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

EXAMINATION REPORT NO.	88-06(OL)
FACILITY DOCKET NO.	50-277 and 278
FACILITY LICENSE NO.	DPR-44 and DPR-56
LICENSEE:	Philadelphia Electric Company
FACILITY:	Peach Bottom Units 2 and 3
EXAMINATION DATES:	February 17 to February 19, 1988

CHIEF EXAMINER: Allen G. Howe — 4/19/88
Allen G. Howe, Senior Operations Engineer, DRS — Date

APPROVED BY: David J. Lange — 4-29-88
David J. Lange, Chief, BWR Section, — Date
Operations Branch, Division of Reactor Safety

SUMMARY: Written examinations and operating tests were administered to four (4) reactor operator (RO) candidates. Two (2) candidates passed these examinations. One candidate failed the written examination and one candidate failed the operating test.

DETAILS

TYPE OF EXAMINATIONS: Replacement

EXAMINATION RESULTS:

	RO Pass/Fail
Written	2/1
Operating	3/1
Overall	2/2

1. CHIEF EXAMINER AT SITE: Allen G. Howe, Senior Operations Engineer

2. OTHER EXAMINERS: M. Evans, Operations Engineer
S. Pullani, Senior Operations Engineer
W. Cliff, PNL
J. Richardson, USNRC, NRR

3. The following is a summary of generic strengths or deficiencies noted on operating tests. This information is being provided to aid the licensee in upgrading license and requalification training programs. No licensee response is required.

STRENGTHS

a. Knowledge of off normal and operational transient procedures.

b. Ability to locate and use piping and instrument diagrams.

DEFICIENCIES

a. Knowledge of radiation exposure limits for visitors.

b. Knowledge of the purpose and principals of instrument line restricting orifices.

4. The following is a summary of generic strengths or deficiencies noted from the grading of written examinations. This information is being provided to aid the licensee in upgrading license and requalification training programs. No licensee response is required.

STRENGTHS

a. Knowledge of reactivity effects during heatup, cooldown rates, steam table use, and subcritical multiplication.

b. Knowledge of the core spray system, RCIC response to level and the SBGTS system.

c. Knowledge of operator actions required for plant shutdown outside the control room.

DEFICIENCIES

a. Understanding of the reasons why xenon concentrations vary with power. Knowledge of power, pressure and level response to a load reject transient. Understanding of the adverse effects of a loss of core bypass flow.

b. Knowledge of how an isolation of the RWCU system, while the dump valve is open, will cause piping stress. Understanding of why vessel level instrumentation accuracy varies from rated conditions to cold conditions. Knowledge that the action of the fast acting solenoids causes a turbine trip on a load reject. Understanding the effect of a condensate pump trip on the feedwater control system.

c. Knowledge of general conditions when the operator should scram the reactor per A-7, (conduct of operations) and knowledge of the conditions when manual control of ECCS systems is allowed.

GENERAL

Although two candidates passed the RO examination, the sectional and overall scores reflected individual weaknesses that were not common to the other candidates but should be reviewed by the training department for additional training during subsequent requalification training.

5. Personnel Present at Exit Interview:

NRC Personnel

A. Howe, Chief Examiner
S. Pullani, Senior Operations Engineer
M. Evans, Operations Engineer
T. Johnson, Senior Resident Inspector
R. Urban, Resident Inspector

Facility Personnel

D. Smith, Vice President, Peach Bottom
J. Franz, Manager, Peach Bottom
J. Cotton, Superintendent of Operations
F. Polaski, Assistant Superintendent of Operations
A. Donell, Quality Assurance

6. Summary of NRC comments made at exit interview:

The chief examiner thanked the training and operations staffs for their cooperation during the examination.

The examiners felt that housekeeping in Unit 2 was good.

The written examination review resulted in a few comments requiring resolution. The reviewers stated that the examination was a good test.

The generic strengths and weaknesses noted on the operating examinations were discussed.

During the examination process it was determined that several procedures had been revised, added, and/or deleted and that some of these procedure changes were not submitted as part of the examination preparation package. The Chief Examiner requested that the facility determine if plant operators and operator candidates have been or will be trained on these changes.

Attachments:
1. Written Examination and Answer Key (RO)
2. Facility Comments on Written Examinations after Facility Review
3. NRC Response to Facility Comments

MASTER Attachment 1

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: PEACH BOTTOM 2&3

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 88/02/17

EXAMINER: MOON/MOORE

CANDIDATE: ANSWER KEY

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
100.00		_____ 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 1.01 (2.50)

The reactor is brought critical at 60 on IRM range 2 with the MINIMUM permissible stable positive period allowed by procedure GP-2. Heating power is determined to be 40 on range 8 of IRM's.

a. WHAT is doubling time if period remains constant? (1.0)

b. HOW long will it take for power to reach the point of adding heat if period remains constant? (1.5)

QUESTION 1.02 (3.00)

Regarding the xenon transient following a significant decrease in reactor power from high power operation:

a. If the decrease in reactor power was from 100% to 50%, WHY is the equilibrium xenon reactivity more than one-half the 100% equilibrium value? (1.0)

b. WOULD the resultant peak from a 100% to 50% power maneuver occur in the same time as the result peak from a 100% to 0% power maneuver? EXPLAIN your answer. (1.0)

NOTE: Consider all production and removal mechanisms in your answer.

c. WHAT would be the effect on the core axial power profile as a result of a down power maneuver from 100% to 50%? WHY? (1.0)

QUESTION 1.03 (3.00)

An EHC load reject occurs at 100% core thermal power with the EHC system aligned for normal 100% power generation. DESCRIBE and DISCUSS how the following parameters respond during the first five minutes subsequent to the opening of the generator output breaker.

a. Reactor Power (1.0)
b. Reactor Pressure (1.0)
c. Reactor Water Level (1.0)

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

QUESTION 1.04 (2.00)

PBAPS Unit 3 is taken critical during startup and a steady-state period is established. After the point of adding heat (POAH), the reactor period lengthens to infinity, and the reactor operator notes that the moderator temperature has changed from 240 degrees F to 260 degrees F.

a. WHAT reactivity coefficients turned reactor power? LIST them in order from the largest effect to the least effect. (1.0)

b. HOW much positive reactivity was added to establish a stable positive period after criticality was obtained? (1.0)

QUESTION 1.05 (2.50)

SELECT the appropriate response for each of the following statements concerning Control Rod Worth:

a. (MORE/LESS) control rods would need to be pulled to make the reactor critical at 545 deg F, as opposed to 140 deg F. (0.5)

b. An INCREASE in the Void Fraction will result in a/an (INCREASE/DECREASE) in individual control rod worth. (0.5)

c. Control Rod Worth will (INCREASE/DECREASE) with an INCREASE in moderator temperature. (0.5)

d. Control Rod Worth at End of Cycle would be (GREATER/LESS) than at the Beginning of Cycle. (0.5)

e. Control Rod Worth will (INCREASE/DECREASE) as the adjacent control rods are withdrawn. (0.5)

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

QUESTION 1.06 (2.75)

ANSWER the following questions concerning "CRITICAL POWER."

a. DEFINE "Critical Power." (1.0)

b. WHICH one of the following conditions would tend to INCREASE the Critical Power level assuming all other variables remain unchanged? (0.75)

NOTE: ASSUME NORMAL FULL-POWER OPERATING CONDITIONS

(1) Reactor pressure is INCREASED

(2) The axial power peak is RAISED (i.e., power profile peaks higher in the core)

(3) Coolant flow rate is INCREASED

c. WHAT fuel failure mechanism is associated with exceeding "Critical Power?" (0.5)

d. WHAT thermal limit has been established to ensure critical power is not exceeded? (0.5)

