U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Licensee: Westinghouse Nuclear Training Center
505 Shiloh Blvd.
Zion, Illinois 60099

Facility Name: Zion Simulator

Examination Administered At: Westinghouse Nuclear Training Center

Examination Conducted: July 24, 30 and 31, 1984

Examiners: R. L. Higgins — 10/1/84
R. L. Higgins — Date

R. L. Higgins for — 10/1/84
B. L. Sailor — Date

Approved By: J. I. McMillen — 10/3/84
J. I. McMillen, Chief — Date
Operating Licensing Section

Examination Summary

Examination administered on July 24, 30 and 31, 1984.
Written, oral and simulator examinations were administered to four instructor certification candidates.
Results: Two candidates passed, two candidates failed.

REPORT DETAILS

1. Persons Examined

Instructor Certification Candidates

Gordon W. Beale
Frank C. Garber III
Paul R. Geddes
Larry J. Peterson

2. Examiners

J. M. Fehringer, Written Exam Author and Grader
R. L. Higgins, Chief Examiner and Simulator Exam Evaluator
B. L. Sailor, Simulator Exam Evaluator

3. Examination Review Meeting

At the conclusion of the written examination the examiners met with WNTC representatives to review the written examination and answer key. The following is a list of the facility comments, all of which were accepted:

5.01 Additional correct peak Xenon values were added to the answer. This is due to differences between the Zion and WNTC curve books referenced.

5.02 Plant Efficiency decreases. This was a typing error.

5.06 b. Full credit was granted for the response "rod worth increases as boron concentration increases because the energy spectrum of the neutrons increases."

5.07 A "Low Pressurizer Pressure Rx Trip" as Tave lowers is an acceptable answer depending on the assumptions of the candidates.

5.09
5.10 Portions of the answers were inadvertently not placed in parentheses and are not required for full credit. This information is for examiner use only.

6.03 Due to an error in the reference material provided, the answer was corrected to read decrease and OPΔT.

6.04 "Briefly Explain" was added to the questions during the examination so that the complete answer was solicited.

6.06 Due to an error in the reference material provided, an additional correct answer (valve 685 throttles to limit flow to 190 gmp) was added.

6.09 Flow rates in the answer were inadvertently not placed in parentheses and are not required for full credit. This information is for examiner use only.

7.02 SWP was changed to RWP during the examination. This was due to a recent Zion procedure change that was not provided in the reference material. Also, "Personnel Exposure Limit Reached" was added to the answer per the procedure change.

8.04 Shift Supervisor or Shift Engineer are both correct answers to reflect the terminology differences between Zion and WNTC references.

4. Exit Meeting

At the conclusion of the simulator/oral examinations the examiners met with representatives of the Westinghouse Nuclear Training Center to discuss the known results of the examination as well as the observations. The following personnel attended the meeting:

NRC Examiners

R. L. Higgins, Chief Examiner
B. L. Sailor

Westinghouse Representatives

Neil P. Hamrick, Manager, Retraining and Technical Services
Robert D. Hagerman, Staff Training Specialist
Gregg M. Smith, Manger, Zion Instruction

The Training Center Representatives were informed that two instructor certification candidates passed the simulator exam and two instructor certification candidates were marginal.

The Training Center was commended for the cooperation extended to the examiners. Gregg M. Smith was personally commended for the expert way in which he operated the simulator during the administration of the simulator examinations.

The only generic weakness noted by the examiners was a tendency of several examinees to operate controls in an impulsive manner.

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

FACILITY: ZION SIMULATOR

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 84/02/24

EXAMINER: FEHRINGER, J.

APPLICANT: MASTER COPY

INSTRUCTIONS TO APPLICANT:

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

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00	100.00			TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

QUESTION 5.01 (2.60)

a. State the production and removal mechanisms for Xe-135 and Sm-149 in the reactor core. (1.0)

b. State the value for Peak Xenon concentration following a trip from 100% power AND the time required to reach this condition. (0.8)

c. State the value of 100% equilibrium Xenon concentration and the time to reach this condition from startup with a clean reactor core. (0.8)

QUESTION 5.02 (2.50)

Indicate how the following will affect Unit efficiency (increase, decrease, no change) at a steady state power level: (Consider each case separately.)

a. Absolute condenser pressure changes from 1 psi to 1.25 psi.

b. Total S/G blowdown is changed from 35 gpm to 40 gpm.

c. Condenser hotwell temperature changes from 125 F to 130F.

d. Steam quality changes from 99.8% to 99.7%.

e. Current being drawn by RCP's increases slightly slight change in bus voltage.

(2.5)

QUESTION 5.03 (1.80)

True or False

a. The 100% reactor power Departure from Nucleate Boiling Ratio (DNBR) is GREATER than 20% reactor power DNBR. (0.6)

b. The point at which the convective heat transfer coefficient is at its MAXIMUM value is called Departure from Nucleate Boiling. (0.6)

c. For a constant temperature difference (Twall - Tsat), if RCS pressure increases, the heat transfer rate (BTU/Hr.square foot) prior to Departure from Nucleate Boiling decreases. (0.6)

QUESTION 5.04 (3.40)

For each of the two transients below, qualitatively explain ALL of the reactivity effects that cause reactor power to change throughout the transient. In your discussion STATE whether reactor power will stabalize HIGHER THAN, LOWER THAN, or the SAME AS initial power.

