W3SES Examination Report
No. 50-382/OL-87-01

Docket No: 50-382 License No.: NPF-38

Licensee: Louisiana Power & Light
142 Delaronde Street
New Orleans, Louisiana 70174

Examinations administered at Waterford 3 Steam Electric Station

Chief Examiner: S. L. McCrory, Lead Examiner Date 2/4/86

Approved by: R. A. Cooley, Section Chief Date 2/4/86

Summary

Examinations conducted on December 16-18, 1987.

Written and operating examinations were administered to eight (8) Reactor Operator candidates, and operating examinations only to one (1) Senior Reactor Candidate. All candidates passed these examinations.

Report Details

I. Examination Results

SRO candidates				RO Candidates			
Total	Pass	Fail	%	Total	Pass	Fail	%
1	1		100	8	8	0	100

II. Examiners

S. L. McCrory, Chief Examiner
D. Graves

III. Examination Report

This Examination Report is composed of the sections listed below.

Examination Review Comment Resolution

Exit Meeting Minutes

W3SES Examination Key (SRO Questions and Answers)

Performance results for individual examinees are not included in this report because examination reports are placed in NRC's Public Document Room as a matter of course. Individual results may be retained in the NRC Region office during the period that the facility is evaluated as unsatisfactory but are not subject to public disclosure.

A. Examination Review Comment Resolution

In general, editorial comments or changes made during the examination, the examination review, or subsequent grading reviews are not addressed by this resolution section. This section reflects resolution of substantive comments made during the examination review. The modifications discussed below are included in the master examination key which is provided elsewhere in this report as are all other changes mentioned above but not discussed herein. Attachment 1 is the facility comments on the examination. Unless otherwise indicated in this section, the facility comments were incorporated into the answer key.

COMMENTS

1. 4.11b. Partial credit was given for "None". Several candidates asked about this question and were told by the examiner that the answer was not "none".

B. Exit Meeting Summary

At the conclusion of the examination period, the examiners met with the members of the facility staff to discuss the results of the examinations. The following personnel were present for the exit meeting:

NRC	UTILITY
S. McCrory	N. Carns
D. Graves	D. Packer
	C. Toth
	L. Myers
	D. Clark
	D. Brown

NRC informed the facility staff that no generic weaknesses were identified during the course of these examinations.

C. General Comments

Over all performance on these examinations was excellent.

D. W3SES Examination Key

Date Administered: 12/16/86

Type of Examination: Reactor Operator

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: WATERFORD 3

REACTOR TYPE: PWR-CE

DATE ADMINISTERED: 86/12/16

EXAMINER: MCCRORY, S.

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

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

_____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

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

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

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

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

6. Use only the paper provided for answers.

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

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

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

10. Skip at least three lines between each answer.

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

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

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

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

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

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

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

18. When you complete your examination, you shall:

a. Assemble your examination as follows:

(1) Exam questions on top.

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

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

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

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

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

QUESTION 1.01 (1.50)

New fuel assemblies introduced into the core during the first and subsequent refuelings nominally spend three cycles in the core.

a. WHERE are most of the new fuel assemblies inserted in the core? (0.5)

b. HOW and WHY does the position of the fuel assembly change relative to the core center during its second cycle? (1.0)

QUESTION 1.02 (1.00)

Explain how pressurizer pressure can affect pressurizer level indication. (1.0)

QUESTION 1.03 (1.50)

For each of the following factors, state whether the B.S. calorimetric will be MORE or LESS conservative. NO explanation is required. (1.5)

a. Feed water temperature is actually 2 deg. F lower than the value used in the calorimetric.

b. The feedwater flow venturi becomes partially fouled.

c. Steam Generator blowdown is 10 gpm greater than the value used in the calorimetric.

QUESTION 1.04 (1.50)

Post accident containment temperatures affect the indicated level vs. actual level relationship for the pressurizer and for the steam generators. How is the relationship affected and what is the mechanism by which this occurs?

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

QUESTION 1.05 (1.50)

a. Why are UNDAMPED xenon oscillations of concern from a core protection standpoint? (1.0)

b. What indications are available to detect and confirm Xenon oscillations? (0.5)

QUESTION 1.06 (2.00)

TRUE or FALSE? No explanation required. (2.0)

a. As condenser vacuum is increased (absolute pressure decreased), more energy can be extracted from the steam.

b. The main condenser uses the conduction mode of heat transfer to reject heat to the circulating water system.

c. Increasing condensate depression (subcooling) will increase overall plant efficiency.

d. Decreasing condensate depression (subcooling) will decrease condenser vacuum.

QUESTION 1.07 (2.00)

TRUE or FALSE? No explanation required. (2.0)

a. The operator can increase the heat removal rate from the RCS by reducing steam pressure.

b. A LOCA with no RCPs running can result in more inventory loss than a LOCA with RCPs running.

c. A total and prolonged loss of feedwater can lead to a loss of RCS liquid inventory.

d. The primary concern when fuel clad temperature reaches 1400 degrees Fahrenheit is the production of hydrogen.

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

QUESTION 1.08 (3.00)

The plant has been operating at 60% power for several days with all rods out. A single CEA drops into the core but does not cause a reactor trip.

a. Explain HOW and WHY the dropped CEA will affect the MAXIMUM (peak) linear power in the core. (1.5)

b. HOW and WHY will the maximum linear power in the core change over the next three hours if the CEA is not recovered? (1.5)

QUESTION 1.09 (3.00)

a. What TWO parameters can the operator control to prevent pressurized thermal shock? (1.0)

b. What is the sequence of generic events that could lead to pressurized thermal shock conditions? (1.0)

c. Why does the concern about brittle fracture of the reactor pressure vessel increase as the W3SES plant ages? Include in your answer the specific material property that is affected. (1.0)

QUESTION 1.10 (1.00)

Describe what would happen to flow rate for a closed loop system for the following cases: (1.0)

a. The system has a single centrifugal pump with its discharge valve partially closed.

b. The system has a single positive displacement pump with its discharge valve partially closed.

c. The system has a single centrifugal pump and the bypass line around a heat exchanger is open.

d. The system has a single positive displacement pump and the bypass line around a heat exchanger is open.