QUESTION 1.07 (2.50)

As a reactor operator coming on shift, you are told that the previous shift performed a reactor shutdown and commenced a cooldown from 1000 psig at 0600. It is now 0730 and you note that wide range reactor pressure is 200 psig. Your shift is to place the reactor in shutdown cooling.

a. HAS the previous shift exceeded the Technical Specification maximum allowable cooldown rate? (INCLUDE in your answer the PBAPS TECHNICAL SPECIFICATION COOLDOWN LIMIT and the assumptions and calculations used.) (1.5)

b. HOW many more degrees of cooldown are necessary before RHR can be unisolated for shutdown cooling? (INCLUDE your assumptions and calculations.) (1.0)

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

QUESTION 1.08 (2.00)

Concerning the Bypass Flow in the reactor core:

a. DEFINE core bypass flow. (1.0)

b. STATE the two most significant consequences that would occur if bypass flow were significantly reduced at full power. (1.0)

QUESTION 1.09 (3.00)

Concerning Net Positive Suction Head (NPSH) with regard to the Reactor Recirculation Pumps:

a. PROVIDE a brief definition of NPSH. (0.5)

b. STATE how the AVAILABLE NPSH changes for a reactor in Cold Shutdown (INCREASES, DECREASES, or REMAINS THE SAME) in each of the following:

1. Reactor water level decreases from normal level to just above the low level scram setpoint (no change in feedwater flow). (0.5)

2. Reactor water temperature decreases. (0.5)

3. Recirc. pump speed is changed from 20% speed to 30% speed. (0.5)

4. The reactor vessel pressure increases from 0 psig to 200 psig. (0.5)

c. STATE what effect can occur if NPSH requirements are not met. (0.5)

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

QUESTION 1.10 (1.75)

During a reactor startup the source range count rate response for a single notch of control rod withdrawal will change as criticality is approached. Assuming a constant moderator temperature and a uniform control rod worth:

a. WILL the AMOUNT OF CHANGE in count rate INCREASE, DECREASE, or REMAIN THE SAME for a single notch of control withdrawal as criticality is approached? (0.5)

b. WILL the AMOUNT OF TIME necessary for count rate to stabilize between the control rod notch withdrawals INCREASE, DECREASE, or REMAIN THE SAME as criticality is approached? (0.5)

c. WHAT criteria are used by the operator to determine when criticality has been achieved? LIST three (3) criteria. (0.75)

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

QUESTION 2.01 (2.75)

Regarding the Reactor Recirc. Flow Control System and the Reactor Recirc System:

a. STATE for EACH of the recirc speed limiters:

1. the purpose of the limiter (1.0)

2. the initiating logic signals (INCLUDE setpoints). (1.0)

b. DESCRIBE HOW the Recirc Pumps respond to a valid ATWS signal. INCLUDE specific electrical breakers affected (breaker I.D. numbers not required). (0.75)

QUESTION 2.02 (2.50)

The reactor water cleanup system is in operation with one pump and one filter demineralizer in service. A reactor startup and heatup is in progress with wide range reactor pressure indicating 400 psig. The RWCU dump valve is open, rejecting water to the main condenser to control reactor water level. Suddenly, the operator receives a RWCU low pump flow alarm and notes that system flow is 0 gpm and the previously running pump has stopped.

a. Given that the containment inlet and outlet isolation valves did not close, STATE four (4) possible causes of the pump trip. (1.0)

b. STATE whether the RWCU dump valve (CV-55) will isolate CONCURRENTLY with any of the pump trips. (0.5)

c. In the above example, if the operator also notices that an RWCU isolation has also occurred, STATE HOW the RWCU dump valve position at the time of the isolation can cause significant stress upon the RWCU system piping and components. (1.0)

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

QUESTION 2.03 (2.50)

The main turbine is on line with the reactor operating at 92% of rated core thermal power. One main steam relief valve fully opens though reactor pressure is less than its setpoint, causing a "Safety Relief Valve Open" alarm.

a. In addition to the relief valve position indications and torus temperature and level indications, LIST four (4) OTHER means or indications by which the operator could use to quickly verify the valve has opened. (1.0)

b. Suppose in the example above, the relief valve reseated but the vacuum breaker in the relief valve discharge piping to the suppression pool failed to open. EXPLAIN HOW plant systems and components could be adversely affected on a subsequent lift of the relief valve. (1.5)

QUESTION 2.04 (3.00)

You are making a tour of an emergency diesel generator room and you notice that the engine control transfer switch at the Emergency Diesel Panel (EDP) is selected to the "NORMAL" position.

a. EXPLAIN WHY this emergency diesel generator could not be considered operable if this switch was selected to "AT ENGINE." (0.5)

b. When aligned for standby (automatic) operation, suppose the voltage drop (droop) selector switch at the local voltage control cabinet and the governor drop (droop) selector switch at the local engine generator cabinet were both in the "PARALLEL" position. EXPLAIN HOW the diesel and generator would respond if the diesel generator were to subsequently auto start on a LOCA signal concurrent with a complete loss of offsite power. (INCLUDE in the explanation WHY this would be undesirable.) (2.0)

c. The diesel has a "Start Failure Relay" that locks out the diesel if it does not achieve 250 RPM within 10 seconds of receiving a start signal. STATE why such a relay is needed in the event a diesel fails to start. (0.5)

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

QUESTION 2.05 (2.50)

The Core Spray System is in a standby lineup. Normal power is available. Rx pressure is 100 psig.

a. STATE ALL logic signals required to cause automatic initiation. (1.0)

b. Upon receiving a valid auto initiation signal, if the "A" core spray pump motor supply breaker were to fail to close, STATE whether core spray loop I WILL or WILL NOT pump water to the vessel. (0.5)

c. If both the "A" and "C" core spray pumps were operating at rated loop flow in the full flow test mode (torus to torus) for surveillance and one pump were to trip, STATE how the remaining operating pump would be adversely effected. (0.5)

d. Should the loop A testable check AIR OPERATOR MECHANISM (AO-13A) bind and become immovable in the CLOSED condition, STATE whether core spray loop I WILL or WILL NOT pump water to the vessel. (0.5)

QUESTION 2.06 (2.00)

The Chief reactor operator on shift suddenly notes that "A" and "B" Emergency Service Water (ESW) Pumps auto started, as well as the Emergency Cooling Water (ECW) pump. The ECW pump subsequently trips with no operator action. The Service Water system is still in service and operating with normal flows and pressures. All systems had been previously aligned for normal operation.

a. STATE ALL the conditions that cause an automatic start of the ESW pumps. (0.5)

b. STATE the reason why the ECW pump subsequently tripped. (Assume no abnormal conditions caused the ECW pump to trip.) (0.5)

c. Given the conditions described above, WHAT loads are being supplied cooling water by the running ESW pumps if no operator action is taken subsequent to the ESW pumps/ECW pumps auto start. (1.0)

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

QUESTION 2.07 (3.00)

a. LIST four (4) major physical barriers against fission product release to the environment BESIDES the primary containment. (1.0)

b. DESCRIBE the conditions under which significant concentrations of hydrogen could develop inside containment (do not discuss radiolytic decomposition of water or corrosion of containment piping and structures). (1.5)

c. EXPLAIN HOW the Containment Atmospheric Control (CAC) system limits the danger of explosion in the event large amounts of hydrogen are produced. STATE the specific limit(s) for the containment gas concentration(s) as required by Technical Specifications. (0.5)

QUESTION 2.08 (3.00)

The reactor is operating at 90% of rated core thermal power, 100% rod pattern, with the main generator on line. The "A" stator water cooling pump is tagged out (blocked).

