U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: WOLF CREEK

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 87/10/27

EXAMINER: PELLET, J.

CANDIDATE: _____

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	25.38	_____	_____	1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
25.00	25.38	_____	_____	2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
24.00	24.37	_____	_____	3.	INSTRUMENTS AND CONTROLS
24.50	24.87	_____	_____	4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
98.50		_____ Final Grade	_____%		Totals

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

_____
Candidate's Signature

QUESTION 1.01 (1.00)

HOW and WHY will Axial Flux Difference change if reactor power is reduced from 100% to 50%? Assume the reactor is operating at 100% power with all rods out (ARO), early in cycle life at equilibrium Xenon conditions when power is reduced to 50% by borating (no rod motion). Neglect changes due to Xenon. (1.0)

QUESTION 1.02 (2.00)

a. Explain two effects on core reactivity that occur as Reactor Coolant temperature is increased at Wolf Creek? (0.75)

b. Which initial temperature, 58 deg's F or 557 deg's F, will give the largest change in the magnitude of MTC as boron concentration is lowered from 1000 to 500 ppm? BRIEFLY EXPLAIN WHY. (0.75)

c. WHY does power defect become more negative as the core ages? (0.5)

QUESTION 1.03 (3.00)

What effect (INCREASE, DECREASE, NONE) does each of the conditions below have on Shutdown Margin. Consider each case separately. Assume the plant is operating at power.

a. RCS boron concentration decreases. (0.6)

b. A single control rod mechanically binds at step 200. (0.6)

c. A single control rod drops from step 200 to step 0. (0.6)

d. RCS Tave decreases 5 deg's F. (0.6)

e. Samarium concentration increases. (0.6)

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

QUESTION 1.04 (2.00)

a. Describe how inserting a control rod group 10 steps (from ARO) would affect each of the parameters below. Continue discussion until steady state reached. Assume the plant is operating at 100% power early in cycle life and all other parameters are normal for this condition.

1. Reactor power. (0.75)

2. RCS Tave. (0.75)

b. How would the plant response differ at end of life? (0.5)

QUESTION 1.05 (2.50)

a. How does reactor response change for equal positive reactivity insertions as the reactor approaches criticality? (1.5)

b. How much reactivity must be added to a critical reactor for it to be considered prompt critical? (Actual value is NOT required.) (0.5)

c. Why are extrinsic neutron sources installed in the reactor core? (0.5)

QUESTION 1.06 (2.00)

a. Explain why a single rod stuck out of the core has a higher reactivity worth than it normally has. (1.0)

b. Why do Technical Specifications require that control rods be moved with proper overlap during operation? (1.0)

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

QUESTION 1.07 (2.00)

TRUE or FALSE?

a. Peak Xenon conditions after a reactor trip may preclude attaining criticality near the beginning of cycle.

b. Equilibrium xenon concentration at 50% power is greater than half of the equilibrium concentration at 100% power.

c. If the reactor trips from 100% power, peak xenon concentration will occur in about 10 hours, with xenon-free conditions requiring about 100 additional hours.

d. Xenon peaking after a reactor shutdown is experienced because the reduced flux reduces production about 25%, but reduces burnout by a factor of 10.

QUESTION 1.08 (2.00)

TRUE or FALSE?

a. Pump shut off head is a term which could be used to describe a centrifugal pump operating with a shut discharge valve.

b. Latent heat of vaporization is another term for latent heat of fusion.

c. For centrifugal pumps in closed loop systems, the power required is directly proportional to the square of the pump speed.

d. For two IDENTICAL centrifugal pumps running at DIFFERENT speeds in IDENTICAL systems, the faster running pump requires a greater NPSH.

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

QUESTION 1.09 (2.50)

a. What two (2) conditions, BESIDES high yield stress, must be present for brittle fracture of the reactor pressure vessel to occur? (1.0)

b. How do heatup and cooldown rate limits on the reactor coolant system reduce the probability of brittle fracture? (0.5)

c. Why does the concern about brittle fracture of the reactor pressure vessel increase as the plant ages? Include in your answer the specific material PROPERTY that is affected. (1.0)

QUESTION 1.10 (1.50)

What steam generator pressure is required to maintain 200 deg's F subcooling margin in the RCS when RCS pressure is 595 psig. Show all work.

QUESTION 1.11 (1.50)

Explain HOW and WHY the following occurrences would affect net positive suction head (NPSH) available to the reactor coolant pumps (RCP's). Assume that no operator action occurs and consider each case independently.

a. Grid frequency decreases from 60.0 hz to 59.8 hz. (0.5)

b. Pressurizer temperature increases. (0.5)

c. Turbine power increases slightly with rods in manual. (0.5)

QUESTION 1.12 (1.00)

What is the INITIAL effect (INCREASE, DECREASE, NONE) on the parameters below if one steam dump valve fully opens with the plant operating at 67% power. Assume all control systems are in automatic.

a. Steam generator level. (0.5)

b. Pressurizer level. (0.5)

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

QUESTION 1.13 (2.00)

Explain WHY each of the condenser conditions below act to decrease overall efficiency of the plant.

a. Hotwell level increases (above normal levels).

b. Noncondensible gas inventory increases.

c. Circulating water flow decreases.

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

QUESTION 2.01 (2.00)

List 4 component interlocks or plant conditions that must be satisfied to open either of the RHR/PCS suction valves (8701/8702). (2.0)

QUESTION 2.02 (2.00)

a. What are 4 conditions (interlocks) must be met to close the racked in alternate supply breaker to NB01 from the control room? (1.2)

b. What are 2 of the 3 conditions or faults, any 1 of which will CAUSE auto transfer of a 13.8 KV bus to the Startup Transformer? (0.8)

QUESTION 2.03 (2.50)

Concerning the Reactor Coolant Pump (RCP) seal package:

a. What is the normal pressure drop across each of the 3 different seals? (0.75)

b. Why must the operator observe and maintain the specified minimum pressure across the #1 seal? (0.75)

c. What are 2 possible collection points for any leakage that goes through the #3 seal? (0.5)

d. How does the operational mode (method of sealing) of the #2 seal change should the #1 seal fail? (0.5)

QUESTION 2.04 (3.00)

List all the interface points between the Chemical and Volume Control System and the following systems. The list should be a descriptive location and /or purpose of the interface. Ignore common mini-flow recirc flow paths and water sources.

a. Component Cooling System

b. Safety Injection System

c. Residual Heat Removal System (3.0)

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

QUESTION 2.05 (2.00)

Concerning the Refueling Machine, answer the following True or False:

a. The air operated pneumatic gripper must have air to engage.

b. All bridge, trolley, and fuel mast positions are controlled from the operator console.

c. Core index strip position is transmitted via TV camera.

d. There is no indication of hoist speed on the console. (2.0)

QUESTION 2.06 (1.00)

Concerning refueling equipment, choose the following statement that is correct:

a. The Burnable Poison Rod Assembly Handling Tool is a short handled tool.

b. The Upender mechanisms are interlocked to the Transfer car position, the Spent Fuel Bridge Position, and the vertical position of the Refueling Machine Gripper.

c. In the event of Transfer Car Roller Chain failure, the emergency pull out cable can be used in conjunction with the Refueling Machine Auxiliary Hoist.

d. On the Spent Fuel Bridge Crane, the 5 ton hoist is used to manipulate the fuel transfer gates, and new and spent fuel assemblies. (1.0)

QUESTION 2.07 (2.50)

a. What is the motive power for positioning the valves that control flow from the Auxiliary Feed Water Pumps to the steam generators? (0.5)

b. Describe any "Smart Valve" features associated with these valves and provide 2 of the 3 reasons why these features are necessary. (1.5)

c. Why are the Turbine Driven Auxiliary Feedwater Pump discharge throttle valves given a demand signal prior to securing the pump? (0.5)

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

QUESTION 2.08 (2.50)

a. Besides under voltage, what are the precise conditions necessary to actuate the SHUTDOWN SEQUENCER? (0.75)

b. What are the 2 precise signals, either of which will actuate the LOCA sequencer? Ignore testing actuation. (0.5)

c. If the motor driven Auxiliary Feedwater (AFW) Pumps receive an auto start signal during LOCA or SHUTDOWN sequencing, will they start in each case? (0.5)

d. How do the sequencers react if both if both receive actuation signals simultaneously? (0.75)

QUESTION 2.09 (2.00)

a. Which one of the following is NOT a design function of the Steam Dump System?

1. Maintain steam pressure during plant startup in accordance with reference pressure.

2. Prevent over pressurization of the main condenser during plant cooldown.

3. Prevents lifting of S/G safety valves on turbine trip at full power.

4. Allows 50% load rejection without resulting in a reactor trip. (1.0)

b. How many solenoid air valves must be properly positioned to:

1. Open a Steam Dump Valve?

2. Close a Steam Dump Valve? (1.0)

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

QUESTION 2.10 (3.00)

a. What are the specific functions of the Emergency Core Cooling System (ECCS) for loss of PRIMARY and SECONDARY COOLANT accidents? (1.0)

b. What are the 4 specific accidents that the ECCS is supposed to provide mitigation for? (1.0)

c. For a SI signal, indicate if the following ECCS valves/components receive a CLOSE, OPEN, or NO SIGNAL: (1.0)

1. ESW supply and return to containment coolers.
2. ESW radiation monitor isolation
3. Auxiliary Bldg. emergency exhaust fan suction damper from Aux. Bldg.
4. Containment Cooler ESW throttle valve.
5. Service Water supply to ESW (1.0)

QUESTION 2.11 (2.50)

a. With some exceptions most of the penetrations into the RCS loops are located above the horizontal centerline of the piping. What is the reason for this? (0.75)

b. What are 3 of the 4 penetrations that actually extend into the coolant flow path AND why is this done? (1.0)

c. What effect will breaking the High Pressure sensing line on a loop flow transmitter have on the protection system? WHY? (0.75)

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

QUESTION 3.01 (2.50)

For this question, assume the reactor is operating at 90% power with bank D at 200 steps and the rods in automatic.

a. How would the parameters monitored by the Rod Control System change change initially after dropping a single peripheral rod? (1.5)

b. Would rod motion be expected, and if so, in what direction? (0.5)

c. Would any of the rod blocks listed below be expected in this situation? (State YES or NO for each.)

1. C-2.

2. C-3.

3. C-4.

4. C-5.

5. C-11. (0.5)

QUESTION 3.02 (1.50)

The reactor is in hot shutdown with RCS pressure at 1800 psig. The reactor trip breakers have been reset and the shutdown banks are fully withdrawn. I & C maintenance personnel want to perform a calibration on the Turbine Impulse pressure channels. Explain why this should or should not be done at this time. (1.5)

QUESTION 3.03 (2.50)

Find five (5) examples of improper plant or system responses in the following scenario:

The plant is operating at 75% power when an instrument technician mistakenly removes two (2) level transmitters on the same Steam Generator (SG) from service by isolating the transmitters and opening the equalizing valves. The resulting indicated low level in the SG causes a reactor trip, Main feedwater pumps trip, and all 3 auxiliary feed water pumps start. The Turbine driven AFW Receives a low lube oil pressure alarm and then trips on loss of lube oil pressure. Motor driven AFW pump flow continues to the affected SG until the pumps trip on 2/4 HI-HI level. (2.5)

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

QUESTION 3.04 (2.50)

For the Digital Rod Position Indicating (DRPI) system:

a. What are the 3 specific conditions detected by DRPI that will cause a Computer Rod Deviation "RPI DEV or PR TILT" (C-079) alarm? (0.75)

b. Generally, what is the cause of "RPI URG" (A-080) and "RPI NON URG" (B-080) alarms? (1.0)

c. What are the variable inputs utilized by a Rod Insertion Monitor System Computer? (0.75)

QUESTION 3.05 (1.00)

What components would be automatically operated if a 17% bistable in the Pressurizer Level Control circuit failed low/off? IDENTICAL PARALLEL COMPONENTS COUNT AS ONLY ONE COMPONENT. (1.0)

QUESTION 3.06 (1.00)

With the pressurizer level control selector switch in the LT-459 position, a failure causes the following SEQUENTIAL plant events. (assume no operator actions taken)

1) Charging flow reduced to minimum

2) Pressurizer level decreases

3) Letdown secured and heaters off

4) Level increases until high level reactor trip

Which ONE of the following failures occurred?

a) Level channel 459 failed high

b) Level channel 459 failed low

c) Reference pressurizer level failed to the no load position

d) Auctioneered Tave failed Hi due to a failed RTD

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

QUESTION 3.07 (2.00)

Match the actual reactor trip breaker response of column B to the reactor trip initiators in column A. Not all of column B answers will be used. Column B answers may be used more than once. (RTBs = reactor trip breakers, RTA or RTB = reactor trip breaker A or B, BYA or BYB = bypass reactor trip breaker A or B).