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

QUESTION 1.11 (1.00)

Indicate whether the following conditions would make cavitation of a Safety Injection pump MORE or LESS likely. Briefly explain WHY. (1.0)

a. Raising supply water temperature

b. Lowering RWSP level

c. Boron precipitation deposits on the walls of the pump suction piping.

QUESTION 1.12 (2.50)

a. List two reasons for the TRANSIENT CEA Insertion limit curve. (1.0)

b. Why does the TRANSIENT CEA Insertion limit increase as power is increased? (0.5)

c. Explain HOW and WHY boron concentration does or does not affect the LONG TERM STEADY STATE CEA Insertion LIMIT. (1.0)

QUESTION 1.13 (1.50)

Match the following items (a-f) with their approximate or thumbrule numerical values taken from the list shown (1-10). (All values are ABSOLUTE and shown to three decimal places regardless of normal convention.) (1.5)

a. "Beta Effective" at BOC
b. 100% Equilibrium Xe worth (%dK/K)
c. Fast fission factor (E)
d. "Beta Effective" at EOC
e. Time (hr) to peak Xe after trip from 100% equilibrium
f. Importance Factor

1. 0.003
2. 0.005
3. 0.006
4. 0.007
5. 0.950
6. 0.980
7. 1.000
8. 1.050
9. 1.500
10. 2.700
11. 3.200
12. 8.000
13. 10.000
14. 24.000

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

QUESTION 1.14 (2.00)

WHAT core reactivity coefficient will be most significant in limiting the power peak following a CEA ejection? WHY will it be most significant and HOW does it work? (2.0)

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

QUESTION 2.01 (1.50)

a. What are the minimum and maximum flowrates permitted by the Letdown Flow Control Valve when operating in automatic? What is the basis for each of these flowrates? (1.0)

b. What is the purpose of the lead/lag unit between the Pressurizer Level Controller and the Letdown Flow Control Valve Controller? (0.5)

QUESTION 2.02 (2.00)

Place the list below in the proper sequence along a feedwater line starting at the main condenser and continuing downstream to a steam generator. (2.0)

a. Main feedwater flow control valve
b. High pressure feedwater heaters
c. Main feedwater isolation valve
d. Low pressure feedwater heaters
e. Emergency feedwater tee
f. Condensate pump
g. Steam generator feedwater pump
h. Gland steam condenser

QUESTION 2.03 (1.50)

The refueling machine bridge and trolley drives are interlocked so that the movement is prohibited in either direction if any one of nine conditions exist. List six of these nine conditions. Redundant or duplicate components count as one. (1.5)

QUESTION 2.04 (1.50)

Station Modification Package 760 changed the seal cooler supply and return CC isolation valves for the RCP's from auto closing on high pressure and added control switches on CP-2. How do these valves operate now? INCLUDE SETPOINTS. (1.5)

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

QUESTION 2.05 (1.50)

a. The halon fire suppression system(s) for WHICH AREA(S) is(are) required to be OPERABLE per Technical Specifications? (0.5)

b. If the automatic halon release fails, how is it released manually both REMOTELY and LOCALLY? (1.0)

QUESTION 2.06 (2.00)

You have been directed to parallel a DG to a live bus. DISCUSS briefly the consequences of shutting the DG breaker under EACH of the following conditions.

a. Incoming and running volts are equal, the breaker is shut when the sync needle points to the 12 o'clock position, and the sync needle is rotating: (1.5)
   1. rapidly in the fast direction.
   2. slowly in the fast direction.
   3. slowly in the slow direction.

b. Incoming and running volts differ significantly when the breaker is shut with the sync needle rotating in the proper manner and at the proper position. (0.5)

QUESTION 2.07 (1.50)

The Post Accident Sampling System (PASS) can draw liquid or gaseous samples from what three areas? (1.5)

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

QUESTION 2.08 (2.00)

Answer TRUE or FALSE to the following statements concerning the Control Room HVAC. (2.0)

a. The Control Room HVAC toilet room exhaust fans will trip and isolate on receipt of a High Radiation Signal or SIAS.

b. SIAS will close the Control Room HVAC emergency outside air intake valves if they are open initially.

c. The receipt of a SIAS will NOT start the "B" emergency filtration unit during a surveillance test run of the "A" emergency filtration unit of the Control Room HVAC.

d. A toxic gas signal due to ammonia detection will start the Control Room HVAC emergency filtration units.

QUESTION 2.09 (1.50)

What conditions will cause a HPSI pump A/B unavailability alarm? (1.5)

QUESTION 2.10 (2.50)

Sketch a typical safety related static uninterruptible power supply showing major components and normal and alternate power inputs. (2.5)

QUESTION 2.11 (2.00)

a. The emergency Feedwater pump turbine is equipped with redundant overspeed trips. State whether the overspeed trips reset automatically or must be manually reset. (1.0)

b. What is the motive force for the Emergency Feedwater Pump turbine steam line shutoff valves (MS 401 "A" & "B")? (0.5)

c. How do the above valves fail on loss of operating power? (0.5)

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

QUESTION 2.12 (2.00)

a. What are four (4) loads cooled by the "A" essential header of the Component Cooling Water (CCW) system? (1.0)

b. After receipt of an SIAS, what two (2) loads are added to the "A" CCW essential header? (1.0)

QUESTION 2.13 (1.50)

Place the fuel handling equipment below in the sequence in which each would be used to move NEW fuel from storage to the reactor vessel. (1.5)

a. Spent fuel upender.

b. Refueling machine.

c. New fuel elevator.

d. Reactor side upender.

e. Spent fuel machine.

f. Carriage.