ASSUME:

1. Initial power = 50%
2. Rod control is in manual
3. No operator action
4. End of core cycle
5. Turbine controls are in auto
6. No reactor trip

TRANSIENTS:

A. Steam Generator PORV fails open. (1.7)

B. One Bank D control rod drops. (The reactor does not trip on negative rate.) (1.7)

QUESTION 5.05 (2.40)

a. Brittle fracture of any carbon steel pressure vessel can occur as stresses well below yeild stress if TWO other conditions are present. What are these TWO conditions? (0.8)

b. How do heatup/cooldown rate limits on the reactor coolant system reduce the probability of brittle fracture? (0.4)

c. Why does the concern about brittle fracture of the reactor pressure vessel increase as the Zion plant ages? Include in your answer the specific material property that is affected. (0.8)

d. What has been done at the Zion plant that specifically reduces the possibility of brittle fracture as the plant ages? (0.4)

QUESTION 5.06 (2.40)

Explain how control rod worth varies:

a. With its radial position in the core. (0.8)

b. If the RC system boron concentration is increased. (0.8)

c. If the moderator temperature increases. (0.8)

QUESTION 5.07 (2.60)

a. Explain the response of reactor power and Tave after 2 minutes of Emergency Boration at 100% power. Assume rod control is in manual. (1.3)

b. Explain the response of reactor power and Tave after 2 minutes of Emergency Boration at 10 -8 amps and no load Tave. (1.3)

QUESTION 5.08 (2.50)

A motor driven centrifugal pump is operating at rated flow when the discharge valve is throttled shut. How are the following parameters affected by this action? (Increase, Decrease, or Unchanged)

a. Flow
b. Discharge pressure
c. NPSH available
d. NPSH required
e. Motor current (2.5)

QUESTION 5.09 (2.60)

At 30% reactor power a RCP is inadvertantly tripped. Assume control rods in manual, all other systems in automatic, and no operator or protective action occurs. Explain the affects on the following.

a. Immediate effects on the affected (loop with tripped RCP) and unaffected S/G levels. (1.0)

b. (Thot) - (Tcold), dT in the unaffected loops (0.8)

c. Steam pressure at turbine inlet (0.8)

QUESTION 5.10 (2.20)

Radial Flux Distribution and Axial Power Distribution are affected by certain core operating parameters.

a. What are the 4 core parameters that affect either the Radial or Axial Distributions? (1.0)

b. Which of the distributions (Radial or Axial) is most readily influenced by the operator? (1.2

QUESTION 6.01 (2.50)

During a power escallation from 15% to 100% operator error causes a power reduction to 8%. The order is again given to raise load to 100%. With no operator action other than RAISING TURBINE LOAD and PLACING RODS IN AUTO, a Reactor Trip occurs. Explain WHY a Reactor Trip occured and the SEQUENCE of events that led to the Trip. (2.5)

QUESTION 6.02 (2.40)

During operation at 80% power, a "B" S/G safety valve fails full open. (Control rods are at 220 steps)

a. Will the S/G level control system detect the added steam flow? Explain. (0.6)

b. Will any of this added load be sharred by the other S/G's? Explain. (1.2)

c. How can nuclear instrumentation and RCS temperature indication alert the operator that a problem has occured? (0.6)

QUESTION 6.03 (2.70)

a. Indicate whether the OTdT and OPdT setpoints will INCREASE, DECREASE, or REMAIN the SAME if the following operating parameter changes occur. (Consider each change separately)

1. Pressurizer Pressure is increased 100psig.
2. Power Range N-41 lower detector fails high.
3. Tave is < full load Tave and Reactor Power is 100%. (1.2)

b. Indicate whether the following statements are TRUE for OPdT, OTdT, or both OPdT and OTdT.

1. Protects the core from DNB.
2. Protects the core from overpower (kw/ft).
3. Backup for the high neutron flux trip.
4. Circuitry includes dynamic compensation for piping delays to the loop temperature detectors.
5. Requires pressure to be within the high and low Reactor Trip setpoints to be valid. (1.5)

QUESTION 6.04 (2.40)

During a dropped rod recovery for a Bank D rod while at 40% power:

a. How do the stationary, movable, and lift coils function for all rods in Bank D during the rod recovery withdrawal? (1.2)

b. Would you expect an Urgent Failure alarm during the rod recovery withdrawal? (Briefly Explain) (1.2)

QUESTION 6.05 (3.00)

The following concern the fire protection systems associated with the Unit 1 & 2 Inner and Outer Cable Spreading Rooms:

a. Smoke has been detected and the Halon System has been activated automatically.