a. DESCRIBE the response of the EHC system, reactor recirc pumps, and reactor power to a trip of the "B" stator water cooling pump, given the transient does not induce conditions requiring a turbine trip or RPS scram. INCLUDE in your discussion the time delay setpoints for major component trips and also final reactor power. ASSUME that no operator action is taken. (2.0)

b. DESCRIBE the two (2) main turbine trips that are enabled on a total loss or stator water cooling. Include in your description all time delay setpoints. (1.0)

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

QUESTION 2.09 (2.50)

The reactor is at normal operating pressure and temperature, operating at 70% of rated core thermal power. The reactor operator manually scrams the reactor. Prior to the scram, control rod 18-31 was fully withdrawn.

a. LIST ALL pressure sources other than the accumulator normally available to drive control rod 18-31 inward during the scram. (1.0)

b. For the reactor conditions described above, if accumulator 18-31 was not precharged with nitrogen and the gage at the accumulator read 0 psig prior to the scram, STATE whether control rod 18-31 WOULD or WOULD NOT fully insert. (0.5)

c. STATE the final position of control rod 18-31 if the scram pilot valves for HCU 18-31 failed to reposition when the scram was initiated, assuming all other scram actions properly functioned. EXPLAIN WHY for full credit. (1.0)

QUESTION 2.10 (1.25)

The RCIC system is in operation on your shift to demonstrate operability for Technical Specifications.

a. DESCRIBE the RCIC system response if reactor water level exceeds +45 inches. (0.75)

b. STATE whether operator action (WOULD/WOULD NOT) be required to permit the RCIC system to inject to the reactor if a reactor low-low water level condition occurs subsequent to the high level condition described in part "a" above. (0.5)

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

QUESTION 3.01 (3.00)

For EACH of the following reactivity control systems, STATE:

1. the purpose for the system.
2. the conditions at which the system is ENABLED.
3. what provisions, if any, exist to manually bypass the ENTIRE system during operation, INCLUDING the administrative requirements that must be met to bypass a system where such a provision has been made.

a. rod worth minimizer (RWM) (1.5)

b. rod sequence control system (RSCS) (1.5)

QUESTION 3.02 (3.00)

You are the Unit 3 Reactor Operator on shift during a refueling outage. Refueling operations are complete and you have been told during your turnover that your shift will be draining the reactor vessel into the normal shutdown band. Yarway and narrow range water level indication are presently upscale on all channels. Bottom head drain temperature is 110 deg F.

a. STATE which indication (YARWAY RANGE or NARROW RANGE) should come on scale first as actual water level is lowered. (0.5)

b. EXPLAIN WHY Yarway and narrow range indications will disagree by as much as 30 inches during cold shutdown. NOTE: Be sure your explanation includes principles of detector operation. (1.5)

c. During a small break LOCA, STATE whether Yarway indication could be HIGHER or LOWER than actual level. ALSO STATE how large a deviation could be expected. (1.0)

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

QUESTION 3.03 (2.00)

a. If the IRMs are indicating 20 on Range 4 and an operator down ranged to Range 3, WHAT trips, if any, would occur? WHY? (0.75)

b. With the mode switch in STARTUP and IRM "C" reading 11 on Range 7, WHAT trip(s) if any, would occur if IRM "C" was down ranged to Range 6? WHY? (0.75)

c. An associated APRM downscale concurrent with an IRM upscale HI-HI will cause an RPS scram signal. WHICH APRM channel is associated with IRM channel "H"? (0.5)

QUESTION 3.04 (3.00)

The reactor is in cold shutdown with the "B" loop of RHR in shutdown cooling at a flow of 10,000 gpm using RHR pump "B". All other RHR pumps are secured and aligned for standby operation. The "D" high pressure service water pump is providing cooling water to the "B" loop RHR heat exchangers. RHR RPV head spray is not in service.

a. DESCRIBE WHAT automatic valve and pump actions should occur in the RHR system if reactor water level decreases to -10 inches with no operator actions taken. LIMIT the description to only those components in the shutdown cooling flow path. (1.0)

b. DESCRIBE WHAT operator actions, if any, are required to inject into the RPV with

1. the "A" loop of RHR
2. the "B" loop of RHR

if water level continues to fall to -140 inches. ASSUME all automatic actions properly occur. (2.0)

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

QUESTION 3.05 (3.00)

Concerning the Reactor Protection System (RPS):

a. EXPLAIN WHY a fast transfer of the E32 4.16KV bus will not cause an RPS half scram, but transferring RPS bus "A" to its alternate source of power will cause a half scram. (1.0)

b. Following a reactor scram from 100% power, several scram setpoints that were in effect at power are bypassed by either automatic or normal post scram operator actions. LIST three (3) of these trips and STATE the conditions that must be in effect for the bypass to occur. (1.5)

c. One of the RPS inputs is main turbine stop valve (TSV) position. STATE whether a SCRAM, HALF SCRAM, or NO HALF SCRAM would occur if TSV #1 and TSV #2 both drifted to 85% of full open position with the reactor at 85% of rated core thermal power. (0.5)

QUESTION 3.06 (3.00)

Concerning the Automatic Depressurization System (ADS):

a. Once ADS has commenced blowdown, STATE ALL the operator actions that could be taken in Unit 2 to reclose the relief valves prior to reactor pressure decreasing below 50 psig. (1.0)

b. STATE which signal input to ADS logic must in all cases be manually reset when the signal clears. (0.5)

c. The ADS logic received a modification from its initial design that added a 9.5 minute timer and a keylock handswitch to each logic train. STATE the purpose(s) of this additional timer and handswitch. DESCRIBE in your statement how the timers and handswitches affect the logic. INCLUDE setpoints associated with these devices. (1.5)

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

QUESTION 3.07 (3.00)

Unit 2 is operating at 100% core thermal power with the main generator producing 97% rated electrical power. The EHC system is aligned for normal 100% power generation. An electrical fault causes both generator output breakers to open. You may use the attached EHC system figure to answer the following questions.

a. DESCRIBE the sequence of events (i.e., signals generated and components actuated) that will lead to the first scram signal to the reactor protection system (RPS). (Assume no operator action.) (1.5)

b. WOULD any automatic changes in the setpoints for either LOAD LIMIT or LOAD SET occur in this transient? If so, DESCRIBE the change(s), INCLUDING the final setpoint value(s). (1.5)

QUESTION 3.08 (2.00)

Reactor power is 85% of core rated thermal power and total core flow is 70%. Neither rod block monitor (RBM) channel is bypassed. Control rod 18-31 is selected.