QUESTION 2.14 (2.00)

a. What are two (2) reasons for the minimum spent fuel pool level of 23 feet above stored fuel? (1.0)

b. What spent fuel pool cooling design features prevent draining the spent fuel pool? (1.0)

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

QUESTION 3.01 (1.50)

List three functions provided by the Safety Channel 10E-4% bistables. (1.5)

QUESTION 3.02 (.50)

Select the best answer to complete the following statement.

The manual/automatic station for the pressurizer heaters and spray is in MANUAL. To increase the heat from the proportional heaters you MUST: (0.5)

a. Decrease controller output.
b. Increase controller output.
c. Decrease pressure setpoint.
d. Increase pressure setpoint.

QUESTION 3.03 (1.50)

In WHAT positions should the operator expect to find the feedwater regulating valves and startup feedwater regulating valves after level in both steam generators decreases to 25% narrow range as a result of a transient? WHY will the valves be in these positions? (1.5)

QUESTION 3.04 (2.00)

CEAC hardware and software failures such as power failure, machine malfunction, memory fault, watchdog timer malfunction, etc. will cause a CEAC to send a FAIL FLAG to the CPCs indicating that CEAC input is invalid. List four OTHER conditions which will cause a CEAC to send a FAIL FLAG to the CPCs. (2.0)

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

QUESTION 3.05 (1.50)

Name the CEDMCS control mode which best relates to each of the following conditions or situations. A mode may be used more than once or not at all. However, only ONE mode applies to each item below. (1.5)

a. Matches Tavg with Tref.
b. Used for CEA alignment within a group.
c. Allows movement of selected group only.
d. Allows movement at low rate or high rate.
e. Prohibits CEA motion except on reactor trip.

QUESTION 3.06 (1.00)

With the Tavg values and power levels listed below, give the direction and rate (fast or slow) of CEA movement with RRS in automatic. (1.0)

a. 586 deg. F at 100% power
b. 576 deg. F at 90% power
c. Tavg - Tref = +3.6 deg. F
d. Tavg - Tref = -1.8 deg. F

QUESTION 3.07 (3.00)

A main feedwater pump is tripped while the plant is at equilibrium 100% power. (1.0 each)

a. Explain HOW and WHY the reactor power cutback system should function.

b. Explain HOW and WHY the turbine load should respond.

c. Explain HOW and WHY the steam bypass control valves should function.

QUESTION 3.08 (2.00)

Concerning the CEAC penalty factor algorithm: (2.0)

a. List five factors which affect the magnitude of the penalty factors.

b. Explain the effect of a failure on one of the CEACs on the CPCs.

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

QUESTION 3.09 (1.50)

Answer the following concerning the RPS/ESFAS SETPOINT RESETS: (1.5)

a. Which parameters have this reset function?

b. From what locations can these functions be performed? BE SPECIFIC.

c. What are the enabling conditions which permit these resets?

QUESTION 3.10 (2.50)

Answer the following concerning the operation of the Reactor Trip on Turbine Trip Modification: (2.5)

a. What parameter is monitored to generate the trip?

b. What type of logic is used to generate a signal to the PPS?

c. When is this trip automatically bypassed?

d. What position must the switches on CP-2 and CP-7 be in to allow the system to be armed?

e. With the plant at 100% power and the system armed, what, if anything, would occur if the switch on CP-2 was repositioned to TEST?

QUESTION 3.11 (2.00)

List six (6) factors or parameters used to generate CPC auxiliary trips? Setpoints are NOT required. (2.0)

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

QUESTION 3.12 (3.00)

For each of the situations below (a - f), indicate which power signal(s) (from 1 - 5) is(are) being used by COLSS as reactor power. Answers to a - f may require more than one response from 1 - 5. (3.0)

a. Reactor power is 10%
b. Reactor power is 50%
c. Reactor power is 50%, BSCAL has failed
d. Reactor power is 50%, CBTFSP has failed
e. Reactor power is 100%, BSCAL and BDELT have failed
f. Reactor power is 100%, CBDELT and CBTFSP have failed

1. Primary Calorimetric (BDELT)
2. Secondary Calorimetric (BSCAL)
3. Turbine Impulse Pressure (BTFSP)
4. Calibrated BDELT (CBDELT)
5. Calibrated BTFSP (CBTFSP)

QUESTION 3.13 (3.00)

a. What control action takes place when a Core Protection Calculator (CPC) pretrip setpoint is reached? Assume that enough channels are at the pretrip setpoint to satisfy circuit logic. (0.5)

b. What reactor protection system trips are generated by the CPCs? (1.0)

c. A CEAC fails and will not reset. How are the penalty factors determined with only one operable CEAC? (1.5)

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

QUESTION 4.01 (1.00)

Briefly describe the operations required to take AUTOMATIC control of pressurizer level LOCALLY at CP-2 and raise level in the pressurizer. Include the location(s) where the operations are performed. (1.0)

QUESTION 4.02 (2.00)

The precautions of OP-10-001, General Plant Operations, require that RCS oxygen concentration be reduced to less than 0.10 ppm before exceeding 250 degrees Fahrenheit.

a. What is used to reduce the oxygen concentration in this condition?(1.0)

b. What is significant about the 250 degree Fahrenheit limit? (1.0)

QUESTION 4.03 (2.00)

TRUE or FALSE? No explanation is required. (2.0)

a. CEA insertion (Group 6 or PLCEA's) is required to drive ASI back to ESI as flux is shifting to a positive ASI.

b. A Tavg drop from the programmed values may be used to reduce boron dilution during a power reduction.

c. During a short term power reduction (e.g., 100% to 60% for 20 hours), ASI should be maintained at the ESI for 100% power.

d. ASI control must always be observed above 20% power.

