U. S. NUCLEAR REGULATORY COMMISSION
OPERATOR LICENSING INITIAL EXAMINATION REPORT

REPORT NO.: 50-083/OL-97-01

FACILITY DOCKET NO.: 50-083

FACILITY LICENSE NO.: R-56

FACILITY: University of Florida

EXAMINATION DATES: February 10 - 11, 1997

EXAMINER: Patrick Isaac, Chief Examiner

SUBMITTED BY: Patrick Isaac, Chief Examiner   2/24/97 Date

SUMMARY:

During the week of February 10, 1997, the NRC administered Operator Licensing Examinations to one Senior Reactor Operator Instant (SROI) candidate. The candidate passed the examination.

REPORT DETAILS

1. Examiners: Patrick Isaac, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	0/0	1/0	1/0
Operating Tests	0/0	1/0	1/0
Overall	0/0	1/0	1/0

3. Exit Meeting:

Dr. William Vernetson, Director of Nuclear Facilities
Daniel Cronin, Reactor Manager
Patrick Isaac, NRC, Chief Examiner

The facility examination comments were discussed as noted in Enclosure 2. There were no generic concerns raised by the Chief Examiner.

ENCLOSURE 1

NRC RESOLUTIONS - WRITTEN EXAMINATION

QUESTION (A.18)

The shutdown margin (SDM), upon full insertion of all control rods following a reactor scram from full power, is ________________ the SDM immediately prior to the scram.

a. Equal to

b. Less than

c. Greater than

d. Independent of

Answer: a

Facility Comment:

The answer key indicates the correct answer to A. 1 8 to be (a); however, we feel the correct answer should be (c) due to the manner in which the facility defines shutdown margin and the manner in which it is applied. The facility makes the distinction between the terms shutdown margin (SDM) and available shutdown margin (ASDM). The full description of the manner in which the trainees and operators are trained on shutdown margin and available shutdown margin is contained in Attachment 1. Additionally, the equation provided on the examination formula sheet for shutdown margin is $SDM = (1-k_{eff})/k_{eff}$. Answer (a) would not be a correct response on the basis of this equation alone because at the critical position, k_{eff} would be one and SDM would be zero; at some rod position below critical, the k_{eff} would be less than one and the SDM would be greater than zero; therefore the SDM at full insertion would be greater than the SDM at critical.

NRC Resolution:

Comment Accepted. The answer key will be modified to accept (c) as the correct answer.

ENCLOSURE 2

QUESTION (B.15)

Who (by title) is the lowest level of operations staff who may authorize switching between City Water and Well Water positions.

a. Licensed Reactor Operator at console

b. Licensed Senior Operator at console

c. Senior Operator on-call

d. The Reactor Manager (or designated alternate).

Answer: c

Facility Comment:

The answer key indicates the correct answer to B. 15 to be (b); however, we feel the correct answer should be either (b) or (c) because our Standard Operating Procedures (SOPS) state that the authorizing individual is the "designated SRO." The "designated SRO" could be the SRO on-call or, if the SRO on-call is also the console operator, as frequently occurs, the SRO at the console.

NRC Resolution:

Comment accepted. The answer key will be modified to accept both (b) and (c) as correct..

QUESTION (C.01)

During operations you notice that the red and orange lights associated with the secondary system are extinguished, while the white light is energized. What is the status of the secondary system? (Assume all lights are operable.)

a. The system is secured.

b. The system is operating with flow less than 60 gpm.

c. The system is operating with flow greater than 60 gpm but less than 140 gpm.

d. The system is operating with flow greater than 140 gpm.

Answer: c

Facility Comment:

The answer key indicates the correct answer to C. I to be (c); however, we feel the question is poorly worded and should be discarded from the examination. The conditions indicated in the question are confusing and probably not possible as worded. The question makes references to the "red", "orange", and "white" lights. Our secondary system has three different white lights associated with it. The condition of the "red" light will be determined by which "white" light is energized. Additionally, two of the "white" lights will also affect the third "white" light. Finally, the secondary flow scram mode in effect will also determine whether or not any or all of the lights are on or off.

NRC Resolution:

Comment accepted. This question will be deleted from the examination.

QUESTION (C.04)

On one of the area monitors, the green light is lit, the red light is extinguished, and the amber light is on. Which ONE of the following conditions is possible?

a. The detector is saturated.

b. The monitor is reading a level of 2 mr/hr.

c. The monitor is reading 9 mr/hr.

d. The monitor is reading 15 mr/hr.