Column A	Column B
a. Hi pressurizer level train A	1. UV trip of all RTBs Shunt trip of all RTBs
b. Simultaneously shutting both bypass RTBs	2. UV trip of RTA & BYB Shunt trip of RTA
c. Manual SI on Main Control Board, Reactor Panel	3. UV trip of RTA Shunt trip of RTA & BYA
d. Manual trip on Main Control Board BOP Panel	4. UV trip of all RTBs Shunt trip of RTA & RTB
	5. UV trip of RTA & RTB Shunt trip of all RTBs

QUESTION 3.08 (3.00)

Answer the following for the RCP Undervoltage AND RCP Underfrequency Reactor Trips

a. WHERE do the detectors sense voltage and frequency (bus, motor, breaker?), and what is the specific detector logic that provides trip actuation signals? (1.0)

b. Along with core protection, what are the specific design goals or accomplishments of the 2 trips? (1.0)

c. Besides reactor trip, what other specific action is performed EITHER by the trip, or as a result of reaching the trip setpoint? (1.0)

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

QUESTION 3.09 (2.00)

For each of the following situations determine whether the rod control interlocks should prevent outward rod motion. For those conditions where outward rod motion is prevented, explain what actions must be taken to reestablish outward rod motion. Assume rod control is in manual. Consider each case separately.

a. An intermediate range nuclear instrument fails high during a plant startup with reactor power at 10%.

b. A power range nuclear instrument fails high during a plant startup with reactor power at 60%.

c. The turbine first stage impulse pressure transmitter fails low during a plant startup with reactor power at 20%.

d. Simultaneously Loop 1 Th fails high and Loop 1 Tc fails low while operating at 100% power. (2.0)

QUESTION 3.10 (2.50)

a. Indicate if the following actuation signals originate in the Solid State Protection System (SSPS) Cabinets or the Engineered Safety Features Actuation System (ESFAS) cabinets.

1. CISA
2. MSLIS
3. CPIS
4. SIS
5. AFAS
6. CSAS (1.5)

b. List 5 ESFAS signals that are initiated directly from or as a result of an SIS. (1.0)

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

QUESTION 3.11 (2.00)

a. State the 5 locations of the remote stations associated with the Site Supervisory System? (1.0)

b. How does system operation change when a Transfer Switch is placed in local? (0.5)

c. What are the 2 design functions of the Supervisory System? (0.5)

QUESTION 3.12 (1.50)

a. What is the only Area Radiation Monitor that does not use a GM Tube as a detector, and what type of detector does it use? (0.5)

b. What condition is necessary to cause the "AREA RAD HI" annunciator to alarm? (0.5)

c. How can the operator select for display the monitor with the second highest priority using the minimum number of key strokes? (0.5)

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

QUESTION 4.01 (2.50)

a. During refueling or fuel shuffle, procedures allow the operator to move the refueling machine "OFF INDEX" to insert or withdraw fuel assemblies. Why must the operator have this leeway? (0.5)

b. If a grappled fuel assembly cannot be placed in it's specified core location, what are 2 locations where the assembly may be temporarily stored. (1.0)

c. Name the positions that are be filled on a NORMAL designated refueling team. (1.0)

QUESTION 4.02 (1.50)

For partial draindown conditions, > 1/2 loop level:

a. What are 3 methods or systems of level indication? (0.75)

b. What affect may a nitrogen purge have on level indication? (0.75)

QUESTION 4.03 (3.00)

Assume a normal shutdown from full power and match the events/occurrences in column "A" with the power level in column "B" where the event normally occurs. Power levels may be used more than once or not at all. (3.0)

	"A"	"B"
a.	Stop 1 (or both) Heater Drain Pumps.	1. 10%
b.	Reduce condensate pumps to 1 operating.	2. 20%
c.	Reduce Circ. Pumps to 2 operating.	3. 23%
d.	Verify P-9 Permissive de-energized.	4. 40%
e	Ensure Power Range Low Range HI Level Trip Status Lights go out.	5. 50%
		6. 75%
f.	Reduce operating Main Feedwater Pumps to 1.	

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

QUESTION 4.04 (2.50)

With the plant at power the operator is conducting "RCS Leakage High", OFN 00-007.

a. At what point should this procedure be abandoned in favor of EMG E-0? (0.75)

b. Why is it recommended that if a leaking S/G tube is diagnosed, the plant be shutdown in a controlled manner in lieu of tripping. (0.75)

c. Which symptom below is NOT indicative of "Leakage Into The Auxiliary Building"?

1. Auxiliary bldg. CAM's show increased activity.

2. Abnormal sump pump operation.

3. Liquid waste holdup tank level increasing.

4. Increased level in Recycle Holdup Tank. (1.0)

QUESTION 4.05 (2.50)

a. During operation at power with control rods in auto, rods start to rapidly step in. What are 3 separate valid reasons for this symptom to occur? (0.75)

b. In the event of failure of the controlling pressurizer level channel, what 2 control functions must be re-established by the operator? (1.0)

c. What are the uses of the steam generator steam flow signal selected for control? (0.75)

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

QUESTION 4.06 (2.00)

Assume the unit is in cold shutdown, with the RCS drained for half loop operation.

a. How will RHR pump cavitation be detected? (0.5)

b. If vortexing and cavitation result in a loss of both RHR trains, given the most limiting conditions, how long until:

1. Boiling starts? (0.25)

2. Core uncovery occurs? (0.25)

c. If both trains of RHR are air bound, what are two (2) alternate means of decay heat removal available during half loop operation, as described in OFN OO-015, "Loss of Shutdown Cooling (RHR)?" (1.0)

QUESTION 4.07 (3.00)

a. What five buildings form the Radiological Controlled Area? (1.0)

b. What are the minimum radiation levels or exposures that require posting as a Radiation Area? (0.5)

c. What personnel monitoring requirements are imposed when entering a High Radiation Area without an RWP (dose rate < 1000 mr/hr)? (0.5)

d. What additional requirements for access are specified for a High Radiation Area where dose rates are greater than 1000 mr/hr? (1.0)

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

QUESTION 4.08 (2.50)

State how each of the cases below relates to WCGS and/or NRC exposure LIMITS. Only the largest limit of concern needs to be addressed (e.g., if a weekly and quarterly limit are challenged, only the quarterly is required for full credit).

a. A 31 year old maintenance worker, with a recorded lifetime dose of 43 rem, receives a total of 500 mrem while repairing a contaminated pump. Assume the job takes 10 days and exposure is constant over the job duration. (0.5)

b. A 21 year old auxiliary operator, with a recorded lifetime dose of 2.3 rem, receives a single exposure dose of 16 rem while locally operating equipment to assure accident mitigation during an emergency. (0.5)

c. A 27 year old Health Physics technician is found to have the following weekly exposures: (0.5)

8/30 - 9/05: 95 mrem	10/04 - 10/10: 105 mrem
9/06 - 9/12: 70 mrem	10/11 - 10/17: 287 mrem
9/13 - 9/19: 63 mrem	10/18 - 10/24: 137 mrem
9/20 - 9/26: 93 mrem	10/25 - 10/31: 63 mrem
9/27 - 10/3: 87 mrem	11/01 - 11/07: 193 mrem

d. A female I&C technician reports that she has just been diagnosed as 10 weeks pregnant. A records review indicates that the estimated dose for the gestation period to date is 625 mrem. (0.5)

e. A 53 year old Shift Supervisor receives a medical exposure of 4000 rads as part of a treatment program. (0.5)

QUESTION 4.09 (2.00)

a. What two (2) parameters, at what values, indicate adverse containment conditions have been reached? (1.0)

b. Why are adverse containment indication thresholds different from those used before reaching adverse conditions? (1.0)

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

QUESTION 4.10 (1.50)

a. When (entry conditions) and why (purpose) is EMG ES-01, "Rediagnosis," used? (1.0)

b. What condition(s) must be met to enter EMG ES-02, "Reactor Trip Response," instead of EMG-E0, "Safety Injection," when responding to a reactor trip? (0.5)

QUESTION 4.11 (1.50)

Concerning the Wolf Creek Emergency Procedures (EMG's) FOLD OUT PAGES, answer the following TRUE or FALSE.

a. All EMG fold out pages have RCP TRIP CRITERIA.

b. Fold out page SI ACTUATION CRITERIA specifics vary with the EMG.

c. Some fold out pages contain either SI RE-INITIATION CRITERIA or SI ACTUATION CRITERIA, but never both. (2.0)

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

(********** END OF EXAMINATION **********)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 1.01 (1.00)

Due to the greater decrease in the temperature of the coolant exiting the core relative to the decrease of the inlet coolant (0.5), more positive reactivity will be added in the upper core regions, resulting in a more positive (less negative) AFD (0.5).

REFERENCE
WC LP 039, Objective 6, p. 14
193009K102 ...(KA'S)

ANSWER 1.02 (2.00)

a. The increasing temperature causes a density change which results in negative reactivity. [0.5] The subsequent decrease in density results in removing boron, causing positive reactivity. [0.25] (0.75)

b. 557 F (0.25). The change in density at higher temperature is much greater than at lower temperature. So more boron atoms enter or leave the core at higher temperatures which causes a larger reactivity change for a given temperature change (0.5). (0.75)

c. Lowering boron concentration over life makes MTC more negative which causes its contribution to power defect to increase. (Hence, power defect increases). (0.5)

REFERENCE
WC LP 039, Objectives 6, 25, & 27
194004K106 192004K108 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 1.03 (3.00)

a. Decrease

b. Decrease

c. None

d. Decrease

e. Increase [0.6 ea.] (3.0)

REFERENCE
WC LP 4, Objective 2, p. 7
192002K114 ...(KA'S)

ANSWER 1.04 (2.00)

a. 1. Reactor power will initially decrease (0.35) then return to the original value (100%) (0.4). (0.75)

2. Tave will decrease until reactor power returns to 100%> (0.75)

b. The primary difference is that Tave will decrease less. Also accept smaller power decrease. (0.5)

REFERENCE
WC LP 049, Objective 4, p. 15
192008K124 192004K107 192004K106 ...(KA'S)

ANSWER 1.05 (2.50)

a. Increase in flux level is greater (0.75) and the time to stabilize is longer (0.75) as Keff approaches 1 (1.5)

b. Beta (accept number). (0.5)

c. Neutron sources are required to assure sufficient indication to safely startup. (0.5)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

REFERENCE
WC LP 043, Objectives 4, 5, p. 22, 23, 24
WC LP 046, Objective 9, p. 11
192003K111 192003K108 192003K101 ...(KA'S)

ANSWER 1.06 (2.00)

a. Rod worth is a function of the local/average flux ratio. When 1 CR is stuck out with all others inserted, it's flux ratio is very large, making it's worth very high. (CONCEPT) (1.0)

b. Rod overlap is one of the conditions necessary to ensure Hot Channel Factors are not exceeded. Also accept power dist. limits. (1.0)

REFERENCE
WC LP 005-8, Objectives 11 & 15, p. 26, 27
192005K115 192005K109 ...(KA'S)

ANSWER 1.07 (2.00)

a. False

b. True

c. False

d. False

REFERENCE
WC LP 039, Objectives 5, 6, 8, & 9, various pages
192006K107 192006K105 ...(KA'S)

ANSWER 1.08 (2.00)

a.True
b.False
c.False
d.True (0.5 pts each)

REFERENCE
Westinghouse Thermal-Hydraulic Principles, Chapter 10, various pages
191004K115 191004K112 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 1.09 (2.50)

a. 1. Presence of a flaw (or crack of sufficient size). (0.5)
2. Low temperature. (or Temp below NDT) (.5)

b. Reduces the thermal stress. (Reduced DT across the RV wall reduces total/thermal/tensile stress.) (0.5)

c. Neutron exposure (integrated) (0.5) makes the material more brittle (raises NDT) (Reduces ductility) (0.5)

REFERENCE
Westinghouse Thermal-Hydraulic Principles, Ch. 13, p. 58-62
193010K105 193010K104 193010K101 ...(KA'S)

ANSWER 1.10 (1.50)

1. Add 15 psi to 595 psig = 610 psia (0.25)

2. Using steam tableS, @ 610 psia, Tsat = 488 +/- 2 deg's F (0.5)

3. Tsat in S/G = Trcs - Tsubcooling = 488 - 200 = 288 +/- 2 deg's F(0.25)

4. Using steam tables, Psat @ Tsat = 288 deg's F = 56 +/- 4 psia (0.5)

REFERENCE
Steam Tables
002000K515 ...(KA'S)

ANSWER 1.11 (1.50)

a. Increases NPSH (0.25), because the slower pump speed will decrease flow / friction / losses (0.25). (0.5)

b. Increases NPSH (0.25), due to RCS pressure increase. (0.25). (0.5)

c. Increases NPSH (0.25), because fluid temperature has decreased (0.25). OR; Decrease [0.25] due to initial pressure decrease. [0.25] (0.5)

REFERENCE
Westinghouse Thermo-Hydraulic Principles, Chapter 10, p. 44
191004K106 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 1.12 (1.00)

a. Increases (because of steam generator swell). (0.5)

b. Decreases (because of pressurizer outsurge). (0.5)

REFERENCE
Westinghouse Thermo-Hydraulic Principles, Ch. 11 & 12
192004K108 002020K508 ...(KA'S)

ANSWER 1.13 (2.00)

a. Effective area available to condense steam is reduced, which increases Tsat and Psat. The change in Psat causes extracting less work from the turbine, so efficiency decreases.

b. Increasing noncondensibles block some tube area, with same consequences as above. Also, this reduces the amount of steam undergoing phase change, which decreases the specific volume change, leading to higher pressure, and the effects above.

c. Reduced mass flow reduces Q from the steam, causing less dT, with a corresponding increase in Tsat and Psat, with the effects above.