QUESTION 4.04 (2.00)

Per OP-901-004, "Evacuation from the Control Room and Subsequent Plant Shutdown,"

a. What is one (1) condition requiring Emergency Boration of the RCS?(1.0)

b. What is one (1) Termination Criteria for Emergency Boration? (1.0)

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

QUESTION 4.05 (2.50)

a. While performing a natural circulation cooldown, what indicates void formation in the reactor vessel head during depressurization? (1.0)

b. What are two (2) positive actions that should be taken, EXCLUDING changing RCS pressure in response to voiding? (1.0)

c. Why should RCS pressure be increased slowly (what are the negative consequences associated with increasing RCS pressure too fast)? (0.5)

QUESTION 4.06 (3.00)

a. Describe the response of four (4) control room indications that would respond similarly for both a steam generator tube rupture (SGTR) and a loss of reactor coolant accident (LOCA) inside containment.

b. Describe the response of two (2) control room instruments to a SGTR that would differ from a LOCA inside containment.

QUESTION 4.07 (2.50)

With respect to OP-902-008, "Safety Function Recovery Procedure,"

a. What criteria must be met to exit this procedure? (0.5)

b. Where in the EOP procedure set will you exit to? (0.5)

c. Which of the success paths shown in a Resource Assessment tree foldout should you try to implement to restore a safety function which is in jeopardy? (0.5)

d. List the safety functions below in order of DECREASING priority: (1.0)

1. RCS and Core Heat Removal,

2. Combustible Gas Control,

3. Reactivity Control, and

4. Containment Isolation.

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

QUESTION 4.08 (4.00)

List 12 of the 16 Immediate Operator Actions required by the Emergency Entry Procedure (Substeps are NOT required). (4.0)

QUESTION 4.09 (2.50)

Give numerical values for the following, based on NRC regulations.

a. Maximum quarterly occupational exposure to hands and forearms. (0.5)

b. MAXIMUM and MINIMUM radiation levels which are posted "Caution - Radiation Area." (1.0)

c. Maximum occupational lifetime whole body exposure for a 25 year old individual. (1.0)

QUESTION 4.10 (1.50)

With respect to the WEEKLY limits:

a. What is the Waterford-3 limit for Whole Body Dose? (0.5)

b. Whose, by job title, permission is required to increase the above limit to 600 mrem? (0.5)

c. Whose, by job title, permission is required to exceed 600 mrem? (0.5)

QUESTION 4.11 (2.00)

a. WHO, by job title, must approve the discharge of a gas decay tank? (1.0)

b. What immediate operator action is required if the waste gas discharge high activity alarm sounds? (1.0)

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

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 1.01 (1.50)

a. Most new fuel assemblies are loaded near the core periphery. (0.5)

b. The assemblies are moved closer to the core center in its second cycle (0.3). As the fuel is depleted in an assembly (0.1), it must be exposed to a higher flux to generate the same power level (0.2). Since the flux density is higher near the center of the core (0.2), older assemblies are moved nearer the center so that their power generation will be roughly the same as those near the core periphery with higher fuel density. This is done to minimize local power peaks (0.2).

REFERENCE
CE CORE DESIGN

ANSWER 1.02 (1.00)

Pressure changes the density of the variable leg (0.3) varying the pressure exerted on the DP cell (0.2). Since the reference leg remains constant (0.3), indicated level varies from actual (0.2).

REFERENCE
W3SES LP 124-046-01-003,4

ANSWER 1.03 (1.50)

a. less
b. more
c. more
(0.5 each)

REFERENCE
BASIC THERMODYNAMICS

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 1.04 (1.50)

Indicated level will be HIGHER than actual level (0.5). As temperature of the reference leg increases, the density decreases (0.25). This will cause the weight of the water in the reference leg to decrease (0.25) making the delta p smaller (0.25) thus causing indicated level to read higher than actual or implying an increase in actual level (0.25).

REFERENCE
W3SES LP L124-046-01-008

ANSWER 1.05 (1.50)

a. Xenon oscillations cause large variations in local power generation (0.5) which, if unchecked, could result in exceeding local power peaking factors leading to fuel damage (0.5)

b. CPC ASI (0.2), COLSS ASI indications (0.2) and neutron flux indications (detector comparisons) (0.1).

REFERENCE
CE CORE DESIGN AND CHARACTERISTICS
W3SES SD CPC, COLSS

ANSWER 1.06 (2.00)

a. TRUE
b. TRUE
c. FALSE
d. FALSE (0.5 ea.)

REFERENCE
BASIC FLUID MECHANICS AND HEAT TRANSFER

ANSWER 1.07 (2.00)

a. TRUE
b. FALSE
c. TRUE
d. FALSE (0.5 ea.)

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

REFERENCE
BASIC REACTOR THEORY

ANSWER 1.08 (3.00)

a. The core maximum linear power will increase (0.5). Total core power does not change. The linear power near the dropped CEA will decrease (0.5), but the rest of the core will be producing a higher linear power (0.5).

b. Xenon will build in near the inserted CEA due to burnout decreasing (0.5). This will further suppress power generation in this area (0.5), and cause the maximum linear power to increase elsewhere in the core (0.5).