1. How many signals are required to activate this system? (Include coincidence) (0.6)
2. Once activated can this system be reset? Explain how or why not. (Consider before and after the evacuation timer has timed out. (1.2)

b. A malfunction occurs in the Halon system and backup fire protection is required. How is backkup fire protection activated? State any associated precautions. (1.2)

QUESTION 6.06 (2.40)

a. How are the RCP seals designed to ensure that a failure of the NO. 1 seal is DETECTED and a LOCA does not occur following the seal failure? (1.2)

b. What design features protect the CCW system from a failure/ rupture in the Thermal Barrier Heat Exchanger? (1.2)

QUESTION 6.07 (2.40)

The plant is operating at 80% power when a Thot RTD fails high. Explain how this failure will affect the following. Consider each item independently. Assume no operator action and all control systems are in automatic.

a. Rod insertion limit setpoint (0.6)

b. Charging flow (initially) (0.6)

c. Control rod bank position (0.6)

d. Steam dump control system (0.6)

QUESTION 6.08 (2.60)

The operation of any trip device and the resultant loss of auto-stop oil pressure will open the interface Emergency Trip Valve.

a. What valves in the steam system will reposition when the Emergency Trip Valve opens? (0.8)

b. Explain HOW this is accomplished and WHY it is necessary? (1.8)

QUESTION 6.09 (2.50)

a. During a small LOCA with RCS pressure decreasing at approximately 50 psig/minute:

1. How are the RHR pumps protected against overheating? (0.7)

2. State 2 reasons why shiftover to hot/cold leg recirculation is required following cold leg injection and recirculation? (0.9)

b. During NORMAL cold shutdown operation, name 3 methods by which the RHR system is protected if an over-pressurization accident occurs? (0.9)

QUESTION 6.10 (2.10)

a. What chemical is used to control RCS ph AND state 2 reasons why ph control is necessary? (0.7)

b. How is oxygen formed in the RCS AND how does the hydrogen blanket in the VCT prevent buildup of this oxygen in the RCS? (0.8)

c. Why is hydrazine added to the RCS AND why should the CVCS demineralizers be removed from service during this addition? (0.6)

QUESTION 7.01 (2.70)

The following concern EOP-0, Safety Injection/Accident Diagnostics.

a. How is the reactor trip verified? (0.9)

b. What criteria is used to terminate operation of all RCP's? (0.9)

c. Once Safety Injection actuation has been determined to be inadvertant or false, Safety Injection is reset in accordance Appendix B. After resetting, what conditions would require manual re-initiation of Safety Injection? (0.9)

QUESTION 7.02 (2.40)

a. What daily personnel whole body exposure requires a ~~Special~~ Radiation Work Permit ~~(SWP)~~ RWP, And how long is an ~~SWP~~ RWP valid? (0.6)

b. Aside from Job completion, what three other circumstances will require the Operating Shift Supervisor to terminate an ~~SWP~~ RWP? (0.9)

c. May respiratory equipment be removed in an airborne radioactivity area? Explain. (0.9)

QUESTION 7.03 (2.40)

During power operation, loss of an instrument bus occurs;

a. In accordance with AOP-15 (Loss of Instrument Bus) what three means should be used to determine which instrument bus was lost? (0.9)

b. An immediate operator action is to attempt to re-energize the bus. How is the lost bus re-energized? (0.9)

c. Why will control rods drive in at a maximum rate if instrument bus 111 is lost? (assume Rod Control in Auto) (0.6)

QUESTION 7.04 (2.40)

The plant is operating at 75% power when an inadvertant Reactor Trip occurs. The turbine does NOT trip (stop and governor valves remain open). What are 4 operator actions that should be performed to limit the severity and/or remedy this situation? (2.4)

QUESTION 7.05 (2.80)

The following concern EOP-8 (Main Steamline or Feedline Break).

a. The immediate operator actions require the operator to identify which type of break has occured. List 4 symptoms that would differentiate a Main Steamline Break from a Feedline Break? (Assume the break is inside containment.) (1.2)

b. Following SI actuation, when MUST the charging pump mini-flow isolation valves be shut? When MUST they be reopened? (0.8)

c. A procedural NOTE states that Pressurizer and Steam Generator Level indication will be effected by containment temperature.

1. Will the higher temperature cause levels to indicate higher or lower? (0.3)

2. How is a more accurate level determined? (0.5)

QUESTION 7.06 (2.40)

During 80% power operation, rod control is in automatic and a Power Range NI channel fails high off scale:

a. In accordance with AOP-7 (Nuclear Instrumention) what are the operators immediate actions? Explain why these actions must be taken. (1.2)

b. In accordance with AOP-9 (Operation With a Failed Instrument Channel) explain why the following actions must be taken. ~~(1.2)~~

1. Select the Current Comparator Upper and Lower Section Selector Switches to the failed channel. (0.6)

2. Select the failed channel on the Comparator Channel Defeat switch. (0.6)

QUESTION 7.07 (2.50)

Assuming NO operator action, if the controlling pressurizer level channel fails high during 100% power operation, what Reactor Protection signal will cause the Reactor to Trip? Explain WHY the trip occured and the SEQUENCE of events that led up to the trip. (2.5)