Answer: d

Facility Comment:

The answer key indicates the correct answer to C.4 to be (d); however, we feel the correct answer should be (c). The question does not distinguish between the setting required by the Technical Specifications and the more conservative setting required by the SOPs. The Technical specifications require a "Trip 2" (amber light) at 5 mR/hr and a "Trip 2" (red light) at 25 mR/hr. However, the SOPs require a "Trip 2" (amber light) at 2.5 mR/hr and a "Trip 1" (red light) at 1O mR/hr. Because of this more conservative setting and the fact that the question does not specify whether the SOPs or Technical Specifications are being used as the basis for the question, the only possible reading on the monitor given the conditions would be (c) 9 mR/hr.

NRC Resolution:

Comment accepted. The answer key has been corrected to accept "c" as correct.

OPERATOR LICENSING EXAMINATION

UNITED STATES NUCLEAR REGULATORY COMMISSION

UNIVERSITY OF FLORIDA
February 10, 1997

ENCLOSURE 3

U. S. NUCLEAR REGULATORY COMMISSION
NON-POWER INITIAL REACTOR LICENSE EXAMINATION

FACILITY: University of Florida

REACTOR TYPE: ARGONAUT

DATE ADMINISTERED: 1997/02/10

REGION: II

CANDIDATE: ______________________

INSTRUCTIONS TO CANDIDATE:

Answers are to be written on the answer sheet provided. Attach the answer sheets to the examination. Points for each question are indicated in brackets for each question. A 70% in each section is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	% OF CANDIDATE'S SCORE	CATEGORY VALUE		CATEGORY
20.00	33.3	______	______	A.	REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	33.3	______	______	B.	NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.3	______	______	C.	PLANT AND RADIATION MONITORING SYSTEMS
60.00		______	______% FINAL GRADE		TOTALS

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

____
Candidate's Signature

ANSWER SHEET

A.1 a b c d ___	A.11 a b c d ___
A.2 a b c d ___	A.12 a b c d ___
A.3 a b c d ___	A.13 a b c d ___
A.4 a b c d ___	A.14 a b c d ___
A.5 a b c d ___	A.15 a b c d ___
A.6 a b c d ___	A.16 a b c d ___
A.7 a b c d ___	A.17 a b c d ___
A.8 a b c d ___	A.18 a b c d ___
A.9 a b c d ___	A.19 a b c d ___
A.10 a b c d ___	A.20 a b c d ___

ANSWER SHEET

B.1 a b c d ___	B.12a check test cal ___
B.2 a b c d ___	B.12b check test cal ___
B.3 a b c d ___	B.12c check test cal ___
B.4 a b c d ___	B.12d check test cal ___
B.5 a b c d ___	B.13 a b c d ___
B.6 a b c d ___	B.14 a b c d ___
B.7 a b c d ___	B.15 a b c d ___
B.8 a b c d ___	B.16 a b c d ___
B.9 a b c d ___	B.17 a b c d ___
B.10 a b c d ___	B.18 a b c d ___
B.11 a b c d ___	B.19 a b c d ___