REFERENCE
Basic Reactor Theory

ANSWER 1.09 (3.00)

a. Coolant temperature (0.5)
Coolant pressure (0.5)

b. Rapid cooldown and depressurization (0.5) followed by rapid repressurization (0.5).

c. Neutron exposure (integrated) (0.5) makes the material more brittle (raises NDTT) (0.5).

REFERENCE
CE EQB

ANSWER 1.10 (1.00)

a. decreases
b. no change
c. increases
d. no change
(0.25 each)

REFERENCE
W3SES LP L110-703-00-007

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 1.11 (1.00)

a. more (0.1) - Raising supply water temperature brings the pumped fluid closer to saturation for pressures experienced during pumping (0.24).

b. More (0.1) - Lower RWSP level implies less static pressure head available at the pump suction to prevent cavitation (0.23)

c. More (0.1) - Deposits act as restrictions and increase piping head losses making pump suction pressure lower (0.23)

REFERENCE
W3SES LP L110-703-00-008

ANSWER 1.12 (2.50)

a. 1. ensure shutdown margin
2. CEA ejection accident
3. maintain power distribution limits
(any 2 at 0.5 each)

b. compensate for power defect (0.5)

c. Boron concentration has NO effect on any CEA insertion LIMIT (1.0). A limit is a predetermined constant parameter value. (Boron concentration must vary to achieve the limit but does not affect the limit itself.)

REFERENCE
W3SES LP L110-508-01-004, T.S. B3.1.3.6

ANSWER 1.13 (1.50)

a. 4 - 0.007
b. 10 - 2.700
c. 8 - 1.050
d. 2 - 0.005
e. 13 - 10.000
f. 6 - 0.980
(0.25 each)

REFERENCE
W3SES LP L110-506-00-003

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 1.14 (2.00)

The fuel doppler (temperature) coefficient (0.5) will respond immediately because the fuel temperature will increase before coolant temperature goes up (0.5). The increase in fuel temperature causes the resonance absorption peaks of the fuel to broaden (0.5) allowing absorption of a wider range of neutron energy levels which reduces flux density and thus reactor power (0.5)

REFERENCE
W3SES LP L110-510-00-002,3

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 2.01 (1.50)

a. Minimum - 28 gpm - ensures adequate heat transfer across the RHX (0.5)
Maximum - 128 gpm - based on max charging pump capacity less RCP CBO flow. (0.5)

b. It slows the speed of the Letdown valve stroke. (0.5)

REFERENCE
W3SES EQB QNUM 949
LESSON PLAN L124-046-01-003,4

ANSWER 2.02 (2.00)

f
h
d
g
b
a
c
e
(0.25 each)

REFERENCE
W3SES LP L124-023-00-002

ANSWER 2.03 (1.50)

1. Either mast bumper is actuated
2. Either grappler is in or below the upper grapple operate zone
3. Either hoist is being operated (not at upper limit)
4. Either hoist has been operated prior to bridge operation
5. Either the spreader or the aligner is not retracted
6. Fuel hoist is in the "fuel only" region with a fuel assembly on
7. CEA hoist is in the "CEA only" region with a CEA on
8. One hoist is not at its upper limit position unless the machine is over the upender.
9. Upender zone unless upender is vertical

(any six at 0.25 each)

REFERENCE
W3SES LP L124-029-00-002

ANSWER 2.04 (1.50)

On high temperature, 155 deg. F, (0.25) the valves will automatically close (0.25) and can be re-opened by momentarily placing the control switch to "close" (0.25) and back to "open" (0.25) which will allow the valves to be re-opened. If the temperature of the CC outlet from the cooler decreases to 145 deg. F the valves will stay open (0.25). If temperature is GT 145 deg. F after 100 seconds the valves will close (0.25).

REFERENCE
W3SES EQB QNUM 572

ANSWER 2.05 (1.50)

a. The computer room (subfloor area). (0.5)

b. Remote - operate pushbutton on the Master Remote Control Panel in the Control Room. (0.5)
Local - pull a pin and rotate a lever (counter-clockwise) at the cylinder head. (0.5)

REFERENCE
W3SES LP L124-026-00-007

ANSWER 2.06 (2.00)

a. 1. Pick up a large load - possibly slowing the diesel excessively.
2. Pick up a small load (preferred)
3. Reverse power - will probably trip breaker

b. Cause reactive current to flow - large KVAR load - possibly trip breaker.

(0.5 each)

REFERENCE
W3SES EQB QNUM 29

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 2.07 (1.50)

Containment atmosphere
Safety injection sump
RCS Hot leg
(0.5 each)

REFERENCE
W3SES LP L124-068-00-002

ANSWER 2.08 (2.00)