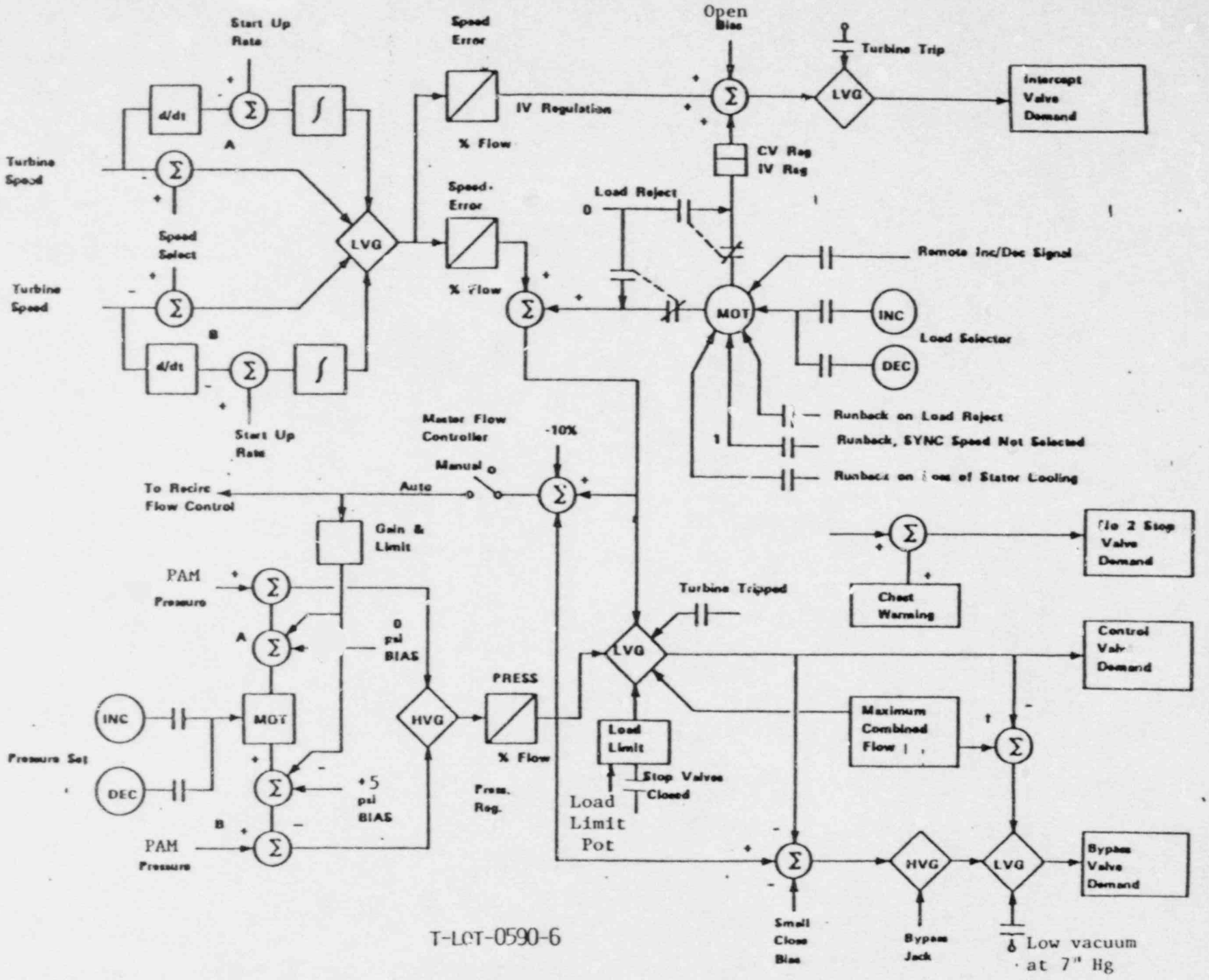
a. STATE the effect upon the RBM system when the reactor operator bypasses APRM channel "E" with its respective APRM joystick for an I&C surveillance. (0.5)

b. If control rod 18-31 is selected and APRM channel "B" indicates 88%, STATE whether the RBM system WOULD or WOULD NOT enforce a rod block. INCLUDE a calculation AND an explanation to support your answer. (1.0)

(turn off rod select power)

c. If the operator were to deselect control rod 18-31 and did not select another control rod, WOULD the RBM system respond with a rod block? (0.5)

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


Start Up Rate
Speed Error
Open Bias
Turbine Trip
d/dt
A
IV Regulation
Intercept Valve Demand
Turbine Speed
% Flow
CV Reg
IV Reg
Speed Error
Load Reject
Speed Select
LVG
Remote Inc/Dec Signal
Turbine Speed
% Flow
MOT
INC
Load Selector
B
DEC
Runback on Load Reject
Master Flow Controller
-10%
Runback, SYNC Speed Not Selected
Manual
Auto
To Recirc Flow Control
Gain & Limit
PAM Pressure
Turbine Tripped
No 2 Stop Valve Demand
Chest Warming
0 psi BIAS
Control Valve Demand
PRESS
HVG
Maximum Combined Flow
Load Limit
Stop Valves Closed
Pressure Set
+5 psi BIAS
Press. Reg.
% Flow
Load Limit Pot
Bypass Valve Demand
PAM Pressure
Small Close Bias
Bypass Jack
Low vacuum at 7" Hg

T-LOT-0590-6

QUESTION 3.09 (1.50)

The reactor is in cold shutdown with bottom head drain temperature of 120 deg F. The standby gas treatment auto initiates with the "C" fan. Both filter train isolation dampers are open.

a. STATE the conditions that could cause standby gas treatment (SBGT) to auto initiate. (1.0)

b. STATE whether the initiating signal was from Unit 2 or Unit 3. (0.5)

QUESTION 3.10 (1.50)

The reactor is operating at 100% rated feedwater flow and 99% rated core thermal power. The "A" condensate pump trips. DESCRIBE HOW interlocks in the following systems would respond:

a. feedwater control system (0.

b. EHC system (0.75)

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

QUESTION 4.01 (3.00)

Regarding Administrative Procedure A-7, "Shift Operations:"

a. STATE which individual by title is required to authorize a startup subsequent to a shutdown or scram. (0.5)

b. Appendix 5 of A-7 lists the specific duties of the control room operator. STATE the three (3) conditions under which the control room operator is responsible for and has the authority to shutdown the reactor. (1.5)

c. Section 7.1 of A-7, "Shift Operations" contains guidance for "On-Duty" senior licensed operators and licensed operators concerning their PERSONAL CONDUCT while on shift. STATE two (2) of these guidelines that help ensure the units are operated as safely and as reliably as possible. (1.0)

QUESTION 4.02 (2.75)

The control room becomes uninhabitable because of a ~~fire~~ Bomb threat and the decision has been made to immediately evacuate the control room.

a. LIST the seven (7) immediate actions the operator is to take PRIOR to exiting the control room as delineated by procedure SE-1, "Plant Shutdown from the Emergency Shutdown Panel - Procedure." (2.0)

b. Once at the emergency shutdown panel, procedure SE-1 instructs the operator to place all the pistol grip hand switches on the emergency shutdown panel in the "pulled-out" position. STATE the purpose of this action. (0.75)

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

QUESTION 4.03 (2.00)

A reactor startup is in progress. Reactor pressure is 920 psig. Reactor power is 2% by APRM. The "A" reactor recirc pump trips and a few minutes later, the "B" recirc pump trips.

a. LIST the immediate operator actions of OT-112, "Recirculation Pump Trip." (INCLUDE actions for one recirc pump trip.) (1.0)

b. STATE whether an automatic reactor scram from the reactor protection system WOULD or WOULD NOT occur in the above situation and SUPPORT your answer with an explanation. (1.0)

QUESTION 4.04 (2.00)

ON-105, "Control Rod Uncoupled-Procedure," provides instructions to follow in the event of an uncoupled control rod.

a. LIST three (3) indications of an uncoupled control rod. (1.5)

b. HOW many recoupling attempts are allowed by ON-105? (0.5)

QUESTION 4.05 (2.50)

The reactor was in hot standby with a bottom head drain temperature of 480 deg F. The high pressure coolant injection (HPCI) system auto initiated on a valid initiation signal while the reactor core isolation cooling (RCIC) system remained in standby. Based on the responses of these two systems alone, STATE whether TRIP procedure entry condition(s) existed and if so, SPECIFY which entry condition(s) AND also which procedure(s) should have been entered. Assume the HPCI and RCIC systems are initially properly aligned in standby for automatic initiation and are fully operable. (2.5)

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

QUESTION 4.06 (1.50)