ANSWER SHEET

C.1 a b c d ___

C.2 a b c d ___

C.3 a FULL ROD-DROP ________

b FULL ROD-DROP ________

c FULL ROD-DROP ________

d FULL ROD-DROP ________

e FULL ROD-DROP ________

f FULL ROD-DROP ________

C.4 a b c d ___

C.5 a b c d ___

C.6 a b c d ___

C.7 a b c d ___

C.8 a b c d ___

C.9 a b c d ___

C.10 a b c d ___

C.11 a b c d ___

C.12 a b c d ___

C.13 a b c d ___

C.14 a b c d ___

C.15 a b c d ___

C.16a 1 2 3 4 5 ___

b 1 2 3 4 5 ___

c 1 2 3 4 5 ___

d 1 2 3 4 5 ___

e 1 2 3 4 5 ___

C.17 a b c d ___

C.18 a b c d ___

EQUATION SHEET

$$\dot{Q} = \dot{m} c_p \Delta T = \dot{m} \Delta H = UA \Delta T$$

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

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

$$\overline{\beta} = 0.007$$

$$SUR = 26.06 \left[\frac{\lambda_{eff} \rho}{\beta - \rho} \right]$$

$$M = \frac{1}{1 - K_{eff}} = \frac{CR_1}{CR_2}$$

$$SDM = \frac{(1 - K_{eff})}{K_{eff}}$$

$$T = \frac{\ell^*}{\rho - \overline{\beta}}$$

$$\Delta\rho = \frac{K_{eff_2} - K_{eff_1}}{k_{eff_1} \times K_{eff_2}}$$

$$T_{1/2} = \frac{0.693}{\lambda}$$

$$DR = DR_0 e^{-\lambda t}$$

$$DR = \frac{6CiE(n)}{R^2}$$

$$P_{max} = \frac{(\rho - \beta)^2}{2\alpha(k)\ell}$$

$$SCR = \frac{S}{-\rho} \approx \frac{S}{1 - K_{eff}}$$

$$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$$

$$CR_1(-\rho_1) = CR_2(-\rho_2)$$

$$M = \frac{1 - K_{eff_0}}{1 - K_{eff_1}}$$

$$P = P_0 \, 10^{SUR(t)}$$

$$P = P_0 \, e^{\frac{t}{T}}$$

$$P = \frac{\beta(1 - \rho)}{\beta - \rho} P_0$$

$$T = \frac{\ell^*}{\rho} + \left[\frac{\overline{\beta} - \rho}{\lambda_{eff} \rho} \right]$$

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

$$DR_1 d_1^2 = DR_2 d_2^2$$

$$\frac{(\rho_2 - \beta)^2}{Peak_2} = \frac{(\rho_1 - \beta)^2}{Peak_1}$$

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

1 Curie = 3.7 x 10^{10} dis/sec

1 BTU = 778 ft-lbf

1 gal (H_2O) ≈ 8 lbm

c_p = 1.0 BTU/hr/lbm/°F

1 kg = 2.21 lbm

°F = 9/5 °C + 32

°C = 5/9 (°F - 32)

c_p = 1 cal/sec/gm/°C

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. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have neither received nor given assistance in completing the examination. This must be done after you complete the examination.

3. 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.

4. Use black ink or dark pencil <u>only</u> to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet and each answer sheet.

6. Mark your answers on the answer sheet provided. USE ONLY THE PAPER PROVIDED AND DO NOT WRITE ON THE BACK SIDE OF THE PAGE.

7. The point value for each question is indicated in [brackets] after the question.

8. If the intent of a question is unclear, ask questions of the examiner only.

9. When turning in your examination, assemble the completed examination with examination questions, examination aids and answer sheets. In addition turn in all scrap paper.

10. Ensure all information you wish to have evaluated as part of your answer is on your answer sheet. Scrap paper will be disposed of immediately following the examination.

11. To pass the examination you must achieve a grade of 70 percent or greater in each category.

12. There is a time limit of three (3) hours for completion of the examination.

13. When you have completed and turned in you examination, leave the examination area. If you are observed in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION (A.1) [1.0]
Which ONE of the four factors listed below is the MOST affected by an increase in poison level in the reactor?

a. Fast Fission Factor (ϵ)

b. Fast Non-Leakage Probability ($\mathcal{L}_f$)

c. Thermal Utilization Factor (f)

d. Reproduction Factor (η)

QUESTION (A.2) [1.0]
Given a control rod worth of 0.1% ΔK/K/inch and an α_T of 0.05% ΔK/K/°F. If temperature **INCREASES** by 9°F, how much and in what direction will the control rod move?

a. 4½ inches inward

b. 4½ inches outward

c. 9 inches inward

d. 9 inches outward

QUESTION (A.3) [1.0]
During startup, you withdraw rods an equal amount (distance). As the reactor approaches criticality, which ONE of the following statements best describes reactor behavior. (Assume the reactor remains slightly subcritical.)

a. Each rod withdrawal will add the same amount of reactivity.

b. Reactor power will increase by the same amount for each rod withdrawal.

c. The time for power to stabilize will increase for each succeeding rod withdrawal.

d. Decreasing time between withdrawals will result in a lower critical rod height.

QUESTION (A.4) [1.0]
Which ONE of the following times would you expect to have the **MAXIMUM** amount of xenon in the core? (Assume initial condition was in effect for 24 hours prior to power change.)

a. 4 to 6 hours following a power increase from 50% to 100%.

b. 4 to 6 hours following a power decrease from 100% to 50%.

c. 8 to 12 hours following a startup to 100%.

d. 8 to 12 hours following a reactor shutdown from 100%.