a. true
b. false
c. true
d. false

REFERENCE
W3SES LP L124-016-00-004

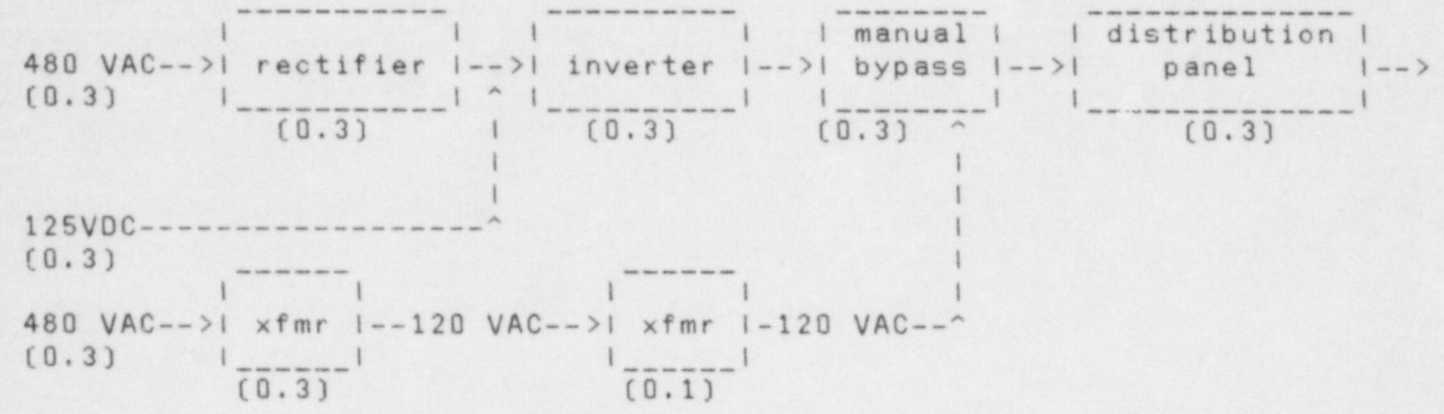
ANSWER 2.09 (1.50)

1. Pump A/B selector switch in A or B (0.1), SIAS present (0.2), and the bkr not closed after one second (0.2).
2. If any valve lineup abnormalities exist between the suction and discharge valves (0.5) (SI-202A & B, SI-212A & B).
3. If the pump valves are aligned to the B header (0.25) and power is lost to the A safeguards room chiller unit (0.25).

REFERENCE
W3SES SD SI pg 26

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 2.10 (2.50)



REFERENCE
Inverters and Distribution System Description, fig. 59-2

ANSWER 2.11 (2.00)

a. Electrical overspeed - auto reset
   Mechanical overspeed - manual reset
b. Motor-operated
c. Fail as is (4 answers at 0.5 ea.)

REFERENCE
W3SES SD - EMERGENCY FEEDWATER SYSTEM, pages 3, 5, 8

ANSWER 2.12 (2.00)

a. 1. Containment fan coolers.
   2. HPSI pump.
   3. LPSI pump.
   4. Shutdown cooling heat exchangers.
   5. Diesel generator.
   6. Containment Spray pump.
   7. Chillers.
   8. H[2] analyzers. (Any 4 at 0.25 ea.)

b. 1. RCP's.
   2. CEDM coolers. (2 at 0.5 ea.)

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

REFERENCE
W3SES L124-009-00, p. 2, 4; Objective 6.a.

ANSWER 2.13 (1.50)

c, e, a, f, d, b (Sequence: 0.3 for ea. swap req'd for proper sequence)

REFERENCE
W3SES L124-029-00, p. 29, 30; Objective 8

ANSWER 2.14 (2.00)

a. 1. Minimize radiation dose at the pool surface (<2.5 mr/hr).
2. (Offsite) Dose consequences of DB FH accident within analysis.
3. Filter (99%) the assumed (10%) iodine gap activity from a ruptured fuel assembly. (Any 2 at 0.5 ea.)

c. 1. Suction lines are elevated. (0.5)
2 Return lines have siphon breakers. (0.5)

REFERENCE
W3SES L-124-030-00, p. 1, 2, 9, 16; Objectives 2, 4, 7

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 3.01 (1.50)

1. Permits manually bypassing the high log power trip when reactor power is > 10E-4%.

2. Supplies input to the CPCs permitting bypassing the DNBR and LPD trips when power is < 10E-4%.

3. Automatically bypasses and reinstates the control withdrawal prohibit (CWP) on a DNBR or LPD pretrip.

4. Automatically reinstates high log power trip when < 10E-4% power and DNBR/LPD when >10E-4% power.

(any 3 at 0.5 each)

REFERENCE
W3SES SD Vol. 2 EXCORE NI

ANSWER 3.02 (.50)

a. Decrease controller output. (0.5)

REFERENCE
W3SES LP L124-046-01-004

ANSWER 3.03 (1.50)

Since this level will generate a low steam generator level reactor trip, the FWCS will respond to a reactor trip override signal (0.5). Main feedwater regulating valves will be closed (0.4) and the startup feedwater regulating valves will be open (at about 25%) with a 5% flow demand signal (0.6).

REFERENCE
W3SES LP L124-024-00-006

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 3.04 (2.00)

1. Operator manually inserts the flag.
2. CEAC in test
3. CEAC in initialization
4. An excessive number of CEA deviations on one quadrant (4 or more)
5. An excessive number of failed CEA sensors (4 or more).

(ANY 4 AT 0.5 EACH)

REFERENCE
W3SES SD CPCs, LP L124-018-00-006,7

ANSWER 3.05 (1.50)

a. auto sequential (AS)
b. manual individual (MI)
c. manual group (MG)
d. auto sequential (AS)
e. Off

(0.3 each)

REFERENCE
W3SES EQB QNUM 270

ANSWER 3.06 (1.00)

a. insert - fast
b. withdraw - slow
c. insert - fast
d. no movement

(0.25 each)

REFERENCE
W3SES LP L124-051-00-020

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 3.07 (3.00)

a. One or two preselected CEA subgroups will drop (0.5) as a result of the feed pump low control oil pressure (0.5).

b. Turbine load will be reduced (0.5) because the RPCS will setback turbine load demand to 50% (0.5)

c. If turbine load runs back faster than reactor power is reduced, high S/G pressure will occur (0.5) which will cause the SBCVs to open (0.5).

REFERENCE
W3SES LP L124-050-00-002,5

ANSWER 3.08 (2.00)

a. 1. magnitude of deviation
2. direction of deviation
3. CEA configuration
4. subgroup with deviating CEA
5. length of time with deviation
(0.2 each)

b. The CPCs will take the last valid PF (0.2) from the failed CEAC (0.2) or the current PF (0.2) from the operable CEAC (0.2) whichever is larger (0.2).