(3 answers @ 0.666 ea.; General concept required, not specific answer)

REFERENCE
Westinghouse Thermo-Hydraulic Principles, Chapter 9, p. 24, 25, 34
193005K103 191006K110 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 2.01 (2.00)

1. Containment sump suction (8811) must be closed.
2. RWST suction (8812) must be closed.
3. Discharge to CCP and SI (8804) must be closed
4. RCS pressure must be < 360 psig. [0.5 ea.] (2.0)

REFERENCE
WC LP 083, P. 11, 12
005000K402 005000K401 ...(KA'S)

ANSWER 2.02 (2.00)

a. 1. Normal breaker open.
2. Alternate voltage > 90% rated.
3. Bus Sync. Transfer Switch on.
4. Lockout relays reset.
5. Dead bus or Sync check met [Any 4, 0.3 ea.] (1.2)

b. 1. Both main generator output breakers open.
2. A lockout relay for the generator has actuated.
3. The 386-1/G relay is satisfied. (This requires:
A reverse power condition which has existed for 30 seconds OR A turbine trip due to thrust bearing wear or loss of vacuum.)
[Any 2, 0.4 ea.] (0.8)

REFERENCE
WC LP 049, Pp. 15,16,23
062000K401 062000K403 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 2.03 (2.50)

a. #1-------- 2200 psi (accept 2100 - 2300 psi)
#2-------- 35 psi (Accept 15 - 50 psi)
#3-------- 0 psi (Accept 0 - 5 psi) [0.25 ea.] (0.75)

b. Must maintain minimum (200) psid so seal surfaces will not contact as it is designed as a film riding seal. (0.75)

c. Containment sump, or RCDT. [0.25 ea.] (0.5)

d. Changes from a face rubbing type (contact) to a film riding seal. (0.5)

REFERENCE
WC LP 025, Pp. 8, 9
003000K103 ...(KA'S)

ANSWER 2.04 (3.00)

a. 1. LD HX
2. Excess LD HX
3. Seal Water HX
4. PDP
5. CCP

b. 1. CCP discharge to BIT
2. SI pump cross-tie to CCP suction

c. 1. RHR letdown to CVCS
2. RHR discharge to CCP suction [0.33 ea.] (3.0)

REFERENCE
WC LP 037, System Diagram
004020K112 004010K101 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 2.05 (2.00)

a. False
b. True
c. True
d. False [0.5 ea.] (2.0)

REFERENCE
WC LP 015-3, Pp13, 14
034000K402 ...(KA'S)

ANSWER 2.06 (1.00)

b.

REFERENCE
WC LP 015-8, Pp. 11 - 20
034000K402 ...(KA'S)

ANSWER 2.07 (2.50)

a. Electric motor
Air (accept N2 backup) [0.25 ea.] (0.5)

b. The motor driven valves will control to limit the total flow to a single S/G to < 300 GPM. [0.5] This design feature will act to:

1. Limit peak containment pressure on a steam break.
2. Prevent pump runout and cavitation.
3. Limit feedline break flow so that intact S/G's can receive sufficient feedwater. [ANY 2, 0.5 EA.] (1.5)

c. To crack the valves off their closed seats and and prevent hydraulic lock (preventing automatic opening). (0.5)

REFERENCE
WC LP 037, Pp.16, 17
061000K605 0610000G007 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 2.08 (2.50)

a. 1. Both normal and alternate ESF supply breakers open.
2. No SIS or CSAS
3. D/G breaker closed [0.25 ea.] (0.75)

b. 1. SIS
2. CSAS [0.25 ea.] (0.5)

c. No. (Accept yes with proper assumption and explanation) (0.5)

d. The LOCA sequencer is blocked immediately. [0.25] The SHUTDOWN sequencer is blocked when the D/G breaker is shut. [0.25] and the LOCA sequencer starts. [0.25] (0.75)

REFERENCE
WC LP 069, Pp. 25 - 29
064000K411 064000K410 ...(KA'S)

ANSWER 2.09 (2.00)

a. 2. (1.0)

b. 1. 4 (Also accept 3 for full credit) [0.5]
2. 1 [0.5] (1.0)

REFERENCE
WC LT 19, Pp.3, 5
041020K404 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 2.10 (3.00)

a. Primary: Provide core cooling.
Secondary: Provide SDM (boration) [0.5 ea.] (1.0)

b. 1. LOCA
2. Rod eject.
3. Loss of secondary coolant
4. SGTR [0.25 ea. (1.0)

c. 1. OPEN
2. CLOSE
3. OPEN
4. NO SIGNAL
5. CLOSE [0.2 ea.] (1.0)

REFERENCE
WC LP 038, Pp. 8, 9, 26 - 28
006030A201 006020K404 006000K405 006000A303 ...(KA'S)

ANSWER 2.11 (2.50)

a. To provide for lowering the water level for maintenance and continuing RHR cooling operation. (0.75)

b. 1. Spray line
2. Hot leg RTD manifold connection
3. Wide range temperature detector
4. Nuclear sampling system connections. [any 3, 0.25 ea.]

To convert coolant velocity to pressure head, OR to obtain a more representative sample. (Accept either answer) [0.25] (1.0)

c. Breaking the high pressure side will provide all 3 low flow signals [0.5] because the HP tap is common to all 3 detectors.[0.25] (0.75)

REFERENCE
WC LP 023, Pp. 16 - 20
002002000K ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 3.01 (2.50)

a. 1. Auctioneered hi NI should decrease. (Also accept local power decrease) (0.5)

2. Turbine impulse pressure should hold constant. (0.5)

3. Auctioneered Tavg should decrease. (0.5)

b. Rods should step OUT (to restore temperature). Also accept OUT in response to spike of auctioneered power. (0.5)

c. 1. NO
2. NO
3. NO [5 answers @ 0.1 each]
4. NO
5. YES (Accept NO for assumption that rods initially move in.)(0.5)

REFERENCE
WC LP LO 13 001 00, Revision 2, p. 22, 31
001050K401 001000A203 ...(KA'S)

ANSWER 3.02 (1.50)

Should not be performed at this time. [0.5] Placing in test will deenergize the interlock circuit P-13 which feeds P-7. [0.5] This will unblock the low pressurizer trip and the shutdown control rods will trip. [0.5] (1.5)

REFERENCE
WC LP 050, P. 18
012000K406 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 3.03 (2.50)

1. Indicated level would increase due to "0" d/p

2. MFW pumps do not trip on low level.

3. TDAFWP does not start does not start on low level on 1/4 S/G.

4. TDAFWP does not trip on low lube oil.

5. MDAFWP's don't trip on high SG level. [0.5 ea.] (2.5)

REFERENCE
WC LP 045, Pp. 12-15
016000A201 ...(KA'S)

ANSWER 3.04 (2.50)

a. 1. Deviation (+ or - 12 steps) between any rod and it's bank demand signal.

2. Deviation (+ or - 12 steps) between any 2 rods in the same bank.

3. Any shutdown rod <210 steps.

4. Bank out of sequence. [any 3, o.25 ea.] (0.75)

b. URG: Occurs if there is an error or failure in the information from both data cabinets. (0.5)

NON URG: Occurs for an error in either "A" or "B" data for any rod. (0.5)

c. Tavg, delta T, and bank demand signal from P/A converter. [0.25 for ea. input] (0.75)

REFERENCE
WC LP 0.3-8, Pp14, 19, 20
014000G012 014000A103 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 3.05 (1.00)

1. Pzr. Heaters
2. Letdown isolation valves
3. Letdown orifice isolation valves [0.33 ea.] (1.0)

REFERENCE
WC LP 055, P. 25
011000K303 011000K302 011000K301 ...(KA'S)

ANSWER 3.06 (1.00)

"a"

REFERENCE
WC LP 055, P. 38
011000A210 ...(KA'S)

ANSWER 3.07 (2.00)

a. 2
b. 4
c. 1
d. 1 (2.0)

REFERENCE
WC LP 050
012000K603 012000K103 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 3.08 (3.00)

a. UF & UV Sensors are between the breaker and the RCP. Accept cabinets in electrical penetration room for detector location. (0.5)
UF & UV Logic - 1/2 detectors on 2/2 busses (0.5)

b. Both trips are designed to anticipate degraded flow conditions [0.5] and improve response time of the RPS. [0.25] An added goal of the UF trip is to improve flow coastdown time. [0.25] (1.0)

c. UF: All RCP breakers are tripped by the trip signal. (0.5)

UV Reaching the setpoint on the bus will trip the RCP's supplied by the affected bus. (0.5)

REFERENCE
WC LP 050, Pp.19, 20
012000K402 003000K502 003000K304 ...(KA'S)

ANSWER 3.09 (2.00)

a. Rod motion is prevented
Block C1 signal
(Accept "No effect" if C-1 blocked) (0.5)

b. Rod motion is prevented
Position Rod stop bypass switch. (0.5)

c. No effect (0.5)

d. No effect (0.5)

REFERENCE
WC LP 063, Pp. 22, 34
012000K610 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 3.10 (2.50)

a. 1. SSPS
2. SSPS
3. ESFAS
4. SSPS
5. ESFAS
6. SSPS [0.25 ea.] (1.5)

b. 1. CISA
2. FWIS
3. CRVIS
4. CPIS
5. AFAS
6. SGBSIS [Any 5, 0.2 ea.] (1.0)

REFERENCE
WC LP 076, Pp.20, 21, 24
012000K105 013000KK10 ...(KA'S)

ANSWER 3.11 (2.00)

a. 1. CWSH
2. SWYD
3. MUSH
4. BDDS
5. MUDS [0.2 ea.] (1.0)

b. Disables digital control functions from the MCB. (0.5)

c. 1. Data collection and analysis.
2. Control [0.25 ea.] (0.5)

REFERENCE
WC LP 045, Pp. 8 -10
016000K402 016000K403 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 3.12 (1.50)

a. Post Accident Sampling Monitor. [0.25] Ion Chamber. [0.25] (0.5)

b. Any area monitor in an "ALERT" (yellow light) condition. (0.5)

c. Press the SEL KEY twice. (0.5)

REFERENCE
WC LP 006-8, P. 5 & WC LP 055, P. 7
072000A401 072000K601 073000A402 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 4.01 (2.50)

a. To facilitate the insertion and removal of fuel assemblies that have become bowed. (0.5)

b. 1. RCCA change fixture
2. Alternate core location [0.5 ea.] (1.0)

c. 1. SRO
2. Cont. Upender Operator
3. Fuel Bldg. Upender Operator
4. Refueling Machine Operator
5. Fuel Pool Bridge Crane Operator [0.2 ea.] (2.5)

REFERENCE
WC FHP 02-011, Pp. 3, 6
034000A203 0340006001 ...(KA'S)

ANSWER 4.02 (1.50)

a. 1. Temporary tygon hose
2. Przr. cold cal. level (LI-462)
3. Loop level ind. (LI-53.
4. RVLIS [any 3, 0.25 ea.] (0.75)

b. Pressure due to purge may cause level to indicate higher than actual level. Accept LOWER if prrge rate is compared to an excessive drain rate. (0.75)

REFERENCE
GEN 00-007, Pp. 2, 3
002000K402 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 4.03 (3.00)

a. 4.
b. 2.
c. 5.
d. 5.
e. 3.
f. 5. [0.5 ea.] (3.0)

REFERENCE
WC GEN 00-004, Pp. 9, 10
194001A102 ...(KA'S)

ANSWER 4.04 (2.50)

a. When leakage exceeds the capacity of 2 charging pumps. (0.75)

b. Prevent excessive thermal stresses on weakened tubes. (0.75)

c. 4. (1.0)

REFERENCE
WC OFN 00-007, Pp. i, 1, 6
000011G011 ...(KA'S)

ANSWER 4.05 (2.50)

a. Instrument failure, Accept any example
Turbine runback
Load rejection
Rx./Sec. power mismatch [Any 3, o.25 ea.] (0.75)

b. Restart control heaters [0.5] and re-establish letdown. [0.5] (1.0)

c. To provide a steam flow /feed flow error signal for the FWRV controller [0.25] and to provide a total flow signal for control of feed pump speed. [0.25] Provide S/G flow mismatch annunciator.[0.25] (0.75)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

REFERENCE
WC OFN 00-008, Pp. 8, 27, 38
016000A401 016000K302 016000K403 ...(KA'S)

ANSWER 4.06 (2.00)

a. Pump/loop current, flow, pressure, level oscillations. Accept any symptom for full credit. (0.5)

b. 1. 15 - 45 minutes. (0.25)

2. 1 - 2.5 hours. Accept any time within ranges. (0.25)

c. 1. Dump from SI accumulators.