A hallway is surveyed and is routinely found to have a radiation field present whereby a person would receive 8 mrem/hr. No loose surface contamination or airborne contamination is present.

a. STATE what entry requirements an individual would have to satisfy to physically enter this hallway. (1.0)

b. At PBAPS, STATE the station's administrative quarterly dose limit for an individual who does NOT have a completed NRC Form 4 on file. (0.5)

QUESTION 4.07 (2.75)

During reactor heatup and pressurization, procedure GP-2, "Normal Plant Startup" is the controlling procedure.

a. STATE what administrative restriction exists if the reactor is brought critical and the EHC system is not available. (0.75)

b. GP-2 administratively limits heatup rate. STATE the maximum allowable heatup rate allowed by GP-2. (0.75)

c. DESCRIBE HOW the EHC pressure control function is first demonstrated properly functional in GP-2 during reactor startup/heatup. (1.25)

QUESTION 4.08 (1.50)

The reactor producing 100% rated core thermal power. The "Drywell Hi-Lo Press" alarm is received. The reactor operator then notes that drywell pressure is 0.8 psig.

a. LIST all immediate actions. (1.0)

b. STATE what condition must be verified prior to the initiation of the standby gas treatment system to vent the drywell of excess pressure. (0.5)

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

QUESTION 4.09 (2.00)

A surveillance test is to be performed on the "A" loop of core spray for unit 2. According to procedure A-41, "Procedure for Control of Safety Related Equipment," the individual who performs this test must receive prior approval.

a. After shift supervision approval is received to perform this test, STATE which other person must also approve the performance of this test and be advised of the anticipated effects of this test. (0.5)

b. LIST what information must be logged by the reactor operator or control operator concerning this test. (1.0)

c. STATE the TYPE of verification that must be performed upon completion of this test to ensure that equipment and components affected by this test are properly returned to service. (0.5)

QUESTION 4.10 (2.00)

Concerning Trip Procedure General Notes:

a. STATE the conditions under which manual control of ECCS systems is allowed. (1.5)

b. STATE the conditions under which an automatic initiation of a safety function can be assumed NOT to be due to a true initiating event. (0.5)

QUESTION 4.11 (1.50)

Radiation work permits (RWPs) control work performed in the radiologically controlled area (RCA). Operations personnel have two "~~Operations~~ General RWP's" in effect at all times, one at each unit, allowing operators to perform certain functions. STATE three (3) operations functions these two RWPs together allow. (1.5)

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

QUESTION 4.12 (1.50)

Procedure ON-103, "Off Gas Stack High Radiation - Procedure" consists of a series of checks to determine the source of the activity followed by actions to be taken based upon the results of those checks.

a. STATE which SYSTEM besides off gas discharges to the off gas stack. (0.5)

the steam packing exhauster, and the mechanical vacuum pump,

b. STATE two (2) actions that must be taken if the source of activity is in fact from unit 2 off gas. (Assume the reactor is at rated power with the main turbine generator on line with a normal full power lineup.) (1.0)

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

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 1.01 (2.50)

a. From GP-2, period equals 50 seconds [+0.5]. Thus doubling time equals 50/1.44 = 34.7 seconds [+0.5].

b. 60 on range 2 is equal to 0.06 on range 8 [+0.5]
P(0) = 0.06 P(t) = 40 Period = 50 seconds
P(t) = P(0) e ^(t/period)
40 = 0.06 e ^(t/50 sec)
t = 50 ln 40/0.06 = 325 sec or 5 min 25 sec [+1.0]

REFERENCE

1. Peach Bottom: LOT-i430; 1530 LO #2.
29003K108 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 1.02 (3.00)

a. {Xe(eq.) --> Production = Removal. The Production term is a flux dependent term; the Removal term is dependent on burnup and decay with only burnup being flux dependent.}

While all the production term would reduce by one-half [+0.5], only the burnup portion of the removal term would reduce by one-half; thereby leaving the xenon concentration at a higher equilibrium level [+0.5] --OR-- Since the major production and removal terms are based on two independent variables [+0.5], flux and decay, Xe versus power is not linear [+0.5].

+1.0 maximum.

b. No [+0.5], because xenon peak following a scram is approximately the square root of the power change (10 hours) [+0.25] due to the loss of the burnup term [+0.25].

+1.0 maximum.

c. Power would peak higher in the core [+0.5] because the amount of xenon that would build into the core would be greatest where power density had been the greatest prior to the down power maneuver. This in turn would make the bottom of the core less reactive and force power production higher in the core until equilibrium xenon concentration was again established [+0.5].

REFERENCE

1. Peach Bottom: LOT 1510, LO #3, 4, and 6.
292006K105 292006K106 292006K107 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 1.03 (3.00)

a. Reactor power will rapidly increase due to a pressure increase [+0.5]. Power will then decrease due to the TCV fast closure scram [+0.5].

b. Reactor pressure will rapidly increase due to the rapid closure of the TCV's [+0.5]. Pressure will then decrease due to the scram and the opening of the bypass valves which will then attempt to maintain reactor pressure at 920 psig [+0.5].

c. Reactor water level will initially drop as steam flow is abruptly interrupted [+0.5]. The feed control system will respond to increase level and level should then rise to the level controller setpoint [+0.5].
(Level may overshoot causing pumps to trip at +45" Rx level)

REFERENCE

1. Peach Bottom: LOT 1600, LO #1 and #4.
241000K101 241000K102 241000K103 ...(KA'S)

ANSWER 1.04 (2.00)

a. 1. mod temp coeff [+0.25]
2. fuel temp coeff [+0.25]
3. void coeff [+0.25]

[+0.25] for correct order

b. Assume (1.) contribution from void and fuel temperature coefficient insignificant and (2.) moderator temperature coefficient = 1 x 10**-4 k/k/deg F. [+0.5]

[1 x 10**-4 (k/k)/deg F] x [(260 - 240) deg F] = 20 x 10**-4 k/k added [+0.5]

REFERENCE

1. Peach Bottom: Reactor Theory, Student Handout, Sections 26 through 30.

2. Peach Bottom: LOT 1440, LO #3 and 5.
292004K114 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 83/02/17-MOON/MOORE

ANSWER 1.05 (2.50)

a. more
b. decrease
c. increase
d. less
e. increase

[+0.5] each

REFERENCE

1. Peach Bottom: LOT 1490, LO 6,7.
292005K109 ...(KA'S)

ANSWER 1.06 (2.75)

a. The assembly power which would cause the onset of transition boiling at some point in the assembly. [+1.0]

b. (3) [+0.75]

c. fuel clad cracking due to a lack of cooling [+0.5]

d. MCPR limit [+0.5]

REFERENCE

1. Peach Bottom: LOT 1380, LO #4.

2. Peach Bottom: LOT 1360, LO #3, #4.
293009K119 293009K120 293009K122 293009K123 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 1.07 (2.50)

a. The previous shift DID EXCEED the cooldown limit [+0.5] of 100 deg F/hour [+0.5].
(Tsat for 1000 psig = 546 deg F;
Tsat for 200 psig = 388 deg F;
cooldown rate = (546-388) deg F/1.5 hours
= 105 deg F/hr) [+0.5]

b. 68 +- 2 deg F (of cooldown required).
(Tsat for 200 psig = 388 deg F;
Tsat for 75 psig = 320 deg F;
(388-320) = 68 deg F) [+1.0]

REFERENCE

1. Peach Bottom: LOT 1150, LO #2.

2. Peach Bottom: LOT 1160, LO #2.

3. Peach Bottom: Technical Specifications, 2.2.2 and 3.6.A.1.

205000K402 293003K123 ...(KA'S)

