. CEA Group Deviation annunciator.

3. CEA Group Gross Deviation annunciator.

4. CEA Group deviation backup annunciator.

5. CEA Motion Prohibit annunciator.

6. Correct discussion of NSS and BOP parameter changes resulting from a power mismatch.

REFERENCES:

M2-OP-RO-I&C-2380-2, pg 19 and 20
OP 2302A, Rev. 9, Sections 8.6, 8.7
8.8, 8.9, 8.15, 8.25

NRC RESOLUTION:

Comment accepted. Answer key modified to incorporate additional six indications not identified in the Dropped CEA Recovery Procedure and references expanded to include additional references.

FACILITY COMMENT 4.11b:

The question asks for "an" indication of RCS leakage . . . ., implying that one answer is required.

The key answer lists two indications, each worth one half of the total point value.

Full credit should be awarded for <u>either</u> of the key answers.

NRC RESOLUTION:

Comment accepted. Answer key was modified during exam review to accept either indication for full credit.

"ATTACHMENT 4"

RESOLUTION OF FACILITY COMMENTS
FOR SRO EXAM GIVEN JANUARY 11, 1988
AT MILLSTONE UNIT 2

FACILITY COMMENT 5.08a:

The answer key gives core size as one of the 4 factors which affect the convergence or divergence of a Xenon Oscillation. While this is true, the design of the core gives a fixed size. The "effective" size of the core can be changed, however, by the positioning of the Group 7 CEAs. Based on this, CEA position as well as core size should be accepted as an adequate answer.

NRC RESOLUTION:

CEA position or core size will be accepted as one of the four factors which affect convergence or divergence of a Xenon Oscillation.

FACILITY COMMENT 5.10:

This question gives reactivity in units of both delta k/k and pcm. At Millstone 2 the operators only use units of delta k/k (or % delta k/k) and are not required to use units of pcm. Based on this it is recommended that no credit is taken off for incorrect conversions between pcm and delta k/k.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 5.11a:

In this part of the question on ECP vs. Actual CEA position, it is stated that one RCP trips two minutes prior to criticality. If this did happen, a Reactor Trip due to RCS Low Flow would occur making the pull to criticality impossible. (Reference attached).

Based on this information, it is recommended that Part a. be deleted.

NRC RESOLUTION:

Comment accepted. 0.1 points will be redistributed to parts b. through e.

FACILITY COMMENT 6.03.b:

The question requires the candidate to use a HPSI pump curve provided to determine HPSI flow rate at a given pressure.

The key answer allows for + or - 50 gpm when making this determination. Based on the pump curve provided, which does not contain an accurate grid, this allowance should be increased. Plus or minus 100 gpm is recommended.

NRC RESOLUTION:

Comment accepted. Also, upon further investigation of the pump curve, the answer was modified to 1032 gpm for the leak rate.

FACILITY COMMENT 6.04.b:

Tne key answer states that (the quick open permissive switch is used) "when there might be radioactivity in a SG." The reference sited (RRS pg 10, 11, 12) includes this information for historical design purposes. The reference uses the words "The switch was included to permit . . . " It is not currently used for this purpose. AOP 2569, Steam Generator Tube Leak, contains no guidance concerning its use.

The answer key should be changed to accept, for full credit, a response that indicates that this switch is used to protect personnel when draining condensation from the valves and mufflers.

Reference: RRS System Description, page 11.

NRC RESOLUTION:

Comment Accepted.

FACILITY COMMENT 6.06.b:

The key answer indicated that the TMLP trip setpoint will "decrease" as ASI changes from 0.0 to -0.1. This is incorrect. The TMLP trip setpoint will increase under this condition.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 6.06.c:

If the candidate assumes that the plant trips due to the RCP trip (as it would), the key answer is correct, the TMLP trip setpoint will decrease to its floor value.

If the candidate considers RCS flow as the only variable of concern when answering the question, then "no effect" is correct. Actual flow is not an input into the TMLP trip circuitry.

NRC RESOLUTION:

If the candidate states an assumption, the response will be graded accordingly; otherwise the response will be graded in accordance with the answer key.

FACILITY COMMENT 6.06.e:

The key answer indicates that the TMLP trip setpoint will decrease when a linear power range channel (safety) fails high. This is incorrect. The TMLP trip setpoint will increase under this condition.

The key answers should be revised accordingly.

Reference: T.S. 2.2 Figures 2.2-3, 2.2-4

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 6.07.g:

The key answer is "No Effect", describing the response of the MSIV's to complete loss of instrument air. The MSIV's are equipped with air accumulators which serve to hold the valves open for a period of time following a degradation in instrument air pressure. Without a time frame for consideration indicated in the exam question, the response could correctly be either "no effect" or "fails closed."

The key answer should be changed to accept for full credit either "no effect" or "Fail Closed."

Reference" Main Stream System Description, pg 8-9

NRC RESOLUTION:

Question 6.07.g will be deleted and 0.03 points redistributed to parts a. through f. and h.

FACILITY COMMENT 6.08.b:

The key answer requires specific pressure values for various seal conditions. No allowance is included in the key for variations from the specified values.