2. Pump/gravity feed from RWST.

3. Increase charging & letdown plus drain to RCDT.

4. With vessel head removed, flood up cavity & use SFPCS.

5. Use SG in reflux mode. [Any 2/5, 0.5 ea.] (1.0)

REFERENCE
WC OFN 00-015, Loss of Shutdown Cooling (RHR), Revision 4, p. 8-11
000025A207 000025K101 000025K303 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 4.07 (3.00)

a. 1. Auxiliary.
2. Fuel.
3. Hot Machine Shop.
4. Radwaste.
5. Reactor.
6. Control building basement. [Any 5, 0.2 ea.] (1.0)

b. 1. Accept 2 or 5 mrem/hr.
2. 100 mrem in any 5 consecutive days. (0.25 ea.] (0.5)

c. Accept either: [Either case, 2 answers at 0.25 ea.]
1. dose rate monitor.
2. dose integrating device with preset alarm
OR
3. H. P. technician and dose rate monitor
Accept 1 and 2 for 0.25 ea. or 3 for 0.5. (0.5)

d. 1. Continuous HP surveillance.
2. Shift Supervisor approval.
3. Required to be locked [Any 2, 0.5 ea.] (1.0)

REFERENCE
WC LP LO 10 310 07, Radiation Protection Manual, Rev. 0, p. 25, 26, 32, 33

194001K103 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 4.08 (2.50)

a. The only limit in question is the 300 mrem weekly limit. If 10 days are assumed to be 2 5-day weeks, then no limit has been violated (note 100 mrem weekly is goal not limit). If 10 days are assumed to be continuous, then weekly limit has been violated (500/10*7=350). (0.5)

b. The dose given will violate the NRC lifetime limit/proviso of 5(n-18). Single 16 rem dose is allowed under emergency conditions. (0.5)

c. No limits are violated. Weekly are all under 300 mrem, and CALENDAR quarter are less than 1000 mrem (Quarter breaks at 10/1). (0.5)

d. Pre-natal limit is 500 mrem. Since exposure occurred prior to notification, may be interpreted as not a violation. (0.5)

e. Medical exposure is not controlled or considered in exposure limits. (Would expect no occupational exposure under conditions.) (0.5)

REFERENCE
WCGS LP LO 10 310 07, Rev. 0, Objectives 6 & 7, various pages
194001K103 ...(KA'S)

ANSWER 4.09 (2.00)

a. 1. Containment pressure @ 5 psig. (0.5)

2. Containment radiation @ 10EE5 rad/hr. (0.5)

b. Adverse containment conditions may cause significant errors in the indications of instruments located inside containment. (CONCEPT) (1.0)

REFERENCE
WC EMG Generic Study Guide, Student Handout, Revision 0, LOSH 001, p. 6

000103A101 000103G015 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-PELLET, J.

ANSWER 4.10 (1.50)

a. ES-01 is used when, based on operator judgement [0.5], it is necessary to determine or confirm the most appropriate post accident recovery procedure [0.5]. (1.0)

b. ES-02 is used when, based on operator judgement, SI is neither actuated nor required. (0.5)

REFERENCE
WC EMG ES-01, Rediagnosis, Revision 1, p. 1
ES-02, Reactor Trip Response, Revision 1, p. 1
000007G011 ...(KA'S)

ANSWER 4.11 (1.50)

a. False
b. False
c. True [0.5 ea.] (2.0)

REFERENCE
WC EMG Fold Out Pages
000011G010 000011K314 ...(KA'S)

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

FACILITY: WOLF CREEK

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 87/10/27

EXAMINER: WHITTEMORE, J.

CANDIDATE: _____

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	25.25	_____	_____	5.	THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.25	_____	_____	6.	PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.25	_____	_____	7.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
24.00	24.24	_____	_____	8.	ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
99.00		_____ Final Grade	_____%		Totals

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

_____
Candidate's Signature

QUESTION 5.01 (1.00)

HOW and WHY will Axial Flux Difference change if reactor power is reduced from 100% to 50%? Assume the reactor is operating at 100% power with all rods out (ARO), early in cycle life at equilibrium Xenon conditions when power is reduced to 50% by borating (no rod motion). Neglect changes due to Xenon.

QUESTION 5.02 (2.50)

a. Explain two effects on core reactivity that occur as Reactor Coolant temperature is increased at Wolf Creek? (0.75)

b. Which initial temperature, 58 deg's F or 557 deg's F, will give the largest change in the magnitude of MTC as boron concentration is lowered from 1000 to 500 ppm? BRIEFLY EXPLAIN WHY. (1.0)

c. WHY does power defect become more negative as the core ages? (0.75)

QUESTION 5.03 (1.00)

Choose the correct statement below:

a. Increasing moderator temperature causes the Doppler to become more negative.

b. Core age causes the Doppler coefficient to become less negative.

c. Core age causes the DOPPLER ONLY coefficient to become more negative.

d. The fraction of neutrons absorbed in the fuel increases as the fuel temperature decreases. (1.0)

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

QUESTION 5.04 (2.00)

a. Describe how inserting a control rod group 10 steps (from ARO) would affect each of the parameters below. Continue discussion until steady state reached. Assume the plant is operating at 100% power early in cycle life and all other parameters are normal for this condition.

1. Reactor power. (0.75)

2. RCS Tave. (0.75)

b. How would the plant response differ at end of life? (0.5)

QUESTION 5.05 (1.00)

Why is the reactor designed with several small control rods in an assembly rather than one large rod? (1.0)

QUESTION 5.06 (2.00)

TRUE or FALSE?

a. Equilibrium Sm-149 concentration is independent of core age. (0.5)

b. Equilibrium Xe-135 concentration is independent of core age. (0.5)

c. After a reactor trip from 100% power, Sm-149 peaks in 20~25 days. (0.5)

d. After a reactor trip from 50% power, the time required to reach Xe-free core conditions is less than half the time to Xe-free from a trip at 100% power. (0.5)

QUESTION 5.07 (1.00)

During a routine reactor startup control rods are withdrawn to increase count rate from 200 cps to 400 cps (double the initial count rate).

a. If the same amount of reactivity were added again, would the reactor be subcritical, critical, or supercritical? (0.5)

b. If the startup continued in a normal manner, would criticality be expected before or after reaching 15,000 cps? (0.5)

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

QUESTION 5.08 (2.50)

a. Provide two reasons why the EFFECTIVE delayed neutron fraction differs from the core ACTUAL delayed neutron fraction. (1.5)

b. TRUE or FALSE

1. 0.02 dk/k = 200 PCM

2. Keff = 1 / 1-Rho (1.0)

QUESTION 5.09 (2.00)

a. Why can the neutron population remain relatively constant in a subcritical reactor with Keff less than 1? (0.75)

b. Explain why initially locating the detector further from the neutron source than required during core loading will still result in a conservative 1/M plot (0.75)

c. Why is initially locating the detector too far from the core during core load considered unconservative? (0.5)

QUESTION 5.10 (1.50)

Explain HOW and WHY the following occurrences would affect net positive suction head (NPSH) available to the reactor coolant pumps (RCP's). Assume that no operator action occurs and consider each case independently.

a. Grid frequency decreases from 60.0 hz to 59.8 hz. (0.5)

b. Pressurizer temperature increases. (0.5)

c. Turbine power increases slightly with rods in manual. (0.5)

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

QUESTION 5.11 (1.00)

What is the INITIAL effect (INCREASE, DECREASE, NONE) on the parameters below if one steam dump valve fully opens with the plant operating at 67% power. Assume all control systems are in automatic.

a. Steam generator level. (0.5)

b. Pressurizer level. (0.5)

QUESTION 5.12 (2.00)

Explain WHY each of the condenser conditions below act to decrease overall efficiency of the plant.

a. Hotwell level increases (above normal levels).

b. Noncondensible gas inventory increases.

c. Circulating water flow decreases.

QUESTION 5.13 (2.00)

TRUE or FALSE?

a. During high power operation, the secondary mass (steam) flow rate changes throughout the turbine. (0.5)

b. The secondary side enthalpy change (delta h) across the steam generator decreases with increasing power. (0.5)

c. During a reactor startup, reactor coolant mass flow rate in the loops with operating reactor coolant pumps (RCPs) increases as each additional RCP is started. (0.5)

d. When operating with three RCPs running, reactor coolant in the loop with a stopped RCP is all at Tcold (no delta T). (0.5)

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

QUESTION 5.14 (1.50)

Define CRITICAL HEAT FLUX as it relates to DNB, AND state the variables of concern. (1.5)

QUESTION 5.15 (2.00)

What two (2) power distribution limits are used to ensure the power distribution shape in the core is acceptable? BRIEFLY describe how each is determined and in which direction (AXIALLY or RADIALLY) each ensures acceptable power distribution. (2.0)

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

QUESTION 6.01 (2.50)

Concerning the Reactor Coolant Pump (RCP) seal package:

a. What it the normal pressure drop across the 3 different seals? (0.75)

b. Why must the operator observe and maintain the specified minimum pressure drop across the #1 seal? (0.75)

c. What are 2 possible collection points for any leakage that goes through the #3 seal? (0.5)

d. How does the operational mode (method of sealing) of the #2 seal change should the #1 seal fail? (0.5)

QUESTION 6.02 (2.00)

Concerning the Refueling Machine, answer the following True or False:

a. The air operated pneumatic gripper must have air to engage.

b. All bridge, trolley, and fuel mast positions are controlled from the operator console.

c. Core index strip position is transmitted via TV camera.

d. There is no indication of hoist speed on the console. (2.0)

QUESTION 6.03 (2.50)

a. Besides under voltage, what are the precise conditions necessary to actuate the SHUTDOWN SEQUENCER? (0.75)

b. What are the 2 precise signals, either of which will actuate the LOCA sequencer? Ignore testing actuation. (0.5)

c. If the motor driven Auxiliary Feedwater (AFW) Pumps receive an auto start signal prior to LOCA or SHUTDOWN sequencing start signal, will they start in each case? (0.5)

d. How do the sequencers react if both receive actuation signals simultaneously? (0.75)

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

QUESTION 6.04 (3.00)

a. What are the specific functions of the Emergency Core Cooling System (ECCS) for loss of PRIMARY and SECONDARY COOLANT accidents? (1.0)

b. What are the 4 specific accidents that the ECCS is supposed to provide mitigation for? (1.0)

c. For a SI signal, indicate if the following ECCS valves/components receive a CLOSE, OPEN, or NO SIGNAL: (1.0)

1. ESW supply and return to containment coolers.
2. ESW radiation monitor isolation
3. Auxiliary Bldg. emergency exhaust fan suction damper from Aux. Bldg.
4. Containment Cooler ESW throttle valve.
5. Service Water supply to ESW (1.0)

QUESTION 6.05 (2.50)