ANSWER 1.08 (2.00)

a. (Core bypass flow is) that portion of total core flow that does not flow inside the fuel channels [+1.0].

b. 1. Excessive voiding in bypass region resulting in unreliable LPRM readings. [+0.5]

2. Inadequate cooling of LPRM detectors resulting in premature LPRM detector failures. [+0.5]

REFERENCE

1. Peach Bottom: LOT 0010, LO #2.

293008K132 293008K133 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 1.09 (3.00)

a. The difference between static pressure at the eye of the pump and saturation pressure. [+0.5]

b. 1. decreases [+0.5]
2. increases [+0.5]
3. decreases [+0.5]
4. increases [+0.5]

c. Cavitation of the reactor recirculation pumps [+0.5]

REFERENCE

1. Peach Bottom: LOT 1290, LO #4.
293006K109 293006K110 ...(KA'S)

ANSWER 1.10 (1.75)

a. (The amount of change will) INCREASE. [+0.5]

b. (The amount of time necessary for count rate to stabilize between control rod notch withdrawals will) INCREASE. [+0.5]

c. 1. positive stable period [+0.25]
2. increasing count rate [+0.25]
3. no rod motion [+0.25]

REFERENCE

1. Peach Bottom: LOT 1530, LO #3.
292008K103 292008K108 ...(KA'S)

ANSWER 2.01 (2.75)

a. 1. (Purposes)

The 60% speed limiter reduces reactor power to reduce the rate of reactor vessel inventory loss in a loss of feedwater situation, either actual or anticipated [+0.5].

The 30% speed limiter ensures the system is properly aligned for operation [+0.25] and also ensures adequate NPSH in a low feed water flow situation [+0.25].

2. (Initiating Conditions)

60% speed limiter

EITHER a. Rx water level < 17 inches AND an individual feed pump flow < 20% [+0.25]

OR b. total feed water flow > 90% AND an individual condensate pump not running [+0.25]

30% speed limiter

EITHER a. total feed water flow < 20% [+0.25]

OR b. recirc pump discharge valve <90% full open (or not full open) [+0.25]

b. Both the reactor recirc pumps trip [+0.25]. Both recirc MG set drive motor breakers open [+0.5].

REFERENCE

1. Peach Bottom: LOT 0040, LO #1, #2, #3, #4, and #8.

202001K414 202002K402 202002K406 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 2.02 (2.50)

a. 1. low pump flow
2. high pump vibration
3. high pump flow
4. pump motor supply breaker trip
5. pump bearing cooling water outlet high temperature
6. pump motor thermal overload trip

Any four (4) [+0.25] each, +1.0 maximum.

b. The RWCU dump valve (CV-55) WILL NOT concurrently isolate. [+0.5]

c. If the dump valve is open at the time of the RWCU system isolation, the system will rapidly depressurize, the water in the piping will flash to steam [+0.5] in the high temperature portions of the system, shocking (water hammering) the system piping and components [+0.5].

REFERENCE

1. Peach Bottom: LOT 0110, LO #5 and #7.

204000K106 204000K401 204000K402 204000K407 ...(KA'S)

ANSWER 2.03 (2.50)

a. 1. relief valve tail pipe thermocouple/high temp alarm
2. relief valve tail pipe acoustic monitor
3. total steam flow/total feed flow mismatch
4. generator MWE reduction

[+0.25] each

b. Following the relief valve's first actuation, the steam in its discharge line would condense causing a vacuum in that line [+0.5]. This would cause suppression pool water to be drawn into the line [+0.5] to an elevation significantly above the elevation of the suppression pool surface. On a subsequent lift of the relief valve, the inertia of the additional water in the discharge line would cause over pressurization of the line while the additional water was being cleared [+0.5].

(Also acceptable: On a subsequent lift of the relief valve, the additional water would cause excessive loading on the diffuser and torus structures.)

REFERENCE

1. Peach Bottom: LOT 1210, LO #3.
239002K403 239002K406 239002K501 239002K503 ...(KA'S)

ANSWER 2.04 (3.00)

a. The emergency diesel generator would not auto start on a LOCA signal [+0.5].

b. The diesel would start and align to the bus [+0.5]. As loads cycled onto the bus, bus frequency would drop as load increased [+0.5], and bus voltage would drop as load increased [+0.5]. This would be highly undesirable because ESF equipment could be operating at speeds less than designed and drawing currents higher than designed as bus loading increased [+0.5].

c. This relay prevents air bleed-down of the starting air receivers in the event the diesel failed to start. [+0.5]

REFERENCE

1. Peach Bottom: LOT 0670, LO #3 and #5.

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

2. Peach Bottom: System Procedure, S.8.4.A.
26400K106 26400K403 26400K406 26400K407 ...(KA'S)

ANSWER 2.05 (2.50)

a. 1. low reactor water level (-130 inches) [+0.5]

2. high drywell pressure (2 psig) (AND Rx pressure < 450 psig) [+0.5]

b. will pump water to the vessel [+0.5]

c. The remaining pump would be operating beyond rated flow conditions (pump runout). [+0.5]

d. will pump water to the vessel [+0.5]

REFERENCE

1. Peach Bottom: LOT 0350, LO #2.
209001K408 209001K410 209001K503 209001SG4 ...(KA'S)

ANSWER 2.06 (2.00)

a. Either a Diesel Generator Start (or 22 seconds after the DG low speed relay (LSR) energized) [+0.25] OR a valid LOCA signal (or 22 seconds after Maximum Credible Accident (MCA) relay energized) [+0.25].

b. The ECW pump tripped because normal ESW pressure was established by the ESW pumps. [+0.5]

c. the Emergency Diesel Generators [+1.0]

REFERENCE

1. Peach Bottom: LOT 0680, LO #2, #3, and #4.

2. Peach Bottom: LOT 0410, LO #3.
264000A306 264000K104 264000SG7 ...(KA'S)

ANSWER 2.07 (3.00)

a. 1. fuel pellet [+0.25]
2. fuel cladding [+0.25]
3. primary system piping [+0.25]
4. secondary containment [+0.25]

b. In a LOCA with inadequate core cooling [+0.5] the zirconium in the fuel rod cladding [+0.5] could react with the water [+0.5] in a zirconium-water reaction to produce explosive concentrations of hydrogen in containment.

c. The containment is inerted with nitrogen [+0.25] to reduce oxygen content to less than 4% [+0.25].

REFERENCE

1. Peach Bottom: LOT 0130, LO #2.

2. Peach Bottom: LOT 0160, LO #1 and #3.
223001K103 223001K404 223001K509 ...(KA'S)

ANSWER 2.08 (3.00)

a. 1. The EHC load set will run back [+0.2] to 25% [+0.1] causing all bypass valves to fully open [+0.2].

2. The "A" reactor recirc pump will trip [+0.3] in 1.0 seconds [+0.2].

3. The "B" reactor recirc pump will trip [+0.3] in 10.0 seconds [+0.2].

4. Reactor power will stabilize at 50-55% of core rated thermal power [+0.5].

b. The turbine will trip if generator amps are not less than 26,530 [+0.1] in 2 minutes [+0.4] or less than 7726 amps [+0.1] in 3.5 minutes [+0.4].

REFERENCE

1. Peach Bottom: LOT 0630, LO #5 and #6.
202001K407 241000K123 241000K125 241000K405 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 2.09 (2.50)

a. 1. Rx pressure [+0.5]

2. CRD pump pressure --OR-- charging water header pressure [+0.5]

b. would fully insert [+0.5]

c. Rod 18-31 should fully insert (position "00") [+0.4] because the backup scram valves would vent off the scram air header [+0.3] causing the HCU 18-31 scram valves to fail open [+0.3] to effect the scram of control rod 18-31.