QUESTION 7.08 (2.80)

During refueling operations, RT-AR03 alarms indicating high radiation in the Fuel Building Pool Area.

a. What automatic actions take place? (0.8)

b. What are the Fuel Handling Supervisors immediate responsibilities as stated in EOP-6 (Fuel Handling Emergency)? (0.8)

c. If Health Physics reports there is a high level of tritium in the area, what protective measures must be taken prior to entry into this area? (1.2)

QUESTION 7.09 (2.80)

A plant startup is in progress in accordance with GOP-2 (PLANT STARTUP).

a. It is necessary to dilute 200 PPM boron to get the critical boron concentration prior to pulling the control banks. Prior to the dilution, the source range instruments read 30 and 37 CPS. After diluting 100 PPM of boron the same instruments read 62 and 75 CPS. Should the operator continue with the planned dilution of another 100 PPM? Explain. (1.2)

b. If criticality is achieved below the 500 PCM rod position and below the Lo-Lo Insertion Limit, what 4 operator actions must be taken? (0.8)

c. Source Range Channels A & B are reading 10 4 CPS. Intermediate Range Channel 35 is reading 10 -10 AMPS and Channel 36 is reading 10 -11 AMPS. How could the operator determine which I/R Channel is reading correctly? Explain. (0.8)

QUESTION 7.10 (1.80)

a. Abnormal procedure AOP-10 (High RCS Activity) gives 2 reasons for having high RCS activity. List these 2 reasons. (1.0)

b. If a cation demineralizer is placed in service and the RCS activity decreases, what can the source of activity probably be contributed to? (0.8)

QUESTION 8.01 (2.70)

List the THREE reasons/bases for the Technical Specification Control Rod Insertion limits. Explain your answers. (2.7)

QUESTION 8.02 (2.40)

a. What is the maximum/MINIMUM Technical Specification T/S quadrant power tilt (QPTR) which requires protective action;

1. At 80% rated thermal power?
2. At 40% rated thermal power? (0.4)

b. What protection does this limit provide? (0.8)

c. The two hour time provision for continued power operation with QPTR above the limit in a, above, allows time for the operator to perform what action(s)? (0.8)

d. How is the QPTR data obtained if one Power Range NI channel is inoperable at 100% power operation? (0.4)

QUESTION 8.03 (2.80)

a. How would you verify the reactor is operating within the "Reactor Core Safety Limit"? (0.8)

b. What automatic protective action will prevent the reactor from exceeding the "Reactor Core Safety Limit"? (0.6)

c. What is the objective of the "Reactor Core Safety Limit"? (0.8)

d. What are the shift supervisors immediate responsibilities if a "Reactor Core Safety Limit" is violated? (0.6)

QUESTION 8.04 (2.60)

a. List 5 of the 6 conditions that must be met to assure containment integrity is established during power operation. (1.5)

b. Who must authorize a containment entry during power operation? (0.5)

c. What are the administrative controls associated with the incore neutron monitoring system while personnel are in the containment during power operation? (0.6)

QUESTION 8.05 (2.50)

What 5 means of protection must be taken in accordance with Technical Specifications to prevent a low temperature over pressurization accident when RCS temperature is below 250 F and the vessel head is installed? (2.5)

QUESTION 8.06 (2.80)

a. In accordance with ZAP 14-51-2, Inspection, Test and Operating Status-Tagging of Equipment;

1. When are Special Order Cards required to be used? (0.6)
2. Who can request the issuance of Special Order Cards? (0.6)
3. Where is the status of the equipment and the removal of the cards recorded? (0.4)

b. 1. When are Hold Cards required to be used? (0.6)
2. Who is responsible for ensuring all Hold Cards associated Hold Cards have been cleared and that the equipment is ready for energizing and/or test? (0.6)

QUESTION 8.07 (3.00)

In accordance with ZAP-02A (Fire Protection Surveillance Procedure) a daily fire hazard inspection of all safety related areas that contain safe shutdown systems, components, unprotected power and/or control cables is required:

a. Where are these areas located? (3 of 5) (1.5)

b. Where is the record of these inspections recorded? (0.7)

c. When it becomes necessary to remove a fixed fire protection system from service, what procedure must be implemented? (0.8)

QUESTION 8.08 (2.20)

Primary to secondary leakage through the steam generator tubes has two leakage rate criteria.