The key should be changed to allow for $\pm$ 15 psi for vapor seal pressure and $\pm$ 100 psi for all other pressure.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 6.11.c:

The circuit that prevents the containment spray pump from responding under the conditions specified in the exam question is the "Main Generator Final Coastdown Circuit" (Reference: Containment Spray System Description, page 6). Detailed knowledge of this circuit is not required by our learning objectives.

The exam should be changed to eliminate part C.

NRC RESOLUTION:

Comment accepted. 1.0 point will be redistributed among parts a., b. and d.

FACILITY COMMENT 7.01:

The question refers to a note contained within a procedural step entitled "Boration without Boric Acid Pumps available". The title of the step was not made available to the candidate. Taking the note out of the context prevents the examinee from interpreting the meaning of "automatic boration unavailable". Therefore, an answer giving the boric acid storage tanks as a source of makeup should be accepted for full credit.

Reference AOP 2551, pg. 6 & 7, step 4.20.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 7.03:

The question asks that three alternate methods of depressuring the RCS be given if auxiliary spray is inoperable.

The objectives listed in the TPG for AOP-2553 do not require the students to memorize alternate actions. In fact, the objectives specifically state that procedures must be used for two of the alternate methods mentioned in the procedure. (Reference attached).

Based on this it is recommended that any reasonable method of depressurizing the RCS should be accepted as an answer.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 7.04:

1. The answer to Part a. states that the cooldown limit below 300°F is 20°F/Hr. This is incorrect. The cooldown limit below 300°F is 30°F/Hr. (Reference attached).

2. Part b. of the question asks what combination of three RCPs will provide the highest spray flow. The objectives listed in the TPG for OP-2207 do not require the students to memorize these pump combinations. (Reference attached.). Additionally, the key answer is incorrect (References attached).

Based on this it is recommended that part b. be deleted.

3. Part d. asks why the charging Header Valves must be closed when securing auxiliary spray. As a matter of fact, these valves must be opened when securing auxiliary spray in order to ensure that the charging pumps have a discharge flowpath. (Reference attached).

Based on this it is recommended that part d. be deleted.

NRC RESOLUTION:

Answer key will be changed from 20°F/hr to 30°F/hr for part a. Parts b. and d. will be deleted and 1.0 point redistributed among parts a. and c.

FACILITY COMMENT 7.06.b:

The question asks for the restrictions on plant operation in Mode 1 based on the stated conditions. The question does not ask for Tech. Spec. references or time limits.

Based on the information given in the question, both D/G's are inoperable (T.S. 3.8.1.1). And both Service Water headers are inoperable based on the provisions of T.S. 3.0.5.

Both of the above technical specifications prevent continued operation in Mode 1.

Additionally, the time limits associated with the actions of these technical specifications do not require memorization.

Based on the above, the correct answer to the question should be that Continued Operation in Mode 1 is not Possible. No other information should be required.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 7.10a:

The answer to this question fails to include the possibility of opening the Gravity Feed Valves to perform a boration of the RCS. This method of boration can be used based on the Emergency Boration Procedure: AOP 2558 and Emergency Operating Procedure 2540A (which is referenced in the boration step, 3.1, of EOP 2525).

Based on this information it is recommended that an additional correct answer would be:

- Open Gravity Feed Valves (2-CH-508, 509)
- Close VCT Outlet Valve (2-CH-501)
- Start all available charging pumps

NRC RESOLUTION:

Comment accepted as an alternate answer.

FACILITY COMMENT 7.11:

1. Part a. of this question asks when it is permissible to not isolate a ruptured Steam Generator. The answer key only gives one answer: If the ruptured SG is the only one available for heat removal. Based on the SGTR EOP, there are additional correct answers:
   - If RCS T_H is not below 520°F, the faulted SG should not be isolated.
   - The faulted SG may be unisolated to prevent overfilling.
   - The faulted SG may be unisolated to cooldown the SG.

   Based on this information it is recommended that any of the above answers also be accepted for full credit. (Reference attached).

2. Part c. The additional correct information that the bypass key is installed to allow for control of the PORV should be accepted.

NRC RESOLUTION:

1. Question 7.11 asked questions regarding EOP 2540 D, Functional Recovery of Heat Removal. The first suggested alternate response to part a. will be accepted in that it is supported by EOP 2540 D. The second and third alternate responses are not supported by EOP 2540 D and therefore will not be accepted as alternate responses.

2. Comment accepted.

FACILITY COMMENT 8.01:

The answer key should be changed to allow for different, correct responses which indicate relationships between LCO's, LSSS's, and Safety Limits. One such response would be:

If the safety limits are not exceeded, fuel and RCS integrity will be maintained. LSSS's serve to trip the reactor to ensure that safety limits will not be exceeded, assuming that LCO's are being met.

Reference: 10 CFR 50.36, M2-OP-RO-ADMIN-2001, T.S. 2.1 and Bases.

NRC RESOLUTION:

Comment Accepted.