REFERENCE

1. Peach Bottom: LOT 0070, LO #7.
201003K404 201003K601 201003K602 ...(KA'S)

ANSWER 2.10 (1.25)

a. The RCIC turbine steam supply valve (MO-131) closes (this is NOT a turbine trip). [+0.75]

b. (operator action) WOULD NOT (be required) [+0.5]

REFERENCE

1. Peach Bottom: LOT 0380, LO #2 and #5.
217000K102 217000K402 217000SG7 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 3.01 (3.00)

a. 1. The purpose is to limit peak fuel enthalpy in a postulated rod drop accident to 280 cal/gm [+0.3]

2. Enabled at 25% (decreasing) Rx feed water flow [+0.4] OR 25% (decreasing) Rx steam flow [+0.4].

3. A bypass switch has been provided to manually bypass the RWM and requires a second licensed operator to verify that the operator at the reactor console is following the control rod program [+0.4].

b. 1. The purpose is to limit peak fuel enthalpy in a postulated rod drop accident to 280 cal/gm [+0.3].

2. Enabled at 21% (decreasing) power as measured by main turbine first stage shell pressure [+0.8].

3. No provision to bypass. [+0.4]

REFERENCE

1. Peach Bottom: LOT 0090, LO #1, #2, and #4.

2. Peach Bottom: LOT 0100, LO #1 and #3.

3. Peach Bottom: LOT 0280, LO #1 and #5.

201002K104 201002K105 201002K106 201006K501 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 3.02 (3.00)

a. narrow range [+0.5]

b. At cold conditions, variable and reference leg temperatures are at conditions other than the calibrated conditions expected for the reactor vessel and drywell when operating [+0.5]. The density increase of the colder water introduces error into both indications proportional to the heights of the reference and variable legs [+0.5]. For a given actual reactor water level, the variable leg height for the Yarway is significantly greater than the variable leg height for the narrow range instrument [+0.5]. (Note: narrow range pressure compensation accentuates the difference; narrow range not accurate at cold conditions, either)

c. Indicated level could be HIGHER [+0.5] by as much as 30 inches [+0.5].

REFERENCE

1. Peach Bottom: LOT 0050, LO #6.

2. Peach Bottom: LOT 3070, LO #5 and #7.
216000K122 216000K501 216000K507 216000K510 ...(KA'S)

ANSWER 3.03 (2.00)

a. None [+0.25]. The IRMs would indicate 20 on Range 3; 0-40 scale [+0.5].

b. An IRM upscale trip (rod block) would occur [+0.25] because the IRM would read 10 on the 0-125 scale [+0.5].

c. APRM channel "B". [+0.5]

REFERENCE

1. Peach Bottom: LOT 0250, LO #5 and #7.
215003K101 215003K102 215005K102 215005K306 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 3.04 (3.00)

a. 1. Shutdown cooling suction inboard and outboard containment isolation valves (MO-18 and MO-17) would auto close. [+0.5]

2. RHR pump "B" will trip. [+0.25]

3. Loop B LPCI injection valve (MO-25B) would auto close. [+0.25]

b. The operator must depress the shutdown cooling valve reset pushbutton for the "A" loop of RHR. [+1.0]

The operator must depress the shutdown cooling valve reset pushbutton for the "B" loop of RHR. [+1.0]

REFERENCE

1. Peach Bottom: LOT 0180, LO #2 and #6.

2. Peach Bottom: LOT 0370, LO #3, #4, #5, and #6.

203000K401 205000K404 216000K105 223002K108 ...(KA'S)

ANSWER 3.05 (3.00)

a. A fast transfer of the E32 4.16 KV bus is fast enough that the inertial energy stored in the flywheel [+0.25] of the RPS motor generator (MG) set will sustain adequate RPS bus "A" voltage and frequency until power is restored to the MG motor by completion of the fast transfer [+0.25]. A transfer of RPS bus "A" to its alternate source of power briefly but totally deenergizes the RPS bus (and causes a half scram) [+0.5].

b. 1. Main steam line isolation scram [+0.25]. Auto bypassed when the mode switch is NOT in RUN [+0.25].

2. Main condenser low vacuum scram [+0.25]. Auto bypassed when the mode switch is NOT in RUN [+0.25].

3. Turbine control valve fast closure scram [+0.25]. Auto bypassed when reactor power is <30% as measured by main turbine first stage pressure [+0.25].

4. Turbine stop valve closure scram [+0.25]. Auto bypassed when reactor power is <30% as measured by main turbine first stage pressure [+0.25].

5. Mode switch in SHUTDOWN scram [+0.25]. Auto bypassed after a 10 sec. TD from when the mode switch was manually placed in shutdown [+0.25].

6. Scram discharge volume (SDV) high level scram [+0.25]. Auto bypassed when mode switch is in SHUTDOWN or REFUEL AND manual keylock bypass switch in BYPASS [+0.25].

7. ~~APRM High Flux scram [+0.25] Auto on~~ APRM Flow biased high flux scram [+0.25] Auto bypassed when the mode switch is not in RUN [+0.25] on

Any three (3), +1.5 maximum.

c. half scram [+0.5]

REFERENCE

1. Peach Bottom: LOT 0300, LO #4, #5, #6, #7, and #8.
212000K110 212000K111 212000K114 212000K201 ...(KA'S)

ANSWER 3.06 (3.00)

a. 1. Depress both the "A" and "B" timer reset pushbuttons to break the seal in. [+0.33]

2. Shutdown the RHR and core spray pumps. [+0.33]

3. Place the "A" and "B" keylock switches in "Inhibit." [+0.34]

b. high drywell pressure [+0.5]

c. The additional timer in each logic train automatically inserts a high drywell pressure permissive signal [+0.25] if reactor water level is not restored to a level greater than -130 inches within 9.5 minutes of level falling below -130 inches [+0.25] The purpose of this feature is to make the logic responsive to a LOCA with the break physically outside the containment [+0.25].

The keylock switches for each logic train of ADS disable their respective logic trains to prevent ADS relief valve actuation [+0.5]. The purpose of this feature is to provide a positive means to disable ADS when under certain accident conditions ADS actuation would be highly undesirable [+0.25]. (ALTERNATE ANSWER: The purpose of this feature is to provide a positive means to disable ADS when directed by procedure. [+0.25])

REFERENCE

1. Peach Bottom: LOT 0330, LO #2, #3, and #5.
216000K107 218000K403 218000K501 ...(KA'S)

ANSWER 3.07 (3.00)

a. An EHC load reject signal [+0.5] will cause an actuation of the EHC system fast acting solenoids [+0.5] which in turn will cause a turbine control valve (TCV) fast closure scram [+0.5].

b. Yes [+0.5]. LOAD SET will runback [+0.5] to minimum (zero load) [+0.5]. (LOAD LIMIT will not change).