QUESTION (A.5) [1.0]
A **FAST** neutron will lose the **MOST** energy per collision when interacting with the nucleus of which ONE of the following elements?

a. H^1

b. H^2

c. C^{12}

d. U^{238}

QUESTION (A.6) [1.0]
The reactor had a shutdown margin of 2.5$, and a source range count rate of 15 counts per minute. After placing samples in the reactor the count rate increased to 30 counts per minute. What is the worth of the sample?

a. ≈ -90¢

b. ≈ +90¢

c. ≈ -1.25$

d. ≈ +1.25$

QUESTION (A.7) [1.0]
A **THERMAL** neutron has the **LEAST** probability of being absorbed by which ONE of the following elements?

a. H^1

b. H^2

c. C^{12}

d. U^{238}

QUESTION (A.8) [1.0]
β for U^{235} is 0.0065. β_{eff} for the Univ. of Florida ARGONAUT reactor is 0.007. Why is β_{eff} larger?

a. The reactor contains U^{238} which has a larger β for fast fission than U^{235}.

b. The reactor contains Pu^{239} which has a larger β for thermal fission than U^{235}.

c. Delayed neutrons are born at a higher average energy than fission neutrons resulting in a greater amount of fast fissioning.

d. Delayed neutrons are born at a lower average energy than fission neutrons resulting in fewer being lost to fast leakage.

QUESTION (A.9) [1.0]
A few minutes following a scram you note that reactor period is stable, and power level reads 3×10^5 counts. What reading would you expect to see three minutes later?

a. 10^5

b. 3×10^4

c. 1.5×10^4

d. 10^4

QUESTION (A.10) [1.0]
Which ONE of the following is the reason for an installed neutron source within the core? A startup without an installed neutron source ...

a. is impossible as there would be no neutrons available to startup the reactor.

b. would be very slow due to the long time to build up neutron population from so low a level.

c. could result in a very short period due to the reactor going critical before neutron population builds up enough to be read on nuclear instrumentation.

d. can be compensated for by adjusting the compensating voltage of the startup detector.

QUESTION (A.11) [1.0]
You remove the source from the reactor. Later you reinstall the source and note that reactor power is increasing **LINEARLY** (i.e. counts increase by 60 count each minute). What was the condition of the reactor just prior to inserting the source? (Assume the source has no reactivity worth, and there are no other changes effecting reactivity). The reactor was ...

a. very subcritical

b. slightly subcritical

c. exactly critical

d. slightly supercritical

QUESTION (A.12) [1.0]
Which ONE of the following is the **MAJOR** source of energy released during fission?

a. Kinetic energy of the fission neutrons.

b. Kinetic energy of the fission fragments.

c. Decay of the fission fragments.

d. Prompt Gamma rays.

QUESTION (A.13) [1.0]
The term ***PROMPT JUMP*** refers to ...

a. the instantaneous change in power due to withdrawal of a control rod.

b. a reactor which has attained criticality on prompt neutrons alone.

c. a reactor which is critical on both prompt and delayed neutrons.

d. a negative reactivity insertion which is less than β_{eff}.

QUESTION (A.14) [1.0]
Which ONE of the following evolutions will take the **LONGEST** time to occur? A reactor power change of ...

a. 5% of rated power, going from 1% to 6% of rated power.

b. 10% of rated power, going from 10% to 20% of rated power.

c. 15% of rated power, going from 20% to 35% of rated power.

d. 20% of rated power, going from 40% to 60% of rated power.

QUESTION (A.15) [1.0]
As primary coolant temperature increases, control rod worth:

a. increases due to higher reflector efficiency.

b. decreases due to higher neutron absorption in the moderator.

c. increases due to the increase in thermal diffusion length.

d. remains the same due to constant poison cross-section of the control rods.