1. What are the allowable leakage rates? (0.6)

2. What is the bases for each of the leakage rates? (1.6)

* QUESTION 8.09 (2.20)

The Zion Administrative Procedure ZAP-0-1 (Admitting and Control of Westinghouse Trainees) delineates the procedures to be followed when a Westinghouse Instructor brings students into the Zion Plant.

a. On each visit, notification of the areas where training will be conducted must be made. What are the ~~three~~ two (person or place) 'notifications' that must be made? (0.9)

b. What is the maximum number of trainees each instructor may escort during a single visit? (0.5)

c. What two documents (forms) must be provided to Zion Plant personnel with each visit prior to entering plant areas for training? (0.8)

QUESTION 8.10 (1.80)

10 CFR 20 provides regulations for radiation exposure at Zion Station.

a. The whole body exposure limit provided is 1.25 R/Qtr. What three non-emergency conditions/criteria must be satisfied in order to exceed this limit? (0.9)

b. In what three situations is personnel monitoring (film badge, dosimeter, etc.) required? (0.9)

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

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ANSWER 5.01 (2.60)

a. Xe-135 Production directly from fission and the decay of Iodine [0.25] Removal by decay and burnout [0.25]

Sm-149 Production from the decay of promethium [0.25] Removal by burnout [0.25] (1.0)

b. Approx 5100 (5600) pcm [0.4] 7-9 hours [0.4] (0.8)

c. Approx. 2700 (3100) pcm [0.4] 40-60 hours [0.4] (0.8)

REFERENCE
Curve Book Fig.1.10 Fundamentals Reactor Physics p.6-15 thru 24

ANSWER 5.02 (2.50)

a. Decrease

b. Decrease

c. ~~Increase~~ ↓

d. Decrease

e. No Change (2.5)

REFERENCE
WNTC Thermo. 12-21 thru 27

ANSWER 3.03 (1.80)

a. False

b. True

c. True (1.8)

REFERENCE
WNTC Thermo. 13-17 thru 23

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 5.04 (3.40)

A. 1. + reactivity: from the lower RCS temperature [0.6]
2. - reactivity: from the increased fuel temperature (power increase) [0.6]
3. Power stabalizes at a higher power level [0.5] (1.7)

B. 1. - reactivity: from the dropped rod [0.3]
2. + reactivity: from the decreased fuel temperature [0.3]
~~from the decreases fuel temperature [0.3]~~ -MTC [0.3]
3. - reactivity: from the increased fuel temperature (as power is turned and increases) [0.3]
4. Power stablizes at the same level [0.5] (1.7)

REFERENCE
WNTC Thermo. 12-38 thru 41

ANSWER 5.05 (2.40)

a. Presence of a flaw
Low temperature (0.8)

b. Reduces thermal stress (0.4)

c. Neutron exposure (irradiated)
Makes the material more brittle (0.8)

d. Use of 'low' leakage core (0.4)

REFERENCE
WNTC Thermo. 13-58 thru 68
WNTC Rx Core Control 1-28

ANSWER 5.06 (2.40)

a. Rod worth will vary with neutron flux, (thus rod worth increases from the outside edge of the core to the middle of the core) (0.8)

b. As boron concentration increases, rod worth decreases because of the higher competetion for neutrons. (0.8)

c. As the moderator temperature increases, rod worth increases because the thermal difusion length increases, thus more neutrons are in the epithermal range and available for rods to absorb. (0.8)

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER, J.

REFERENCE
WNTC 6-24 thru 35

ANSWER 5.07 (2.60)

a. Power decreases initially due to the boron addition [0.4] the primary to secondary mismatch causes Tave to decrease [0.4] the decrease in Tave inserts positive reactivity and restores reactor power to a slightly lower than or the same as initial power [0.5] (possible low pressure trip - lo-lo Tave ⇒ press ↓) (1.3)

b. Tave is determined by the amount of pump heat [0.4] and the steam dump setting thus it does not change [0.4] After the initial transient, power decreases at a -1/3 DPM rate to the multiplied source level [0.5] (1.3)

REFERENCE
WNTC 6-15 thru 24 and 35 thru 48

ANSWER 5.08 (2.50)

a. Decrease

b. Increase

c. Increase

d. Decrease

e. Decrease (2.5)

REFERENCE
WNTC Thermo.

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 5.09 (2.60)

a. (Affected S/G - steaming rate is reduced
Unaffected S/G's - steaming rate is increased)

Affected S/G - level will shrink
Unaffected S/G's - levels will swell (1.0)

b. (Affected loop - decreases as reverse flow occurs)
Unaffected loops - increases due to increased steaming rate (0.8)

c. Q=UA(Tave-Tstm) Steam pressure will decrease (0.8)
WNTC Thermo.

ANSWER 5.10 (2.20)

a. (1. Fuel depletion – *not an operating parameter*)
2. Fission product concentrations
3. Power level
4. Moderator density
5. Rod height/allignment (1.0)

b. Axial Power Distribution [~~0.6~~ 1.2] (because rod height most readily affects axial flux patterns which the operator can control [~~0.6~~]) (1.2)

REFERENCE
WNTC Rx Core Control

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 6.01 (2.50)

Dropping below 10% automatically unblocks P-10 [0.6] (raise turbine load and rods to auto) rod step out to the I/R 20% rod stop [0.6] Tave decreases raising reactor power [0.6] a Reactor Trip occurs from the 25% P/R, or 25% I/R current equivalent [0.7] (2.5)

REFERENCE
ZNPT-227 chap. 34
SD-9 p. 21,21,28

ANSWER 6.02 (2.40)

a. Yes [0.3] the steam flow nozzles are upstream of the safety valve tap offs [0.3] (0.6)

b. Yes [0.3] the safety lifting lowers pressure in the "B" S/G [0.3] turbine load is set [0.3] thus, the other S/G's steaming rate increases [0.3] (1.2)

c. Nuclear power increases above turbine power [0.3] Tave (lowers) deviates from Tref [0.3] (0.6)

REFERENCE
System Descriptions 4, Chap. 21 (Main Steam P&ID)

ANSWER 6.03 (2.70)

a.