REFERENCE

1. Peach Bottom: LOT 0590, LO #5.
241000K101 241000K102 241000K103 241000K104 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON'MOORE

ANSWER 3.08 (2.00)

a. RBM "A" will automatically shift from APRM "E" to APRM "C" for its APRM reference. [+0.5]

b. Would enforce a rod block [+0.34]. Even upranged to the high setpoint, with total core flow at 70%, rod block setpoint would be [(0.66)(0.7) + 0.41] 100 = 87.2% [+0.33]. APRM channel "B" (at 88%) is the reference channel for RBM channel "B" and so regardless of the LPRM average of channel "B" about control rod 18-31, the RBM LPRM averaging and gain change circuit will ensure at least 88% power is used for rod block determination [+0.33].

c. Yes [+0.5]

REFERENCE

1. Peach Bottom: LOT 0280, LO #3 and #4.
215002K101 215002K103 215002K401 215005K103 ...(KA'S)

ANSWER 3.09 (1.50)

a. Low Rx water level (0 inches)
high drywell pressure (2 psig)
refuel floor exhaust high radiation (16 mr/hr)
Rx building exhaust high radiation (16 mr/hr)

[+0.25] each

(Also allow loss of power to "A" RPS in Unit 3)

b. unit 3 [+0.5]

REFERENCE

1. Peach Bottom: LOT 0210, LO #2 and #5.
261000K401 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 3.10 (1.50)

a. The feedwater control system would limit feed pump speed control signal to 90%. [+0.75]

b. The EHC system would runback at 1%/sec until feed water flow is <95%. [+0.75]

REFERENCE

1. Peach Bottom: LOT 0550, LO #13 and #15.
256000K102 256000K301 259002K113 259002K116 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 4.01 (3.00)

a. ~~station superintendent~~ Plant Manager or [+0.5]

b. 1. The safety of the reactor is in jeopardy. [+0.5]

2. Operating parameters exceed reactor protection system setpoints and automatic shutdown does not occur. [+0.5]

3. When there is doubt as to whether safe conditions exist. [+0.5]

c. 1. (On duty SLO's and LO's) must be alert and attentive.

2. (On duty SLO's and LO's) must be aware of and responsible for the plant status at all times.

3. (On duty SLO's and LO's) must prohibit distracting activities in the control room.

Any two (2) [+0.5] each, +1.0 maximum.

REFERENCE

1. Peach Bottom: LOT 1570, LO #2a and #3b.
294001A103 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 4.02 (2.75)

a. 1. runback recirc flow to minimum [+0.3]

2. transfer house loads [+0.3]

3. manually scram and execute T-100 [+0.3]

4. place the drywell instrument air in service [+0.3] (allow drywell instrument nitrogen for drywell instrument air).

5. close MSIV's [+0.3]

6. establish torus cooling [+0.3]

7. obtain master keys [+0.2]
(allow [+0.3] if all six preceding actions are not produced)

b. Placing the switches in the "pulled-out" position transfers control of the associated components from the control room to the emergency shutdown panel. [+0.75]

REFERENCE

1. Peach Bottom: SE-1, "Plant Shutdown from the Emergency Shutdown Panel - Procedure."

295016AK20 295016SG10 ...(KA'S)

ANSWER 4.03 (2.00)

a. If one recirc pump is operating, then drive in deep rods fully as required to prevent a scram. [+0.33]

If neither recirc pump is operating, then scram and enter T-100. [+0.34]

If a scram condition occurs, enter procedure T-100. [+0.33]

b. An automatic scram WOULD NOT occur [+0.5] because power level prior to the loss of both reactor recirc pumps was not sufficiently high to produce a control rod pattern that would produce a power under natural circulation conditions that could exceed a ~~flow biased~~ high flux / IRM scram setpoint [+0.5].

REFERENCE

1. Peach Bottom: LOT 1540. LO #2.

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

295001AK20 295001SG10 ...(KA'S)

ANSWER 4.04 (2.00)

a. 1. rod overtravel alarm when fully withdrawn [+0.5]

2. control rod withdrawal with no apparent nuclear response [+0.5]

3. no control rod drive water "stall flow" observed when performing an uncoupling check at position 48 [+0.5]

4. RPIS position indication goes blank [+0.5]

b. three [+0.5]

Any two or three (3), +1.5 maximum

REFERENCE

1. Peach Bottom: LOT 1550, LO #1 and #2.
201001SG15 ...(KA'S)

ANSWER 4.05 (2.50)

A trip procedure entry condition DID exist [+0.5]. The entry condition was high drywell pressure > 2 psig [+0.5], and the TRIP procedures which should have been entered were T-102, "Containment Control" [+0.5]; T-101, "RPV Control" [+0.5]; and T-100, "Scram" [+0.5].

REFERENCE

1. Peach Bottom: LOT 1560, LO #9.
295024SG11 ...(KA'S)

ANSWER 4.06 (1.50)

a. The individual would be required to be wearing his personal dosimetry consisting of his TLD [+0.5] and a self reading dosimeter [+0.5].

b. 1000 mrem/qtr [+0.5]

REFERENCE

1. Peach Bottom: LOT 1730, LO #1 and #2.
294001K103 ...(KA'S)

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

ANSWER 4.07 (2.75)

a. The reactor operator, upon achieving criticality, must insert control rods to make the reactor slightly subcritical. [+0.75]

b. 80 deg F/hr [+0.75]

c. At a reactor pressure of 150 psig with the EHC pressure setpoint set at 120 psig [+0.25], bypass valves are verified to open as necessary [+0.5] to maintain reactor pressure at 120 psig as control rods are withdrawn [+0.5].

REFERENCE

1. Peach Bottom: LOT 1530, LO #2, #4, and #5.
216000SG10 216000SG1 241000SG10 241000SG1 ...(KA'S)

ANSWER 4.08 (1.50)

a. 1. maximize drywell cooling [+0.34]
2. terminate drywell inerting [+0.33]
3. if a scram conditions occurs, enter T-100 [+0.33]

b. Drywell temperature must be less than 212 deg F. [+0.5]

REFERENCE

1. Peach Bottom: LOT 1540, LO #1 and #2.
295024EA20 295024SG11 ...(KA'S)

ANSWER 4.09 (2.00)

a. reactor operator [+0.5] (also allow A.C.O. for full credit)

b. surveillance test number [+0.33]
equipment affected [+0.34] (allow procedure title)
start date/time [+0.33] (allow full credit if only start time provided. Lapses are dated)

c. double (verification) [+0.5]
(also allow independent verification for full credit)

REFERENCE

1. Peach Bottom: LOT 1570, LO #3.

ANSWERS -- PEACH BOTTOM 2&3 -88/02/17-MOON/MOORE

294001A103 294001A106 ...(KA'S)

ANSWER 4.10 (2.00)

a. By at least two indications [+0.5] that either:
1) misoperation in the automatic mode is confirmed [+0.5] or
2) adequate core cooling is assured [+0.5].

b. Automatic initiation can be assumed not to be due to a true initiating event when supported by at least two independent verifications. [+0.5]

REFERENCE

1. Peach Bottom: LOT 1560, LO #3 and #4.
295031SG7 ...(KA'S)

ANSWER 4.11 (1.50)

1. (operator) rounds [+0.5]
2. blocking [+0.5]
3. inspection [+0.5]

REFERENCE

1. Peach Bottom: LOT 1760, LO #4.
294001K103 . .(KA'S)

ANSWER 4.12 (1.50)

a. standby gas treatment (SBGT) [+0.5]

b. 1. place the unit 2 main turbine sealing steam supply on auxiliary steam [+0.5]

2. drop load on unit 2 to maintain off gas stack radiation below the alert limit [+0.5]

REFERENCE

1. Peach Bottom: LOT 1550, LO #2.
261000K107 271000K111 271000K302 272000K103 ...(KA'S)

$f = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = V\ \Delta P$

$\Delta E = 931\ \Delta m$

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

$Q = UA\Delta h$

$Pwr = W_f \Delta h$

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

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

$SUR = 26.06/T$

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

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

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

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

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

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

$P = (\Sigma_f \bar{\nu} V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$v = s/t$

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

$a = (V_f - V_o)/t$

$w = \theta/t$

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

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

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

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

$I = I_o e^{-\bar{\epsilon}x}$

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

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

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

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

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

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

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

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

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

$\ell^* = 10^{-5}$ 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