REFERENCE
W3SES LP L124-018-00-006, SD CPC 3.5.1.1, 3.2.5.4.7

ANSWER 3.09 (1.50)

a. pressurizer pressure (0.25)
S/G pressure (0.25)

b. BCP (0.125) at CP-10 (0;125)
CPS ROM (0.125)
Remote Shutdown panel (LCP-43) (0.125)

c. pzr pressure w/i 400 psia of setpoint (0.25)
S/G pressure w/i 200 psia of setpoint (0.25)

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

REFERENCE
W3SES SD PPS 5.1.3.3.5, LP L124-021-00-007

ANSWER 3.10 (2.50)

a. auto stop oil pressure
b. 2/3
c. reactor power <70%
d. CP-2 ENABLE, CP-7 OFF
e. reactor trip
(0.5 each)

REFERENCE
W3SES LP L124-021-00-001,7

ANSWER 3.11 (2.00)

(ANY 6 AT 0.333 EACH)
1. RCS pressure
2. T cold
3. RCPs running (flow)
4. Radial Peaking Factors
5. ASI
6. Quality Margin
7. CPC failure

REFERENCE
W3SES SD CPC pg 31-32

ANSWER 3.12 (3.00)

a. larger of 1 and 3 (0.5)
b. larger of 4 and 5 (0.5)
c. larger of 1 and 3 (0.5)
d. 4 (0.5)
e. 3 (0.5)
f. 2 (0.5)

REFERENCE
COLSS System Description, pg 20-22, Fig. 14 and 14A

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 3.13 (3.00)

a. CEA withdrawal prohibit

b. Low DNBR
High local power density

c. The CPC will keep the last valid penalty factors from the failed CEAC prior to its failure (0.5). These factors are auctioneered against the operable CEAC penalty factors (0.5). The larger of the two is selected for use by the CPC.

REFERENCE
W3SES SD - CPC, pages 66, 72

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 4.01 (1.00)

Place both (0.2) (toggle) switches (0.2) on CP-31 (0.2) to local position (0.2). Raise the setpoint on the controller on CP-2 (0.2).

REFERENCE
W3SES EQB QNUM 979

ANSWER 4.02 (2.00)

a. Hydrazine is used to remove O[2]. (1.0)

b. Hydrazine breaks down OR can no longer remove O[2] effectively. (1.0)

REFERENCE
OP-10-001

ANSWER 4.03 (2.00)

a. F, b. F, c. T, d. F (4 answers at 0.5 ea.)

REFERENCE
W3SES OP-10-001, 133; EQB 4.1-1160

ANSWER 4.04 (2.00)

a. 1. > 1 CEA stuck out of the core, OR
   2. reactor tripped from outside the control room. (1/2 at 1.0)

b. 1. RCS boron conc. incr. by 165 ppm & rx pwr decr., OR
   2. RCS boron conc. > 1300 ppm. (1/2 at 1.0)

REFERENCE
W3SES OP-901-004, 10; L125-202-01-007/9; EQB 4.2-104

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 4.05 (2.50)

a. Pressurizer level increases (more, quicker than expected). (1.0)

b. 1. Match charging & letdown (letdown in manual).
2. Vent head.
3. Letdown back in automatic (when void collapsed). (2/3 at 0.5 ea.)

c. Pressurizer may empty if pressure increased too rapidly. (0.5)

REFERENCE
W3SES OP-902-005, 20/21; L125-305-01-004; EQB 4.3-105

ANSWER 4.06 (3.00)

a. 1. Low pressurizer pressure.
2. Pressurizer level changing.
3. Increased charging flow.
4. Decreased letdown flow.
5. Decreasing VCT level.
6. Stable SG pressure.
7. Increasing/stable SG level. (Any 4 or similar at 0.5 ea.)

b. 1. High cond. offgas radiation.
2. High SG blowdown radiation.
3. Steam/Feed flow mismatch.
4. Stable containment parameters.
5. High radiation on main steam lines (Any 2 or similar at 0.5 ea.)

REFERENCE
W3SES OP-902-002, 2; OP-902-007, 7; L310-043-21-002; EQB 4.3-660

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 4.07 (2.50)

a. When all success criteria are met for an implemented success path for all jeopardized safety functions (CONCEPT). (0.5)

b. The diagnostics section of the Emergency Entry Procedure. (0.5)

c. The highest priority or leftmost path for which all required equipment and conditions are available. (0.5)

d. 3, 1, 4, 2 (Order: 3 swaps at 0.333 ea.)

REFERENCE
W3SES EQB 4.3-674

ANSWER 4.08 (4.00)

1. Verify rx trip.
2. Verify turbine trip.
3. Verify generator trip.
4. Reset MSR controls.
5. Verify SBCS operating in automatic.
6. Verify FWCS in RTO.
7. Safety bus A powered (by SUT or EDG A).
8. Safety bus B powered (by SUT or EDG B).
9. Containment temperature < 120 deg's F.
10. Containment radiation monitors normal.
11. If Prcs > 1684 psia, PLCS & PPCS in auto.
12. If Prcs <= 1621 psia, stop RCP's 1A and 2A.
13. If Prcs <= 1684 psia, or Pcont >= 17.1 psia, SIAS/CIAS occurred.
14. If Pcont > 17.7 psia, CSAS occurred.
15. If Psg <= 764 psia, or Pcont >= 17.1 psia, MSIS occurred.
16. If SG level <= 27.4% NR, EFAS occurred. (Any 12 at 0.3 ea.)