QUESTION (A.16) [1.0]
An initial count rate of 100 is doubled five times during startup. Assuming an initial K_{eff}=0.950, what is the new K_{eff}?

a. 0.957

b. 0.979

c. 0.988

d. 0.998

QUESTION (A.17) [1.0]
Which ONE of the following describes the **MAJOR** contribution to the production and depletion of xenon in the reactor?

a. Produced from radioactive decay of iodine and depletes by neutron absorption only

b. Produced from radioactive decay of iodine and depletes by radioactive decay and neutron absorption

c. Produced directly from fission and depletes by neutron absorption only

d. Produced directly from fission and depletes by radioactive decay and neutron absorption

QUESTION (A.18) [1.0]
The shutdown margin (SDM), upon full insertion of all control rods following a reactor scram from full power, is ________________ the SDM immediately prior to the scram.

a. Equal to

b. Less than

c. Greater than

d. Independent of

QUESTION (A.19) [1.0]
Which one of the following statements is FALSE?

a. The value of an isotope's neutron absorption cross section is independent of a neutron's energy.

b. A U-235 atom can be fissioned by a "fast" neutron.

c. A U-238 atom is less likely to have a "thermal" fission, than a Pu-239 atom.

d. Approximately 210 MeV is released per fission event.

QUESTION (A.20) [1.0]
Which ONE of the following is the reason that reactor indicated power (count rate) stabilizes several hours after a reactor trip? Assume all instrumentation is operable, and no reactivity changes.

a. Subcritical multiplication of source neutrons.

b. Continuing decay of the longest lived delayed neutron precursor.

c. Neutron level dropping below detection threshold, the detector reading is due to a test signal input from Nuclear Instrumentation.

d. Gamma radiation due to decay of fission products below detection threshold, the detector reading is due to a test signal input from Nuclear Instrumentation.

QUESTION (B.1) [1.0]
A radiation worker works in a room with an average radiation dose of 10 mR/hr, for four hours a day. Which ONE of the following is the MAXIMUM number of days the worker may work without exceeding his 10 CFR 20 limits?

a. 250 days

b. 125 days

c. 25 days

d. 12½ days

QUESTION (B.2) [1.0]
Which ONE of the following is the **MINIMUM** amount of time, according to 10 CFR 55.53.e, that a licensed operator must perform his/her licensed duties to maintain proficiency?

a. four hours per calendar month

b. eight hours per calendar month

c. four hours per calendar quarter

d. eight hours per calendar quarter

QUESTION (B.3) [1.0]
Per Technical Specifications, a system or component is defined as **OPERABLE** if ...

a. a channel check has been performed.

b. a functional check has been performed.

c. it is capable of performing its intended function.

d. it has no outstanding testing requirements.

QUESTION (B.4) [1.0]
Assuming equal amounts of energy absorbed (Rads), which ONE of the listed types of radiation will have the greatest effect on the body?

a. Beta

b. Gamma

c. Alpha

d. Thermal Neutrons

QUESTION (B.5) [1.0]
Two point sources emit gamma radiation at the same curie strength. Source A's gammas have an average energy of 1 Mev, while Source B's gammas have an average energy of 2 Mev. You obtain readings for each source using a **Geiger Muller Detector** at 10 feet with no shielding. Which one of the following is the expected relative reading levels for the two sources?

a. Source B will read four times as high as source A.

b. Source B will read twice as high as source A.

c. Both sources will read the same.

d. Source B will read half as high as source A.

QUESTION (B.6) [1.0]
A four inch thick steel plate reduces gamma radiation dose from 60 mrem/hr to 6 mrem/hr. What is the expected dose (at the same distance) if you add another 1 inch of steel plate?

a. 0.56 mrem/hr

b. 1.50 mrem/hr

c. 2.62 mrem/hr

d. 3.37 mrem/hr

QUESTION (B.7) [1.0]
A irradiation sample of Sodium ($t_{½}$ = 15 hours) reads 4.5 R/hr at one meter. How long must the experimenter wait before the sample will read 1 R/hr at one meter?

a. 30 minutes

b. 5 hours

c. 12 hours

d. 33 hours

QUESTION (B.8) [1.0]
Crystal River has an accident. You receive 5 REM performing volunteer work in the accident recovery phase. How is this radiation tracked?

a. It is tracked at University of Florida as part of your normally allowed 5 REM/year for a radiation worker.

b. It is tracked at University of Florida as part of your lifetime Planned Special Exposure Limit (5 REM/year, 15 REM/lifetime).

c. As an emergency dose, it only tracked at the accident site, it is not tracked at University of Florida.

d. As an emergency dose, it is only tracked by the NRC, it is not tracked at the University of Florida.