	OTdT	OPdT
1.	Increase	Same
2.	Decrease	~~Same~~ Decrease
3.	Increase	Same

(1.2)

b. 1. OTdT
2. OPdT
3. OPdT
4. ~~Both~~ OPAT
5. OTdT (1.5)

REFERENCE
ZNPT-227 C-34 p. 9
T/S p. 8,9,21,22

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 6.04 (2.40)

a. The stationary and movable grippers cycle as usual for all rods [0.6] lift coils are disconnected on the non-affected (not dropped) rod [0.6] (1.2)

b. Yes [0.6] the rods that are disconnected are receiving rod control circuit signals to move and the rods are not respondin[0.6] (inhibit only on bank D group without dropped rod) (1.2)

REFERENCE
ZNPT-227 C-33 P. 18,26
SD-8a P. 66

ANSWER 6.05 (3.00)

a. 1. 2 detector signals [0.3] one from each train of detection [0.3] (0.6)
2. BEFORE: Yes [0.3] momentary toggle switches located on the front of the control cabinet [0.3] (fuse block inside will deactivate the entire system)

AFTER: No [0.3] Halon must be discharged in order for the discharge valves to reseat [0.3] (1.2)

b. Manual and Manual Electric (cardox) [0.4]
M/E none [0.2]

M-(bypasses timing functions) CO2 dumps immediately [0.3]
Pilot valves must be shut manually [0.3] (1.2)

REFERENCE
ZNPT-221-6 P. 14-30
SD-36

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 6.06 (2.40)

a. No. 1 seal failure is detected by alarms that monitor the seal dP [0.3] and the amount of leakoff flow through No. 1 seal [0.3]

LOCA prevention- The No. 2 seal is designed to withstand full system pressure thus keeping to an allowable value [~~0.6~~ 0.3] and (1.2)
685 will throttle to 190 gpm [0.3]

b. CCW flow is supplid to the HX through a check valve which will prevent reverse flow to the low pressure piping [0.6] and the piping downstream of the check valve is rated for RCS pressure [0.6] on 685 throttle (1.2)

REFERENCE
RCP's C-5 p. 16,19

ANSWER 6.07 (2.40)

a. Raises the limit, because high dT means high power (0.6)

b. Increases to raise pressurizer level to 100% program, because of the higher Tave (spurious input) (0.6)

c. Rods move in, because of the Auct. Tave/Tref mismatch (0.6)

d. No effect, the demand signal is present (Tave/Tref) but there is no arming signal present (0.6)

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 6.08 (2.60)

a. 4 stop valves
4 governor valves
6A reheat valves
6# intercept valves
(extraction steam non-return checks) (0.8)

b. The Emergency Trip fluid is depressurized when the trip valve opens [0.3] allowing the EH fluid dump valves on each turbine valve to open [0.3] the EH pressure holding the turbine valves open is releived [0.3] spring action closes the turbine valves [0.3] (1.2)

This is necessary to prevent turbine damage from overspeed. (0.6)

REFERENCE
M/T & EHC C-21 sec. 3,4,5,6
SD-22b p.11

ANSWER 6.09 (2.50)

a. 1. The RHR mini-flow control valves (FCV-610 and 611),
Open when pump flow decreases to(<500 gpm)
Close when pump flow increases to(>1000 gpm) (0.7)

2. Flush boric acid that has plated out on the rods
Collapse steam bubbles and voids
(Stop boiling in the core) (0.9)

b. RHR suction valves (1MOV-RHR701 and 8702) are interlocked to shut on high pressure (600 psig)
Discharge check valves shut (only after 8701 + 2 shut)
Suction relief valve is avaiable for pressure relief
Discharge relief valve is available for pressure relief
(3 required) (0.9)

REFERENCE
System Description C-10 p. 4,8,9,23,25,29
C-12a p. 12

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 6.10 (2.10)

a. LiOH (enriched in Li-7) [0.3] Reduced corrosion [0.2] and crud deposition at higher ph [0.2] (0.7)

b. Oxygen in the RCS is formed by radiolysis of water. Hydrogen gas from the VCT enters the RCS to force back the reaction of hydrolysis. (also oxygenated makeup water) (0.8)

c. To scavange oxygen [~~0.2~~] Demins are taken out of service to reduce resin damage from chemical interaction (with ammonia) [~~0.2~~] Demins will remove hydrazine [~~0.2~~] (0.6)
(2 of the 3 0.3 each)