Answer the following concerning the Containment Cooling System:

a. What equipment or components are cooled by the "Cavity Cooling Fans" and how are the fans affected by a SIS? (1.0)

b. What is the normal status of the Hydrogen Mixing Fans, and how does the status change in the event of Safety Injection? (0.5)

c. 1. Describe how the flow path of the air moved by the Containment fan coolers may change during LOCA conditions. (0.4)

2. Describe WHAT causes the flow path change to occur and explain WHY the change is desired. (0.6)

QUESTION 6.06 (1.50)

The reactor is in hot shutdown with RCS pressure at 1800 psig. The reactor trip breakers have been reset and the shutdown banks are fully withdrawn. I & C maintenance personnel want to perform a calibration on the Turbine Impulse pressure channels. Explain why this should or should not be done at this time. (1.5)

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

QUESTION 6.07 (2.50)

Find five (5) examples of improper plant or system responses in the following scenario:

The plant is operating at 75% power when an instrument technician mistakenly removes two (2) level transmitters on the same Steam Generator (SG) from service by isolating the transmitters and opening the equalizing valves. The resulting indicated low level in the SG causes a reactor trip, Main feedwater pumps trip, and all 3 auxiliary feed water pumps start. The Turbine driven AFW Receives a low lube oil pressure alarm and then trips on loss of lube oil pressure. Motor driven AFW pump flow continues to the affected SG until the pumps trip on 2/4 HI-HI level. (2.5)

QUESTION 6.08 (1.00)

With the pressurizer level control selector switch in the LT-459 position, a failure causes the following SEQUENTIAL plant events. (assume no operator actions taken)

1) Charging flow reduced to minimum

2) Pressurizer level decreases

3) Letdown secured and heaters off

4) Level increases until high level reactor trip

Which ONE of the following failures occurred?

a) Level channel 459 failed high

b) Level channel 459 failed low

c) Reference pressurizer level failed to the no load position

d) Auctioneered Tave failed Hi due to a failed RTD

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

QUESTION 6.09 (2.00)

For each of the following situations determine whether the rod control interlocks should prevent outward rod motion. For those conditions where outward rod motion is prevented, explain what actions must be taken to reestablish outward rod motion. Assume rod control is in manual. Consider each case separately.

a. An intermediate range nuclear instrument fails high during a plant startup with reactor power at 10%.

b. A power range nuclear instrument fails high during a plant startup with reactor power at 60%.

c. The turbine first stage impulse pressure transmitter fails low during a plant startup with reactor power at 20%.

d. Simultaneously Loop 1 Th fails high and Loop 1 Tc fails low while operating at 100% power. (2.0)

QUESTION 6.10 (2.50)

a. Indicate if the following actuation signals originate in the Solid State Protection System (SSPS) Cabinets or the Engineered Safety Features Actuation System (ESFAS) cabinets.

1. CISA
2. MSLIS
3. CPIS
4. SIS
5. AFAS
6. CSAS (1.5)

b. List 5 ESFAS signals that are initiated directly from or as a result of an SIS. (1.0)

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

QUESTION 6.11 (1.00)

Concerning the Steam Generator Level Control System (SGLC) System flow or level error dominance feature, which statement below is correct?

a. The dominance results from the controller proportional output only.

b. The dominance factor will change for a constant level error with time.

c. The rate of level error change affects the dominance.

d. The level lag circuit ensures level error dominance during transient periods. (1.0)

QUESTION 6.12 (2.00)

a. What is the purpose of the isolation switches on the Auxiliary Shutdown Panel 118B? (0.5)

b. What automatic features or interlocks will be deleted if RP HIS-1, HIS-2, and HIS-3 are placed in "ISOLATE"? (1.0)

c. What equipment and/or parameters are affected by the 12 remaining panel transfer switches? (0.5)

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

QUESTION 7.01 (2.50)

Explain what actions or verifications are required to complete the immediate action steps from EMG E-0, "Safety Injection," listed below.

a. Step 1. Verify Reactor Trip (4 actions). (1.0)

b. Step 2. Verify Turbine Trip (2 actions). (0.5)

c. Step 3. Verify Power to AC Emergency Busses (1 action). (0.5)

d. Step 4. Check if Safety Injection is Actuated (2 actions). (0.5)

QUESTION 7.02 (2.50)

a. What are the six (6) Critical Safety Function Status Trees and the order which they should be checked per EMG F-0, "Critical Safety Function Status Trees," (CSFST's)? (1.5)

b. In general terms, what does a "red path" CSFST signify AND what action(s) are required? (1.0)

QUESTION 7.03 (1.50)

a. When (entry conditions) and why (purpose) is EMG ES-01, "Rediagnosis," used? (1.0)

b. What condition(s) must be met to enter EMG ES-02, "Reactor Trip Response," instead of EMG-E0, "Safety Injection," when responding to a reactor trip? (0.5)

QUESTION 7.04 (2.00)

What are four (4) of the five criteria which are verified to indicate natural circulation flow in the RCS? (2.0)

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

QUESTION 7.05 (2.50)

a. What are three (3) symptoms which require immediate boration? (1.0)

b. If immediate boration is required, what three (3) actions are required by OFN 00-009, "Immediate Boration," to establish immediate borate flow of at least 30 gpm? (1.5)

QUESTION 7.06 (2.00)

a. What two (2) parameters, at what values, indicate adverse containment conditions have been reached? (1.0)

b. Why are adverse containment indication thresholds different from those used before reaching adverse conditions? (1.0)

QUESTION 7.07 (1.00)

When should OFN 00-013, "Control Room Not Habitable," be used rather than OFN 00-017, "Control Room Evacuation?" (1.0)

QUESTION 7.08 (2.00)

a. Which of the following Reactor Coolant Pump (RCP) parameter(s) is/are sufficiently abnormal to require operator action? Assume the plant is operating at 100% power. (1.0)

1. RCP A number one seal differential pressure indicates 150 psid.

2. RCP A number one seal and bearing water temperature indicates 200 deg's F.

3. RCP A shaft vibration indicates 10 mils.

4. RCP A frame vibration indicates 10 mils.

b. Assuming the conditions in part a, what operator action(s) is/are required? (1.0)

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

QUESTION 7.09 (2.00)

Assume the unit is in cold shutdown, with the RCS drained for half loop operation.

a. How will RHR pump cavitation be detected? (0.5)

b. If vortexing and cavitation cause a loss of both RHR trains, given the most limitng conditions, how long until:

1. Boiling starts? (0.25)

2. Core uncovery occurs? (0.25)

c. If both trains of RHR are air bound, what are two (2) alternate means of decay heat removal available during half loop operation, as described in OFN 00-015, "Loss of Shutdown Cooling (RHR)?" (1.0)

QUESTION 7.10 (1.50)

What three (3) types of leakage are defined by Technical Specifications as identified leakage? (1.5)

QUESTION 7.11 (3.00)

a. What five buildings form the Radiological Controlled Area? (1.0)

b. What are the minimum radiation levels or exposures that require posting as a Radiation Area? (0.5)

c. What personnel monitoring requirements are imposed when entering a High Radiation Area without an RWP (dose rate < 1000 mr/hr)? (0.5)

d. What additional access controls are specified for a High Radiation Area where dose rates are greater than 1000 mr/hr? (1.0)

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

QUESTION 7.12 (2.50)

State how each of the cases below relates to WCGS and/or NRC exposure LIMITS. Only the largest limit of concern needs to be addressed (e.g., if a weekly and quarterly limit are challenged, only the quarterly is required for full credit).

a. A 31 year old maintenance worker, with a recorded lifetime dose of 43 rem, receives a total of 500 mrem while repairing a contaminated pump. Assume the job takes 10 days and exposure is constant over the job duration. (0.5)

b. A 21 year old auxiliary operator, with a recorded lifetime dose of 2.3 rem, receives a single exposure dose of 16 rem while locally operating equipment to assure accident mitigation during an emergency. (0.5)

c. A 27 year old Health Physics technician is found to have the following weekly exposures: (0.5)

8/30 - 9/05: 95 mrem	10/04 - 10/10: 105 mrem
9/06 - 9/12: 70 mrem	10/11 - 10/17: 287 mrem
9/13 - 9/19: 63 mrem	10/18 - 10/24: 137 mrem
9/20 - 9/26: 93 mrem	10/25 - 10/31: 63 mrem
9/27 - 10/3: 87 mrem	11/01 - 11/07: 193 mrem

d. A female I&C technician reports that she has just been diagnosed as 10 weeks pregnant. A records review indicates that the estimated dose for the gestation period to date is 625 mrem. (0.5)

e. A 53 year old Shift Supervisor receives a medical exposure of 4000 rads as part of a treatment program. (0.5)

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

QUESTION 8.01 (2.00)

True or False

a. The Technical Specifications consider Pressure Isolation Valve Leakage to be a portion of the allowable identified leakage.

b. The pressure isolation valve leakage limit is specified at an RCS pressure of 2235 psig. Thus is is not possible that a lower leak rate could be limiting at a lower pressure in mode 3 or 4.

c. All listed pressure isolation valves must undergo leak rate verification surveillance after manual or auto operation.

d. The Containment Air Cooler Condensate Flow Rate and the Containment Atmosphere Gaseous Activity monitoring systems constitute 2 of the 3 normally required leakage detection systems. (2.0)

QUESTION 8.02 (2.50)

a. During operation in mode 1 with the Positive Displacement Charging Pump undergoing repair, the "A" Centrifugal Charging Pump (CCP) fails due to a power supply breaker that burns up. State 2 Technical Specification requirements that are affected and will have to be addressed. (1.5)

b. What is the basis for requiring only 1 CCP to be operable with the plant in mode 4? (1.0)

QUESTION 8.03 (2.00)

Any individual that is permitted to enter a high radiation area without an RWP must satisfy ONE of THREE Technical Specification requirements concerning radiation monitoring. What are there three requirements? (2.0)

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

QUESTION 8.04 (2.00)

It is discovered today, October 27, 1987, at 0800, that a monthly surveillance item which was due Thursday, October 22, during the midnight shift (0000-0800), was NOT performed.

In addition, you learn that the last monthly surveillance for this item was performed four (4) days late. It was performed on time for six months previous to last month.

Explain why any extended time intervals for this surveillance as given by the WCGS Technical Specifications HAVE or HAVE NOT been exceeded? (2.0)

QUESTION 8.05 (1.00)

What are 2 documents the Shift supervisor can use to determine if an event that occurs on shift is reportable, and the time constraints for reporting that event. (1.0)

QUESTION 8.06 (2.50)

a. Technical Specifications require that safety systems undergo operability surveillance. Describe the basic tasks required of operations personnel every 31 days to prove OPERABILITY of the following systems. (Correct answer requires 2 basic tasks for each system.)
   1. Containment Spray System

   2. Containment Cooling system (1.25)

b. Explain why the Technical Specifications impose internal temperature and pressure limits on the containment. Include the limiting event(s) which form the bases of the limitations. (1.25)

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

QUESTION 8.07 (3.00)

a. When is a Work Request TAG NOT required to be attached to a component affected by an open work request. (0.75)

b. How is a corrective work request readily discernible from scheduled work request? (0.5)

c. If during a review of a work request that is not yet approved it is noticed that Block 11, "Fire Protection Review" is not filled out, who should be contacted for resolution? (0.5)

d. What are 3 different methods of assigning work request numbers to work requests. The answer should include the responsible individual or group. (0.75)

e. If a work request addresses a failed safety system component, what additional documentation must be attached to the request by operations personnel? (0.5)

QUESTION 8.08 (1.00)

Choose the correct response to complete the statement below.
Tabulating and keeping track of component cycles and transient limit events listed in Table 5.7.1 of Technical Specifications is the responsibility of:

a. Technical Support

b. Operations

c. Results Engineering

d. Compliance Engineering (1.0)

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

QUESTION 8.09 (3.00)

When an operating procedure is to be utilized, it is required to be verified as current (latest revision). Further, the affected system status must be determined.

a. What are 3 of the 4 types of procedures that are exempt from the above verification requirement? (0.75)

b. What are 2 ways to verify that a procedure is current? (0.5)

c. What are 3 documents or logs that may be used to determine system status? (0.75)

d. What should an operator do when he is performing a Checklist and can not reposition a component as required by the checklist due to a surveillance in progress? Explain how he documents the action he takes. (0.5)

e. What are 2 acceptable methods of independently verifying that a procedure step is completed? (0.5)

QUESTION 8.10 (2.00)

a. Describe the procedure for tagging out components located inside the containment, in modes 1 - 6, in accordance with the Clearance Order procedure. (1.0)

b. How is a temporary ground that is placed as part of a Clearance Order recognizable? (0.5)

c. Whose approvals are required to remove tags when the individual who received the Clearance to Work is not available on site or by telephone? (0.5)

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

QUESTION 8.11 (1.50)

EPP 01-2.3, Accident Assessment and Mitigation defines KEY VARIABLE as indications that may be used to assess the condition of a barrier, safety system ,or initiation of a function. (paraphrased)

Match the sets of KEY VARIABLES in column "B" with the boundary or system it may be used to assess in column "A".