REFERENCE
W3SES OP-902-000, 3-8; EQB 4.3-1316

ANSWERS -- WATERFORD 3 -86/12/16-MCCRORY, S.

ANSWER 4.09 (2.50)

a. 18.75 rem. (0.5)

b. Min: 5 mr/hr or 100 mr in work week (0.5)
Max: 100 mr/hr (0.5)

c. 5(N-18) (0.5) so 35 rem (0.5) (1.0)

REFERENCE
W3SES EQB 4.4-392

ANSWER 4.10 (1.50)

a. 300 mrem. (0.5)

b. HP Supervisor. (0.5)

c. HP Superintendent. (Radiation Protection Superintendent) (0.5)

REFERENCE
W3SES EQB 4.4-526

ANSWER 4.11 (2.00)

a. HP Dept. head (0.5) & Shift Supervisor/Control Room Supervisor. (0.5)

b. Verify that any discharge has been terminated. (1.0)

REFERENCE
W3SES EQB 4.1-62

ATTACHMENT 1

WATERFORD 3 SES

TRAINING DEPARTMENT COMMENTS ON

NRC LICENSE EXAMINATION

ADMINISTERED ON DECEMBER 16, 1986

Prepared by _____ 12/18/86
Date

Reviewed by David P. Clark 12/18/86
Date

Reviewed by _____ 12/18/86
Date

Approved by _____ 12/18/86
Date

CATEGORY 1

1.03c. Comment

On answer key, DELETE: [?]

Basis

Answer is more, (BSCAL accounts for 10 gpm receiving the latent heat of vaporization. Thus calibrated power higher than actual.)

1.05b. Comment

On answer key, ADD: (ASI) after "CPC" and "COLSS".

Basis

ASI is the primary indicating parameter of xenon oscillation.

1.10 Comment

Question needs to have an action verb to clarify change in status, i.e.

"The system has a single centrifugal pump then its discharge valve is partially closed."

Basis

Clarify concept being asked for on future examinations.

END OF CATEGORY 1

2.05a. Comment

On answer key, PLACE: "subfloor area" in parenthesis.

Basis

Technical Specification 3.7.10.3 on page 3/4 7-34 refers to the halon system as the: "Computer Room Halon System". This question requested the area as per Technical Specifications.

2.05b. Comment

On answer key, CHANGE: "rotate a lever counter clockwise" to "rotate the lever".

Basis

Lever only rotates one (1) direction.

2.12b. Comment

On answer key, also ACCEPT: HPSI Pump, LPSI Pump, Containment Fan Coolers, Emergency Diesel Generator, and Essential Chiller as two (2) of the possible answers.

Basis

A & B safety headers normally supply the A/B Header, but on SIAS the 'B' supply is isolated to separate the safety headers. No new loads are added to the 'A' safety header. Extra heat loads occur due to the starting of the LPSI Pump, HPSI Pump, and Essential Chiller (if not running). Extra flow and heat load occurs due to Emergency Diesel Generator Starting. Extra flow occurs to the Containment Fan Coolers and extra heat load is added if 'A' or 'C' fan coolers were shutdown upon receipt of SIAS. Refer to W3 SES LP L124-009-00.

2.13 Comment

On answer key, order should be c, e, a, f, d, b, vice c, a, e, f, d, b

Basis

Spent Fuel Handling Machine moves new fuel from the New Fuel Elevator to the Spent Fuel Upender. Refer to W3 SES LP L124-029-00, page 2, part A.2.D.

END OF CATEGORY 2

CATEGORY 3

3.01 Comment

On answer key part 3, after "bypasses", ADD: "and reinstates"

Basis

10E-4% Bistable bypasses and reinstates the CWP on a DNBR or LPD pretrip. Refer to W3 SES LP L124-022-00, page 19 part 4.4.3.

3.07a. Comment

On answer key, DELETE: "reduced feed flow signal" and INSERT: "Feed pump Low Control Oil Pressure"

Basis

Signal is from Low Control Oil Pressure. Refer to W3 SES LP L124-050-00, page 5, part 4.1.1.

END OF CATEGORY 3

4.06b. Comment

On answer key, ADD: 5. High Radiation Levels on Main Steam Lines.

Basis

Answer is an indication of Steam Generator Tube Rupture in accordance with OP-902-007 Rev. 2, Step 2a on Page 1 of 35.

4.08 Comment 1

On answer key, on Step 12 CHANGE: "Stop all RCPs" to "Stop 1A and 2A RCPs".

Basis 1

This is Step 10 of OP-902-000 Rev. 2 on Page 5. This change has not been incorporated into the question bank yet, awaiting Revision 2 approval.

Comment 2

On answer key, Step 15 DELETE: "& MFIS".

Basis 2

This is not a part of OP-902-000 Rev. 2. Refer to Step 16 on Page 8.

4.11a. Comment

On answer key, CHANGE answer to read: "Shift Supervisor/Control Room Supervisor".

Basis

Correction to existing question in examination bank based upon procedure change. Shift Supervisor/Control Room Supervisor approves release as per HP-1-232 Rev. 2, Step 8.8. HP Supervisor verifies data as per HP-1-232 Rev. 2, Step 8.7.7 (see attachment 4.11a) See attached CHANGE to question bank. (see attachment 4.11).

4.11b. Comment

CHANGE answer key to "None (ACCEPT: Verify that any discharge has been terminated.)"

Basis

Waste Gas Discharge High Radiation, OP-901-026, Revision 3, has no immediate action with the latest revision. See attached CHANGE to question bank. (Attachment 4.11)

However, the discharge termination is: an automatic action, the first Subsequent Action, and a good operating practice. Therefore, we request that the present answer "Verify that any discharge has been terminated." is also acceptable.

END OF CATEGORY 4