REFERENCE
Rad. Chem. & Corrosion 7-14 thru 24
SD-5a p. 1,2

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 7.01 (2.70)

a. Train A & B reactor trip breakers open
Control and shutdown rods fully inserted
Reactor power decreasing (0.9)

b. After verification that at least one centrifugal charging or safety injection pump is in operation [0.3] and when wide range RCS pressure drops below 1520/1200 psig [0.3] or

Within 5 minutes after loosing CC water to the RCP's [0.3] (0.9)

c. Pressurizer pressure drops below 1815 psig
Pressurizer level drops below 10%
RCS subcooling drops below 35 F (0.9)

REFERENCE
EOP-0 p.6,7, & 10

ANSWER 7.02 (2.40)

a. >50 mrem, 24 hrs. (0.6)

b. Cancelation
Expiration
Change in working conditions (0.9)
Personnel exposure limit reached

c. Yes ~~[0.4]~~ in the case of shortness of breath (or similiar emergency) providing the individual leaves the area ~~[0.5]~~ (0.9)
[0.6] 0.3

REFERENCE
ZNPT-211 A-13 p. 21-23

ANSWERS -- ZION STIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 7.03 (2.40)

a. Check the AC amps and/or output voltage of the inverter
Check the power supply lights on the RPS or safeguards status panels
Check any 4 common channel indications (PZR press) fo the failed bus (0.9)

b. Open the inverter feed breaker (at the instrument bus)
Shift the mechanical interlock
Shut the dirty power feed breaker (0.9)

c. Loss of PT 505 (0.6)

REFERENCE
AOP-15 ZED vol. 1, p. 12

ANSWER 7.04 (2 40)

Manually reinitiate a turbine trip
Stop EHC pumps
Shut valves or trip turbine locally
Manually runback turbine
Shut MSIV's and Bypasses (4 required) (2.4)

REFERENCE
EOP-1 p. 5 & Turbine Controls

ANSWER 7.05 (2.80)

a. 'Steam Line Pressure Low' alarm
'Steam Line Flow High' alarm
'Stm. Gen. Loop A-D Feedwater Flow Low Rx. Trip' alarm
Steam line flow on affected steam generator high
Feedline flow on affected steam generator high or low
(other reasonable answers accepted) (4 required) (1.2)

b. Close-any time in the depressurization transient following SI actuation prior to RCS pressure reaching RCP termination pressure
Open-during re-pressurization transient between the RCP termination pressure and 2000 psig (0.8)

c. 1. Higher ~~(0.2)~~ (0.4) (less dense water in the reference leg ~~(0.2)~~) (0.4)
2. Refer to curve book for correction factors (0.4)

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

REFERENCE
EOP-8 P.2,4, & 5

ANSWER 7.06 (2.40)

a. Rod bank selector switch to MANUAL [0.4/3] this will stop inward rod motion [0.3/3]
Adjust turbine load to control Tave [0.2/3] this is necessary because of the Overpower Rod Stop (103%) [0.2/3] (1.2)

b. 1. Removes the faulty input to the Detector Current Comparator (Current Deviation Alarm) (axial) (0.6)

2. Removes the faulty channel input to the Channel Current Comparator (Channel Deviation Alarm) (quadrant) (0.6)

REFERENCE
AOP-7 P.4 & AOP-9 P.14

ANSWER 7.07 (2.50)

High pressurizer level trip [0.5]
Charging flow decreases [0.5]
Pressurizer level decreases [0.5]
Letdown isolates (heaters off) [0.5]
Pressurizer level increases (backup heaters on) [0.5] (2.5)

REFERENCE
AOP-9 P.7

ANSWER 7.08 (2.80)

a. Fuel building ventilation diverts through the charcoal filters
Charcoal booster fans auto start (done per proced. prior to moving fuel) (0.8)

b. All personnel accesses to the affected area are closed
All personnel have evacuated the affected area (0.8)

c. Shield against injestion [0.6] air feed respirator [0.3]
use of a plastic of rubber suite [0.3] (1.2)

REFERENCE
EOP-8 P.4,5 & Rad Con Considerations

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 7.09 (2.80)

a. No, if the counts are doubled the Shutdown Margin is halfed, (shutdown reactivity was decreased by approximately 50%) thus by adding the same amount of reactivity again the reactor would be critical. (1.2)

b. Emergency Borate
Reinsert control banks
Recalculate the ECC
Adjust boron concentration (0.8)

c. Channel 35 [0.4] compare S/R to I/R, 10 4 CPS = 10 -10 AMPS [0.4] (0.8)

REFERENCE
GOP-2 p. 13,14,22

ANSWER 7.10 (1.80)

a. Activation of corrosion products and dissolved chemicals (Crud Burst)

Clad failure resulting in fission product release (1.0)

b. Activity should be due to corrosion products (Crud Burst) (0.8)

REFERENCE
ADP-10

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 8.01 (2.70)

1. Assure adequate SDM [0.4] Rods above the RIL assure that sufficient negative reactivity is avaiable to offset the positive reactivity inserted from the power defect [0.5] (0.9)