"A"	"B"
a. Safety and Support Equipment	1. RCS Radioactivity RCS Pressure
b. RCS Pressure Boundary	2. Containment O2 Concentration Containment Temperature
c. Containment Pressure Boundary	3. CST Level Safety Equip. Rm. Temperature
	4. Containment Sump Level Containment Pressure (1.5)

QUESTION 8.12 (1.50)

List 3 responsibilities of the Duty Emergency Director (DED) that may may not be delegated. (1.5)

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

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 5.01 (1.00)

Due to the greater decrease in the temperature of the coolant exiting the core relative to the decrease of the inlet coolant (0.5), more positive reactivity will be added in the upper core regions, resulting in a more positive (less negative) AFD (0.5).

REFERENCE
WC LP 039, Objective 6, p. 14
193009K102 ...(KA'S)

ANSWER 5.02 (2.50)

a. The increasing temperature causes a density change which results in negative reactivity. [0.5] The subsequent decrease in density results in removing boron, causing positive reactivity. [0.25] (0.75)

b. 557 F (0.5). The change in density at higher temperature is much greater than at lower temperature. So more boron atoms enter or leave the core at higher temperatures which causes a larger reactivity change for a given temperature change (0.5). (1.00)

c. Lowering boron concentration over life makes MTC more negative which causes its contribution to power defect to increase. (Hence, power defect increases). (0.75)

REFERENCE
WC LP 039, Objectives 6, 25, & 27
194004K106 192004K108 ...(KA'S)

ANSWER 5.03 (1.00)

" a "

REFERENCE
WC LP 039 Pp. 48,49
192004K106 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 5.04 (2.00)

a. 1. Reactor power will initially decrease (0.35) then return to the original value (100%) (0.4). (0.75)

2. Tave will decrease until reactor power returns to 100%> (0.75)

b. The primary difference is that Tave will decrease less. Also accept smaller power decrease. (0.5)

REFERENCE
WC LP 049, Objective 4, p. 15
192008K124 192004K107 192004K106 ...(KA'S)

ANSWER 5.05 (1.00)

1. Central section of a large rod would be shielded from neutrons.

2. Smaller rods yield more surface area. (Any 1/2 or CONCEPT; 1.0)

REFERENCE
LO 11 306 33, Rev. 1
192005K102 ...(KA'S)

ANSWER 5.06 (2.00)

a. T

b. F

c. F

d. F (4 answers @ 0.5 ea.; 2.0)

REFERENCE
LO 11 306 37, Rev. 1, p. 9-16
192006K102 192006K115 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 5.07 (1.00)

a. Supercritical (Will accept critical)

b. Before [0.5 ea.] (1.0)

REFERENCE
LO 11 306 41, Rev. 2, p. 14-17
192008K103 ...(KA'S)

ANSWER 5.08 (2.50)

a. 1. Lower energy delayed neutrons are less likely to cause fast fission. (0.75)

2. Lower energy delayed neutrons are less apt to leak out of the core before thermalization. (0.75)

b. 1. False

2. True [0.5 ea] (1.0)

REFERENCE
WC LP 2, P. 8,14
192003K107 192002K111 192002K112 ...(KA'S)

ANSWER 5.09 (2.00)

a. The loss of fission neutrons is made up by source neutrons. (0.75)

b. The count rate is low [0.25] so that a change in count rate will make the ICRR small, [0.25] and criticality is underpredicted.[0.25] (0.75)

c. The detector will not detect fission neutrons until there is a large flux, yielding a plot that overpredicts. (0.5)

REFERENCE
WC LP 043, Pp. 16,17
192003K101 192008K106 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 5.10 (1.50)

a. Increases NPSH (0.25), because the slower pump speed will decrease flow / friction / losses (0.25). (0.5)

b. Increases NPSH (0.25), due to RCS pressure increase (0.25). (0.5)

c. Increases NPSH (0.25), because fluid temperature has decreased (0.25). OR; Decrease [0.25] due to initial pressure decrease. [0.25] (0.5)

REFERENCE
Westinghouse Thermo-Hydraulic Principles, Chapter 10, p. 44
191004K106 ...(KA'S)

ANSWER 5.11 (1.00)

a. Increases (because of steam generator swell). (0.5)

b. Decreases (because of pressurizer outsurge). (0.5)

REFERENCE
Westinghouse Thermo-Hydraulic Principles, Ch. 11 & 12
192004K108 002020K508 ...(KA'S)

ANSWER 5.12 (2.00)

a. Effective area available to condense steam is reduced, which increases Tsat and Psat. The change in Psat causes the extraction less work from the turbine, so efficiency decreases.

b. Increasing noncondensibles block some tube area, with same consequences as above. Also, this reduces the amount of steam undergoing phase change, which decreases the specific volume change, leading to higher pressure, and the effects above.

c. Reduced mass flow reduces Q from the steam, causing less dT, with a corresponding increase in Tsat and Psat, with the effects above.

(3 answers @ 0.666 ea.; General concept required, not specific answer)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

REFERENCE
Westinghouse Thermo-Hydraulic Principles, Chapter 9, p. 24, 25, 34
191006K110 193005K103 ...(KA'S)

ANSWER 5.13 (2.00)

a. T

b. T

c. F

d. T Accept FALSE if assumed that PORV or Safety is open.[0.5 ea] (2.0)

REFERENCE
Thermo-Hydraulic Principles and Applications to the PWR II, Ch. 12, p. 1-16

193006K113 193001K104 ...(KA'S)

ANSWER 5.14 (1.50)

CHF is the heat transfer rate (power) [0.5] which will cause DNB (0.25) for a given pressure (0.25), flow (0.25), and temperature (0.25). (1.5)

REFERENCE
Thermo-Hydraulic Principles and Applications to the PWR II, Ch. 13, p. 20

193008K106 193008K105 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 5.15 (2.00)

Axial Flux Difference (0.25) determines axial distribution (0.25) and is determined by subtracting calibrated I from the bottom detectors from the calibrated I from the top detectors and dividing by the 100% power calibrated I (0.5).

Quadrant Power Tilt Ratio (0.25) determines the radial flux shape (0.25) and is determined by ratioing the maximum upper half excore detector I to the average upper excore detector I (also applies to lower detectors)(0.5).

F(Q)Z [0.25] determines local heat flux at a specific elevation [0.25] by use of the in-core NI's to ensure both axial and radial flux within limits. [0.5]

Fxy [0.25] ensures that radial peaking factors within limits [0.25] and is determined with in-core NI's. [0.5]

[Any 2 of 4 that addresses both radial and axial flux] (2.0)

REFERENCE
Westinghouse Thermal Hydraulic Principles and Applications to PWR, pg 13-43 - 13-50
193009K101 193009K102 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 6.01 (2.50)

a. #1-------- 2200 psi (accept 2100 - 2300 psi)
#2-------- 35 psi (Accept 15 - 50 psi)
#3-------- 0 psi (Accept 0 - 5 psi) [0.25 ea.] (0.75)

b. Must maintain minimum (200) psid so seal surfaces will not contact as it is designed as a film riding seal. (0.75)

c. Containment sump, or RCDT. [0.25 ea.] (0.5)

d. Changes from a face rubbing type (contact) to a film riding seal. (0.5)

REFERENCE
WC LP 026, Pp. 8, 9
003000K103 ...(KA'S)

ANSWER 6.02 (2.00)

a. False
b. True
c. True
d. False [0.5 ea.] (2.0)

REFERENCE
WC LP 015-8, Pp13, 14
034000K402 ...(KA S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 6.03 (2.50)

a. 1. Both normal and alternate ESF supply breakers open.
2. No SIS or CSAS
3. D/G breaker closed [0.25 ea.] (0.75)

b. 1. SIS
2. CSAS [0.25 ea.] (0.5)

c. No. (Accept yes with proper assumption and explanation.) (0.5)

d. The LOCA sequencer is blocked immediately. [0.25] The SHUTDOWN sequencer is blocked when the D/G breaker is shut. [0.25] and the LOCA sequencer starts. [0.25] (0.75)

REFERENCE
WC LP 069, Pp. 25 - 29
064000K410 064000K411 ...(KA'S)

ANSWER 6.04 (3.00)

a. Primary: Provide core cooling.
Secondary: Provide SDM (boration) [0.5 ea.] (1.0)

b. 1. LOCA
2. Rod eject.
3. Loss of secondary coolant
4. SGTR [0.25 ea. (1.0)

c. 1. OPEN
2. CLOSE
3. OPEN
4. NO SIGNAL
5. CLOSE [0.2 ea.] (1.0)

REFERENCE
WC LP 038, Pp. 8, 9, 26 - 28
006000A303 006000K405 006020K404 006030A201 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 6.05 (2.50)

a. Nuclear detectors [0.25], Primary shield [0.25], and Reactor vessel supports [0.25]. Not affected by SIS [0.25]. (1.0)

b. Normal: 4 fans on fast speed.
SI: All fans shift to slow speed. [0.25 ea.] (0.5)

c. 1. Fan discharge is normally to lower part of containment outside of secondary shield. During LOCA fans may discharge directly to containment atmosphere. (0.4)

2. Fusible links melt and release a plate in the discharge. (0.3)
Less restriction to air flow. (0.3)

REFERENCE
WC LP 025, Pp. 6 - 8
022000A301 022000K402 ...(KA'S)

ANSWER 6.06 (1.50)

Should not be performed at this time. [0.5] Placing in test will deenergize the interlock circuit P-13 which feeds P-7. [0.5] This will unblock the low pressurizer trip and the shutdown control rods will trip. [0.5] (1.5)

REFERENCE
WC LP 050, P. 18
012000K406 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 6.07 (2.50)

1. Indicated level would increase due to "0" d/p
2. MFW pumps do not trip on low level.
3. TDAFWP does not start does not start on low level on 1/4 S/G.
4. TDAFWP does not trip on low lube oil.
5. MDAFWP's don't trip on high SG level. [0.5 ea.] (2.5)

REFERENCE
WC LP 045, Pp. 12-15
016000A201 ...(KA'S)

ANSWER 6.08 (1.00)

"a"

REFERENCE
WC LP 055, P. 38
011000A210 ...(KA'S)

ANSWER 6.09 (2.00)

a. Rod motion is prevented
Block C1 signal
(Accept "No effect" if C-1 blocked) (0.5)

b. Rod motion is prevented
Position Rod stop bypass switch. (0.5)

c. No effect (0.5)

d. No effect (0.5)

REFERENCE
WC LP 063, Pp. 22, 34
012000K610 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 6.10 (2.50)

a. 1. SSPS
2. SSPS
3. ESFAS
4. SSPS
5. ESFAS
6. SSPS [0.25 ea.] (1.5)

b. 1. CISA
2. FWIS
3. CRVIS
4. CPIS
5. AFAS
6. SGBSIS [Any 5, 0.2 ea.] (1.0)

REFERENCE
WC LP 076, Pp.20, 21, 24
012000K105 013000K104 ...(KA'S)

ANSWER 6.11 (1.00)

"b"

REFERENCE
WC LP 022, Pp. 13, 14
016000K112 016000K403 ...(KA'S)

ANSWER 6.12 (2.00)

a. To preserve 1 train of ESF equipment in the event of fire in the Main Control Boards. (0.5)

b. 1. Lo Przr level Htr cutout [Accept "Loss of heater Control in
2. Lo press. htr turn on place of b.1, b.2. and b.3]
3. Hi level htr turn on
4. Auto swapover of AFP suct. to ESW [0.25 ea.] (1.0)

c. 1. Aux. feed flow to S/G's
2. S/G PORV's [0.25 ea.] (0.5)

REFERENCE
WC LP 014, Pp. 6, 17, 18
068000G006 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 7.01 (2.50)

a. 1. All rod bottom lights lit. (0.25)
2. Reactor trip (& bypass) breakers open. (0.25)
3. Neutron flux decreasing. (0.25)
4. Transfer NR-45 to intermediate range. (0.25)

b. 1. All turbine stop valves closed
OR
Emergency trip system pressure less than 590 psig. (0.25)
2. Generator breakers (main & exciter) open. (0.25)

c. Voltage no. (NB01/NB02/emergency buses). (0.5)

d. 1. BIT flow indicated. (0.25)
2. LOCA sequencer annunciator(s) lit (0.25)

REFERENCE
WC EMG E-0, Safety Injection, Revision 1, p. 3, 4
000007G010 ...(KA'S)

ANSWER 7.02 (2.50)

a. 1. Subcriticality
2. Core Cooling
3. Heat Sink
4. Integrity
5. Containment
6. Inventory [6 CSFST'S, 0.2 EA, 0.3 FOR ORDER] (1.5)

b. 1. A red path means loss of or extreme challenge to a CSFST. (0.5)

2. For a red path, immediately stop any EMG in progress [0.25] and perform the required function restoration procedure [0.25]. (Unless CO in progress) (0.5)

REFERENCE
WC EMG F-0, Critical Safety Function Status Trees, Revision 1, p. 2
000007G012 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 7.03 (1.50)

a. ES-01 is used when, based on operator judgement (0.5), it is necessary to determine or confirm the most appropriate post accident recovery procedure (0.5).

b. ES-02 is used when, based on operator judgement, SI is neither actuated nor required. (0.5)

REFERENCE
WC EMG ES-01, Rediagnosis, Revision 1, p. 1
ES-02, Reactor Trip Response, Revision 1, p. 1
000007G011 ...(KA'S)

ANSWER 7.04 (2.00)

1. RCS subcooling either: (either i or ii for full credit)
i. Greater then required per Zero Subcooling Curves or
ii. Greater than 30 deg's F on subcooling margin monitor.