FACILITY COMMENT 8.02:

Technical Specification 4.02 b. specifies "the combined time interval for any 3 consecutive surveillance intervals not to exceed 3.25 times the specified surveillance interval". The period between 7/6/86 and 5/6/87 incorporates 3 consecutive surveillance intervals and exceeds 3.25 times the surveillance interval. The question asks "EXPLAIN WHETHER OR NOT a surveillance interval has been exceeded and if so WHICH ONE.

Bases on this an acceptable alternative answer should be

"The interval from 7/6/86 to 5/6/87 (for 3 consecutive surveillance intervals) [0.5] exceeds the required 3.25 times the surveillance interval [0.5]".

NRC RESOLUTION:

Comment Accepted.

FACILITY COMMENT 8.03:

This question asks "What action, if any, is required . . . " "and why?" It does not ask for the time in which this action must be completed nor the reference, by paragraph, for this action. Therefore, the answer should read "A plant shutdown should be started (within 1 hour) [1.0] as required by Technical Specifications [0.5] with subsequent action to bring the plant to cool shutdown in accordance with T.S. [0.5].

NRC RESOLUTION:

The 1 hour time limit will be required for full credit because T.S. 3.03 prescribes that actions must be performed within a specified time limit.

FACILITY COMMENT 8.04:

TPG ACP-QA-2.06A EO #9d requires the operator to: "Given ACP-QA-2.06A and a request for clearing tags explain the conditions required for clearing including documentation of restoration".

Question 8.04 c. specifically addresses the topic with regard to documentation of restoration but did not provide the candidate the requisite procedure.

Additionally the reference sited in the answer key specifies that "Normally the "Restoration Performed" block should not be filled in when the tags are issued". The question addressed a specific exception from this normal practice as allowed by the cited reference.

It is recommended that 8.04 c. be deleted.

NRC RESOLUTION:

Comment accepted.

FACILITY COMMENT 8.05:

The question does not ask for the time frame during which "Actions and notifications must be completed" but only for "WHAT" actions and notifications must be completed".

Additionally MP2 learning objectives do not require memorization of one hour (immediate) reporting criteria.

The answer key should be changed to allow full credit if the candidate stated that RCS pressure must be restored to within its limits and that notifications are conducted in accordance with procedures.

NRC RESOLUTION:

The time limit will be required for restoring RCS pressure, whereas no time limit will be required to notify the NRC.

FACILITY COMMENT 8.07:

This question specifies "B HPSI pump was taken out of service for maintenance". No reference is made to either A or C HPSI pumps. OP 2308 paragraph 7.5 provides operational guidance for removal of B HPSI pump from service that results in "Restoring HPSI pump A to service as Fac I pump or HPSI pump C as Fac II pump. . . " Therefore two HPSI pumps would be available on separate facilities. T.S. 3.5.2 requires "Two seperate and independent ECCS subsystem shall be operable with each subsystem comprised of one operable HPSI pump . . ." Therefore operability of ECCS is not relying on the action statement.

The answer should read "The startup can be commenced [1.0] because the ECCS is operable provided both A & C HPSI pumps are properly aligned [1.0].

Additionally, full credit should be awarded if the candidate assumed that the A or C HPSI pump was inoperable and answered in accordance with key.

NRC RESOLUTION:

Comment Accepted.

FACILITY COMMENT 8.08:

ACP-QA-3.02 provides guidance for non intent changes in Section 6.9.1. Since temporary changes to procedures meet the definition of non intent changes as specified in paragraph 4.7, they could be treated as a non intent change. Therefore an acceptable alternative answer is:

1. The change is a non intent change [.6].

2. The change is approved by two licensed SRO's from the unit involved, at least one of whom shall be the on duty SS [0.7].

3. The change shall be reviewed within 14 days of implementation (by PORC/SORC) [0.7].

Additionally, in that temporary changes are only allowed if the intent of the procedure is not altered, then credit should be awarded if the candidate describes those provisions which distinguish between intent and non intent changes.

NRC RESOLUTION:

The criteria suggested by the Facility (especially No. 2) will be accepted as alternate responses. However, credit will not be given if a candidate describes those provisions which distinguish between intent and non intent changes because the question did not ask for distinctions between intent and non intent changes.

FACILITY COMMENT 8.10:

The cited TPG states "Define non compliance per 3.02". No TPG for Shutdown Cooling Refueling or Technical Specification requires the licensed operator to know from memory those times/conditions when both trains of SDC are not required, when in mode 6.

The operator is thus encouraged and trained to reference Tech Specs and Procedures prior to removing a SDC loop from Service.

Based on those points it is recommended that this question be deleted.

NRC RESOLUTION:

The enabling objective used in the reference was intended to be TPG SDCS EO 11 (instead of TPG EO 11). This enabling objective states: "State the Technical Specification requirements for the SDCS operation in Modes 5 and 6." Based on this facility-specific enabling objective, question 8.10 will not be deleted.

FACILITY COMMENT 8.11:

The point distribution of the key answer in unclear.

NRC RESOLUTION:

The point distribution was changed and clearly labelled to aid in the grading process.