2. Minimize the consequences of a rod ejection accident [0.4] With rods above the RIL the amount of reactivity inserted (power excursion) during a rod ejection accident is limited [0.5] (0.9)

3. Assure acceptable nuclear peaking factors [0.4] With rods

**, SYSTEM GOING DOWN AT 1200 .

**, PLEASE SAVE FILES AND LOG OUT.

3. Assure acceptable nuclear peaking factors [0.4] With rods above the RIL there is little/no flux distortion from rod position [0.5] (0.9)

REFERENCE
Zion T/S 3.2.1.D.1 & Bases P.65

ANSWER 8.02 (2.40)

a. 1. 1.02
2. Not applicable (0.4)

b. DNB and linear heat generation rate protection (with x-y power tilts) (0.8)

c. verify the tilt with incore mappings [0.4] and/or to determine and correct the cause of the tilt [0.4] (0.8)

d. By using the movable incore detectors (thermocouples) (0.4)
(engineering) or (operator)

REFERENCE
Zion T/S 3.2.2.B & Bases P.71,72

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 8.03 (2.80)

a. Compare thermal power, pressurizer pressure, and highest operating loop Tave, and ensure this point is under the appropriate safety limit curve. (0.8)

b. OTdT (back-ups - hi flux, hi press, low press, OPAT, low flow) (0.6)

c. To prevent clad damage from overheating, and thus prevent the release of fission products. (0.8)

d. Shutdown the reactor and inform the Division Vice President. (0.6)

REFERENCE
Zion T/S 1.1 p.7 & Sec.6 p.314

ANSWER 8.04 (2.60)

a. 1.All automatic containment isolation valves are operable or secured in the closed position, or manually isolated.

2.Manual containment isolation valves are shut.

3.Equipment hatch is closed.

4.One door in each air lock is closed and sealed.

5.Containment leakage within T/S

6.Penetration pressurization system is operable (5 required) (1.5)

b. Operating Shift Supervisor (Shift Engineer) (0.5)

c. Must be in parked or stored position, unless maintaince is in progress, or APDMS is in operation (0.6)

REFERENCE
Zion T/S 1.C p.2 & ZAP 5.51-7

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 8.05 (2.50)

1. Two PORV's operable [0.2] or one PORV shall be open [0.2] or Pzr level shall be <25% and pressure <100 psig [0.2] (0.6)

2. Only one of three charging pumps operable. (0.5)

3. No safety injection pumps. (0.4)

4. No accumulators. (0.4)

5. The first RCP shall not be started with associated S/G temperature >50 F above RCS temperature. (0.6)

REFERENCE
Zion T/S p.82,83

ANSWER 8.06 (2.80)

a.1. Station equipment under the Juristiction of the Load Dispatcher. (0.6)
2. Station or (other responsible) personnel [0.3] or the Load Dispatcher [0.3] (0.6)
3. Electrical Log (0.4)

b.1. When any point of isolation or source of potential is under the Juristiction of the Load Dispatcher. (Not Division or Generating Station) (0.6)

2. Load Dispatcher (0.6)

REFERENCE
ZAP 14-51-2 p.4,5, & 37

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

ANSWER 8.07 (3.00)

a. 1. Cable Spreading Rooms
2. Auxiliary Building (542 ft., 560 ft., 579 ft.)
3. Crib House
4. Battery Rooms
5. D/G Oil Storage Rooms (3 required) (1.5)

b. Operators Routine Check Sheets (Appx. A) (0.7)

c. The Fire Protection Impaired Protection Procedure (SOI-65) must be implemented. or Post Fire watch within 1 hr. (0.8)

REFERENCE
ZAP-02A p.2,3

ANSWER 8.08 (2.20)

a. 1 GPM total leakage for all S/G's
500 GPD per S/G (0.6)

b. 1 GPM, ensures that the dosage contribution from the tube leakage will be limited to a small fraction of the Part 100 limits in the event of either a steam generator tube rupture or steam line break (0.8)

500 GPD, ensures that S/G tube integrity is maintained in the event of a steam line rupture as under LOCA conditions (0.8)

REFERENCE
Zion T/S Amend. 34 & 31, p.98a

ANSWER 8.09 (2.20)

a. Shift Engineer
Radiation protection Department
Control Room (0.9)

b. Eight (0.5)

c. Trainee Access/Entry List
Contaminated or High Radiation Area Access List (0.8)

ANSWERS -- ZION SIMULATOR -84/07/24-FEHRINGER,J.

REFERENCE
ZAP-0-1 p. 3,4,5

ANSWER 8.10 (1.80)

a. 3 R/Qtr is not exceeded
Total accumulated dose does not exceed 5(N-18)
Accumulated exposure on record (NRC-4) (0.9)

b. If an individual entering a restricted area recieves or is likely to recieve 25% of the quarterly exposure limit

If an individual 18 years or younger receives or is likely to receive 5% of the adult quarterly limit

If an individual is entering a high radiation area (0.9)

REFERENCE
ZNPT-211 A-13 p.8,11,12