2. SG Pressure: stable or decreasing.

3. RCS Hot Leg Temperature: stable or decreasing.

4. Core Exit TCs: stable or decreasing.

5. RCS Cold Leg Temperature: at Tsat for S/G press. [4/5, 0.5 ea.] (2.0)

REFERENCE
WC EMG ES-03, SI Termination, Revision 1, Appendix D, p. 18
000017K101 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 7.05 (2.50)

a. 1. Excessive rod bank insertion.
2. Failure of two or more rods to fully insert on trip.
3. Uncontrolled cooldown of RCS.
4. Unexplained or uncontrolled reactivity increase.
5. Inadequate shutdown margin. (Any 3/5 @ 0.333 ea.; 1.0)

b. 1. Start BOTH boric acid transfer pumps. (0.5)
2. Stop VCT Makeup (BG HIS-26). (0.5)
3. Open borate valve to charging pump suction (BG HIS-8104). (0.5)

REFERENCE
WC OFN 00-009, Immediate Boration, Revision 1, p. i, ii, 1
000024K301 000024G011 000024G010 ...(KA'S)

ANSWER 7.06 (2.00)

a. 1. Containment pressure @ 5 psig. (0.5)

2. Containment radiation @ 10EE5 rad/hr. (0.5)

b. Adverse containment conditions may cause significant errors in the indications of instruments located inside containment. (CONCEPT) (1.0)

REFERENCE
WC EMG Generic Study Guide, Student Handout, Revision 0, LOSH 001, p. 6

000103G015 000103A101 ...(KA'S)

ANSWER 7.07 (1.00)

OFN 00-013 is used when the control room has been evacuated but no spurious equipment operations have occurred or are eminent. ie, no MCR fire. OR; Kicked into from OFN 00-017.

REFERENCE
WC OFN 00-013, Control Room Not Habitable, Revision 6, p. ii
000067G011 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 7.08 (2.00)

a. 1 (<220#), 2 (200 deg's), [any 2, 0.5 ea.] (1.0)

b. Trip the reactor (0.5), then trip RCP A (0.5). (1.0)

REFERENCE
WC OFN 00-005, RCP Malfunctions, Revision 5, p. ii
000015A201 000015K303 ...(KA'S)

ANSWER 7.09 (2.00)

a. Pump/loop current, flow, pressure, level oscillations. Accept any symptom for full credit. (0.5)

b. 1. 15 - 45 minutes. (0.25)

2. 1.0 - 2.5 hours (Accept times within ranges) (0.25)

c. 1. Dump from SI accumulators.

2. Pump/gravity feed from RWST.

3. Increase charging & letdown plus drain to RCDT.

4. With vessel head removed, flood up cavity & use SFPCS.

5. Use SG in reflux mode. (Any 2/5 @ 0.5 ea.; 1.0)

REFERENCE
WC OFN 00-015, Loss of Shutdown Cooling (RHR), Revision 4, p. 8-11
000025A207 000025K101 000025K303 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 7.10 (1.50)

1. Leakage into closed systems. (0.5)

2. Leakage into (containment) atmosphere from sources that are known and do not interfere with the leakade detection systems, or is not RCPB leakage. (0.5)

3. Leakage into the SG. (0.5)

REFERENCE
WC TS 1.14, p. 1-3
203000G005 ...(KA'S)

ANSWER 7.11 (3.00)

a. 1. Auxiliary.
2. Fuel.
3. Hot Machine Shop.
4. Radwaste.
5. Reactor.
6. Control Bldg. basement [any 5, 0.2 ea.] (1.0)

b. 1. Accept 2.0 or 5.0 mr/hr.
2. 100 mrem in any 5 consecutive days. [0.25 ea.] (0.5)

c. Accept either: [For either case, 2 answers @ 0.25 ea.]
1. dose rate monitor.
2. dose integrating device with preset alarm
OR
1. H. P. technician.
2. Dose rate mcnitor (0.5)

d. 1. Continuous HP surveillance.
2. Shift Supervisor approval.
3. Required to be locked. [any 2, 0.5 ea.] (1.0)

REFERENCE
WC LP LO 10 310 07, Radiation Protection Manual, Rev. 0, p. 25, 26, 32, 33

194001K103 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 7.12 (2.50)

a. The only limit in question is the 300 mrem weekly limit. If 10 days are assumed to be 2 5-day weeks, then no limit has been violated (note 100 mrem weekly is goal not limit). If 10 days are assumed to be continuous, then weekly limit has been violated (500/10*7=350). (0.5)

b. The dose given will violate the NRC lifetime limit/proviso of 5(n-18). A single 16 rem dose is allowed under emergency conditions. (0.5)

c. No limits are violated. Weekly are all under 300 mrem, and CALENDAR quarter are less than 1000 mrem (Quarter breaks at 10/1). (0.5)

d. Pre-natal limit is 500 mrem. Since exposure occurred prior to notification, may be interpreted as not a violation. (0.5)

e. Medical exposure is not controlled or considered in exposure limits. (Would expect no occupational exposure under conditions.) (0.5)

REFERENCE
WCGS LP LO 10 310 07, Rev. 0, Objectives 6 & 7, various pages
194001K103 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 8.01 (2.00)

a. True
b. False
c. False
d. False (0.5 ea.) (2.0)

REFERENCE
WCTS B3/4.4.6, 3/4.4.8, 3/4.4.20
002000G011 002020K401 ...(KA'S)

ANSWER 8.02 (2.50)

a. 1. Two independent ECCS subsystems shall be operable. (0.75)

2. At least two CCP's shall be operable. (0.75)

b. To assure that a mass addition pressure transient (0.5) can be relieved by 1 PORV OR, 1RHR Suction Relief. (Accept either valve for full credit of 0.5 pts.) (1.0)

REFERENCE
WC T.S 3.5.2, 3.2.4, B.3.1.2
002020G006 006000K504 006050K506 ...(KA'S)

ANSWER 8.03 (2.00)

Individuals permitted to enter shall be provided with or accompanied by one or more of the following:

1. Radiation monitoring device which continuously indicates the radiation dose rate in the area. [0.5]

2. Radiation monitoring device which continuously integrates the radiation dose rate in the area [0.5] and alarms when a preset integrated dose is received [0.5].

3. An individual qualified in rad. protection procedures.[0.5] (2.0)

REFERENCE
WC T.S. pg. 6-23
194001K105 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 8.04 (2.00)

The extended surveillance time may not exceed 25% of the surveillance interval, or 31 x .25 = 7.75 days. At this time, the surveillance is only five days late. (1.0)

However, the total time for the last three consecutive surveillances may not exceed 3.25 times the surveillance interval. For the last three intervals, time = 31 + 35 + 36 = 102. and 3.25 * 31 = 100.75 days. So this allowable interval has been exceeded. (1.0)

REFERENCE
WC TS, P. 3/4 0-2
0020206006 ...(KA'S)

ANSWER 8.05 (1.00)

1. Wolf Creek Admin. Procedures (ADM 01-033) (0.5)

2. 10CFR (parts 21 & 50) (0.5)

REFERENCE
ADM 01-033 & 10CFR
0020206003 ...(KA'S)

ANSWER 8.06 (2.50)

a. 1. o Verify system valve lineup [0.25]
o Run pumps on recirc (to verify head) [0.5]

2. o Operate each fan (for 15 min.) [0.25]
o Verify cooling water flow (rate) [0.25] (1.25)

b. Pressure: To prevent exceeding design pressure in the event of a steam line break, [0.5] and to prevent exceeding design negative differential pressure limit. [0.25]

Temperature: To assure that temperature does not exceed temperature assumed in analysis of steam line break. [0.5] (1.25)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

REFERENCE
WC T.S. Pp. 3/4 6-13, 3/4 6-15, B 3/4 6-2
022000A102 022000G001 022000A101 ...(KA'S)

ANSWER 8.07 (3.00)

a. If the work request was written to document deficiencies [0.25] and the component is operable. [0.5] OR; ALARA or safety consideration, or instrument on MCB. (0.75)

b. The corrective work request form has a black border. (0.5)

c. Fire Protection Specialist OR; Group leader (0.5)

d. 1. Group leader will assign (for housekeeping, support, or work done in a shop)
2. Op's assign next sequential number on computer system.
3. Op's assign next sequential number in WR manual log.
[0.25 ea.] (0.75)

e. A completed NPRD form (0.5)

REFERENCE
ADM 01-057, Pp. 1-6
002000G001 ...(KA'S)

ANSWER 8.08 (1.00)

** "d" **

REFERENCE
ADM 01-097, P. 1
002000G002 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 8.09 (3.00)

a. ALR's, EMG's, EPP's, OFN's [any 3, 0.25 ea.] (0.75)

b. 1. Check against the SS Controlled procedure manual.
2. Check against the CSARS Status Index/CSARS. [0.25 ea.] (0.5)

c. Clearance Order Log, Latest System Checklist, Equipment Out Of Service Log, Temporary Mod. Log. [any 3, 0.25 ea.] (0.75)

d. Leave the item blank and note reason on checklist cover sheet. (0.5)

e. 1. Verifier may actually observe the step performed. [0.25]
2. Verifier may observe plant indication which serves as positive indication that the step is complete. [0.25] (0.5)

REFERENCE
ADM 02-021, Pp1,2,3,7
194001A101 ...(KA'S)

ANSWER 8.10 (2.00)

a. Modes 1 - 4: [0.25] Tags will be hung on the bulletin board at the personnel access hatch, [0.25] and a lock or seal will be placed on the actual component. [0.25]

Modes 5 - 6: (At the discretion of the Op's Sup't), Tags are placed on the the component itself. [0.25] (1.0)

b. There will be a numbered disc attached. (0.5)

c. Superintendent of Operations, OR
Call Superintendent, [Accept either answer for 0.25] AND the individual's supervisor. [0.25] (0.5)

REFERENCE
ADM 02-100, Pp. 8,9,11,14
194001K102 ...(KA'S)

ANSWERS -- WOLF CREEK -87/10/27-WHITTEMORE, J.

ANSWER 8.11 (1.50)

a.------ 3.
b.------ 4.
c.------ 2. [0.5 for ea. correct match] (1.5)

REFERENCE
EPP 01-2.3, P.4
194001A116 ...(KA'S)

ANSWER 8.12 (1.50)

1. Classification. 2. Notification of off-site authorities.
3. Protection action recommendations. 4. Authorization of emergency exposure limits. [any 3, 0.5 ea.] (1.5)

REFERENCE
EPP 01-1.1, Pp.1,21
194001A116 ...(KA'S)

RO EXAM COMMENTS

SECTION ONE

1.01 NO COMMENT

1.02 NO COMMENT

1.03 NO COMMENT

1.04 b. Instead of describing how plant response would differ at EOL based on Tave and power defect, the effect could be shown to differ based on the 10 step insertion being significantly less at EOL as the flux shifts from the top to the bottom of the core. See attached AFD curves (BOL to EOL). There is very little "rod bite" at EOL. From the curves, it can be seen that the AFD went from +2.54 at 100% (BOL, 12/31/86)) to -4.53 (EOL, 9/2/87) during cycle two.

1.05 a. The aporopriate response to this question should be "greater increase in neutron population", and "longer and longer to stabilize." If the question had been to explain the shape of the curve, they would have included a discussion of "prompt jump." See attached training material.

1.06 a. No comment

b. Pg. 17 of 27 of LP0005-8 states other reasons for overlap.

1) Increases reactivity near extremes of travel,

2) Makes reactivity more uniform.

1.07 c. The referenced training material had <u>no</u> hard number for xenon free conditions. They are taught that Xenon is mostly gone in 5 to 7 half lives (or 72 hours), but, like any decay process, some Xenon is always present. This would make it difficult to state true or false for "Xenon free" after 100 hours.

1.08 No comment

1.09 No comment

1.10 No comment

RO EXAM COMMENTS

SECTION ONE (CONT.)

1.11 a. and b. No comment

c. See attached training material. Since available $NPSH = P_{suct} - P_{sat}$, response to "c" could be a temperature drop causing a pressure drop (which would be more significant). If so, P_{suct} could drop more than P_{sat}, causing NPSH to drop.

1.12 No comment

1.13 a. Recommend removal of "as level increases to cover tubes". If level gets high enough to cover tubes, the feed pumps will trip due to exhaust back pressure (see attached diagram).

RO EXAM COMMENTS

SECTION TWO

2.01 NO COMMENT

2.02 NO COMMENT

2.03 a. Should accept a wider range as charging header pressure could vary by as much at 200 psi, VCT from 15 to 50 psi, and RCDT from 0-5 psig.

b.,c., and d No comment

2.04 a. No comment

b. 2. should read SI pump suction crosstie to CCP suction. The question said to ignore water sources. The key answers on b.2, c.1, and c.2 were all water sources.

2.05 a. Recommend removal of part a. The operators are trained to know air is needed to disengage so that on a loss of air a fuel assembly would not drop. There is no objective and they were not trained as to whether the gripper could engage on a loss of air since that had no safety significance and fuel handling could not continue without air available.

b. Normally true; however, there is capability to manually (not from the console) position, so they could have answered false.

c. True or False could be correct. One of the two core index strips is monitored via TV, so answer would depend on which strip was being considered.

d. No comment

2.06 No comment

2.07 a. May not have specified that the electric motors are on the valves from the MDAFP and air on the TDAFP valves, since the question did not require this. Should accept Air and Electric motor. For air should accept air or nitrogen (nitrogen is a backup supply, see attached reference).

b. No comment

c. No comment

RO EXAM COMMENTS

SECTION TWO (CONT.)

2.08 a. b. No comment

c. The question is too vague to require one specific answer. If the auto start signal was received prior to the LOCA signal or the SHUTDOWN sequence, it would start immediately, so the proper response would be "yes". If the auto start signal was received after the receipt of a sequencer initiating signal but before the sequencer sends a start signal to the pump, the auto start is blocked until the sequencer starts the pump. Then the answer would be "no".

2.09 a. No comment

b.1 Could correctly answer "3" since the fourth solenoid only determines whether the valve will trip open or modulate open. (see attached reference).

b.2 No comment

2.10 No comment

2.11 No comment

RO EXAM COMMENTS

SECTION THREE

3.01 a.1 Auctioneered Hi nuclear instrumentation would actually increase because of the shift in power to the unaffected quadrants. This is verified on the simulator.

2 No comment

3 Auctioneered Tavg did not decrease until rods started driving IN, so answer would be time dependent.

b. Rods stepped in because of the spike up in auctioneered high NI. The referenced lesson plan was only correct for an interior dropped rod.

c. 1,2,3, and 4 No comment

5. Depends on how b. above was answered and is time dependent.

3.02 No comment

3.03 Accept additional responses:

1. No Rx trip on SG level because level really failed high
2. No AFW pump start because level really failed high
   The last statement is wrong because flow is not only to the affected SG

3.04 a. Accept also control bank operating out of program sequence and shutdown bank operating out of program sequence. Reference Pg. 19 of the exam listed reference and the attached alarm response.

3.05 All pressurizer heaters are interlocked "off" at 17% level (both BU and variable). See objective 7 on pg. 7 of listed reference and also attached.

3.06 No comment

3.07 No comment

3.08 a. "Where" in the question could mean physical location as well as where in the flow path. Another acceptable answer could be in Cabinets PA03,4,5, and 6 in the electrical penetration rooms.

b. By the question stipulating "aside from core protection", RCP pump motor protection could be be an acceptable answer. (all of the answers listed in the key are for core protection.)

RO EXAM COMMENTS

SECTION THREE (CONT.)

3.09 a. Accept "no effect if C-1 is blocked" If C-1 was not blocked, a reactor trip results, which would make any rod block academic. There are two ways to block C-1. One is via the MCB "block" pushbutton (the normal way), and another is via the TRIP BYPASS switch on the NIS cabinet (used for maintenance). See reference.

b. Delete "or trip the PR bistables". This is not a rod stop bypass.

3.10 Also accept SGBSIS (Steam Generator Blowdown and Sample Isolation Signal). See attached.

3.11 a. The question would have been clearer if it had used "site supervisory" instead of just "supervisory" as the plant has other supervisory systems.

b. No comment

c. Accept also as a design function to replace the need of long runs of direct wired circuits. See reference.

3.12 a,b, and d no comment

c. Inappropriate (not job based). The KA catalogue calls for ability to monitor and operate the panel. Memorizing the color scheme is unnecessary, since the CRT displays the meanings of the colors when any monitor is called up. There is no training objective to memorize these colors. The candidates were trained to not memorize the colors, but to use the console to determine the status of any monitor.

RO EXAM COMMENTS

SECTION FOUR

4.01 a and b No comment

c. Response would depend on whether "normal" or "must" is emphasized in the question. If "must" is emphasized, the response would be without the optional upender operators provided certain constraints are met. See attachment.

4.02 a. Accept also RVLIS (Reactor Vessel Level Monitoring System) RVLIS indication was included on training of OFN 00-015 Loss of Shutdown Cooling as an indicator of level when in partial draindown. An attachment was done for Wolf Creek showing the relationship between the four level indicators. See attached.

b. Accept erroneous indication on LI-53 or Temporary tygon hose. If the purge rate was too slow for draindown, this could collapse the tygon hose (see attached). If the purge rate was too high, this could cause LI-53 to respond as the key stated because LI-53 is not pressure compensated.4.03 No comment

4.04 No comment

4.05 a. In addition to OFN 00-008 INSTRUMENT MALFUNCTIONS, OFN 00-012 ROD CONTROL MALFUNCTIONS also gives reasons for rod motion, which include secondary vs. reactor power and inadvertent dilution. Should accept any 3 of

1. Specific instrument failures (temp. or power or impulse pressure)
2. Turbine runbacks
3. Load rejection
4. Secondary vs. Rx power mismatch for any reason
5. Inadvertent dilution

b. Accept also the other control action required in the reference listed, pg. 27, step 1.2, which is to select the non-failed channels (to control charging flow).

RO EXAM COMMENTS

SECTION FOUR (CONT.)

c. The steam flow and feed flow selected for control are also used to produce the SG flow mismatch annunciators. Accept this as a possible answer.

4.06 a. Since pump amperage is not directly displayed (must call up a computer point and observe over a period of time), the response may not include amperage. They may include fluctuating discharge pressure or loop level at vortexing conditions. See attached.

b. A recent study done for Wolf Creek plots time to boil vs. time shutdown and time for core uncovery vs. time shutdown, on which the candidates were trained. The exact times listed in the OFN are for a specific time shutdown, so the actual times may vary based on time since shutdown. Accept any time from 12 to 45 minutes for boiling and 50 min to 2.5 hours for core uncovery.

c. No comment

4.07 a. Accept also basement of control building (ESW pipe chase). Although not listed in the Rad Protection Manual, the only access to the basement is through the RCA, so it was officially made part of the RCA, which the candidates know.

b. Expected response per 10CFR20 and the RPM is 5 mr/hr or 100 mr in any 5 consec. days.

Accept also 2 mr/hr, since some candidates are aware of an HP procedure (not required for operators to know) which requires posting at 2 mr/hr.

c. The proper response should be:

1. Dose rate monitor OR
2. Dose integrating device with preset alarm OR
3. HP and dose rate monitor

See reference showing only one of these three items is required.

d. Also accept "required to be locked"

4.08 No comment

4.09 No comment

RO EXAM COMMENTS

SECTION FOUR (CONT.)

4.10 NO COMMENT

4.11 a. True - per question that stipulated fold out pages. Some EMGs have different RCP trip criteria in the body of the particular EMG, but all EMGs that have RCP trip criteria on a FOLD OUT PAGE have the same criteria.

SRO EXAM RESPONSE

5.01 See RO exam 1.01

5.02 See RO exam 1.02

5.03 No comment

5.04 See RO exam 1.04

5.05 Add 1. Minimize the effects of water hole peaking when rod is withdrawn.

2. Improve flux distribution or better for flux shaping.

5.06 No comment

5.07 For part b, the referenced lesson plan says nothing about this topic, but we teach 5 to 7 doubling to criticality (see attached lesson plan) 7 doublings is 25,600 counts, which would change the answer to the question.

5.08 No comment

5.09 No comment

5.10 See RO exam 1.11

5.11 See RO exam 1.12

5.12 No comment

5.13 Part d is only true if the SG with no RCP is not being steamed. (SG PORVs opened)

5.14 Actual heat flux (power) is what is compared to CHF to determine if DNB has occurred. The question asked for parameters of concern to CHF. These are only pressure, temperature, and flow.

5.15 Should also accept Fq(Z) as axial and radial, and Fxy as radial.

6.01 See RO exam 2.03

6.02 See RO exam 2.05

6.03 See RO exam 2.08

6.04 See RO exam 2.10

6.05 No comment

6.06 See RO exam 3.02

6.07 See RO exam 3.03

6.08 See RO exam 3.06

6.09 See RO exam 3.09

6.10 See RO exam 3.10

6.11 No comment

6.12 Consider "Loss of automatic PZR heater control in lieu of b.1,2, and 3

7.01 No comment

7.02 b.1 Recommend also accepting actual or assumed loss of a critical safety function.

b.2 Recommend also accepting the additional phrase "except if in C-0"

7.03 See RO exam 4.10

7.04 No comment

7.05 No comment

7.06 No comment

7.07 No comment

7.08 a.2 Our training material inadvertently had 200°F vice 220°F. (attached) Recommend also accepting 2 (200°F) as an answer.

7.09 Recommend also accepting "Discharge pressure oscillations" as an indication of pump cavitation.

7.10 No comment

7.11 See RO exam 4.07

7.12 See RO exam 4.08

8.01 No comment

8.02 a.2 Should also accept "boration flow paths" as an answer.

8.03 No comment

8.04 Consider: Some surveillances are scheduled on a given date each month, and as such may be due prior to a 31 day expiration date. If this is assumed, part 2 may result in NOT exceeding intervals.

8.05 Should also accept Technical Specifications as an answer, since several reports are specified in section 6.

8.06 Part A is based on the following generic knowledge and ability category:

Knowledge of operator responsibilities during all modes of plant operation.

Part A is an inappropriate question. The operator is never allowed to perform surveillances from memory, and as such is not job based, and is not justified by the above KA.

8.07 a. Should also accept:

1) Alara concerns
2) Safety concerns
3) Inside containment
4) Instrument in main control (see attached)

c. The responsible GROUP LEADER is responsible for filling block 11. (see attached) He could also be contacted to finish his work.

d. Should also accept Planned maintenance group for scheduled work requested.

8.08 This is based on the following generic knowledge and ability category:

Knowledge of system status criteria which require the notification of plant personnel.

This is an inappropriate question (not job based). The operator logs component cycles and transient limits in the Control Room log and in the cyclic log. The group who is responsible to tabulate the events is irrelevant to the operator after he performs his required task.

8.09 a. Should include FPPs.

8.10 a. Modes 5-6 should accept "at discretion of Superintendent of Operations"

8.11 No comment

8.12 This is based on the following Generic knowledge and ability category:

> Ability to take actions called for in the facility Emergengy Plan, including (if required) supporting or acting as the Emergency Coordinator.

Parts b and c are inappropriate. The SRO is not related to TSC functions. The SRO license only functions as the DED in the Control Room.