QUESTION (B.9) [1.0]
Who (by title) may authorize personnel to receive doses in excess of their normal occupational limits?

a. Emergency Director

b. Radiation Control Officer

c. Emergency Director with Radiation Control Officer Concurrence

d. Emergency Coordinator with Radiation Control Officer Concurrence

QUESTION (B.10) [1.0]
As a result of a failed experiment, two out of three of the area radiation monitors are reading 150 mR/hr. What emergency class level is this?

a. Event less severe than the Lowest Category.

b. Notification of Unusual Event

c. Alert

d. Site Emergency

QUESTION (B.11) [1.0]
The reactor trips due to a loss of power. What is the lowest level of management who may authorize restart?

a. Any licensed Reactor Operator.

b. The console operator if licensed as a Senior Reactor Operator.

c. The Senior Reactor Operator on-call.

d. The Reactor Manager (or designated alternate).

QUESTION (B.12) [2.0]
Identify each of the following as either a Channel Check, a Channel Test or a Channel Calibration, as defined by Technical Specifications.

a. Observe overlap between the startup channel and the intermediate range of Nuclear Instrumentation.

b. Replace a resistance temperature detector (RTD) with a precision resistance bridge to check proper circuit operation.

c. Monitor nuclear instrumentation verifying proper shutdown period indication.

d. Based on a heat balance (calorimetric) performed on the primary system, adjust Nuclear Instrumentation.

QUESTION (B.13) [1.0]
Which ONE of the following conditions is allowable during reactor operations?

a. Only one air particulate monitor (APD) capable of audibly warning personnel of radioactive particulate airborne contamination in the cell atmosphere.

b. Failure of the fixed stack monitor recorder in the control room.

c. Only one gamma area monitors capable of audibly alarming on high radiation level in the control room.

d. Failure of the building evacuation alarm.

QUESTION (B.14) [1.0]
What is the radiation dose limit (on contact) for a sample in the rabbit receiver above which Reactor Manager permission is required for removal?

a. 100 mR/hr

b. 200 mR/hr

c. 500 mR/hr

d. 1000 mR/hr

QUESTION (B.15) [1.0]
Who (by title) is the lowest level of operations staff who may authorize switching between City Water and Well Water positions.

a. Licensed Reactor Operator at console

b. Licensed Senior Operator at console

c. Senior Operator on-call

d. The Reactor Manager (or designated alternate).

QUESTION (B.16) [1.0]
An accessible area with a radiation level of 50 mR/hr should be posted as a:

a. restricted area

b. radiation area

c. high radiation area

d. very high radiation area

QUESTION (B.17) [1.0]
Which ONE of the following conditions is the minimum to be met in order to be the *Second Person* during reactor operations?

a. Read and understand the Emergency Plan.

b. Read and understand the Emergency Procedure-Radiological and Emergencv Procedure-Fire.

c. Read and understand the Emergency Plan, and sign Emergency Plan Qualification Form.

d. Read and understand the Emergency Procedure-Radiological and Emergency Procedure-Fire, and sign Emergency Procedure Qualification Form SOP-B.1A.

QUESTION (B.18) [1.0]
Which ONE of the following is the lowest level of staff who may operate the 3-ton bridge crane during reactor operations?

a. Anyone Nuclear Engineering Student.

b. Any Univ. of Florida Maintenance Technician.

c. Certified Second Person.

d. Licensed Reactor Operator.

QUESTION (B.19) [1.0]
A daily startup was completed at 8:15 am, Monday February 10, 1997. This startup checklist is valid as long as the reactor is started up by ...

a. 2:15 pm, 2/10/97

b. 4:15 pm, 2/10/97

c. 8:15 pm, 2/10/97

d. 8:15 am, 2/11/97

QUESTION (C.1) [1.0] ***DELETED***
During operations you notice that the red and orange lights associated with the secondary system are extinguished, while the white light is energized. What is the status of the secondary system? (Assume all lights are operable.)

a. The system is secured.

b. The system is operating with flow less than 60 gpm.

c. The system is operating with flow greater than 60 gpm but less than 140 gpm.

d. The system is operating with flow greater than 140 gpm.

QUESTION (C.2) [1.0]
Which ONE of the listed gases is used as the propellant for the rabbit system?

a. Air

b. Nitrogen

c. CO_2

d. He

QUESTION (C.3) [2.0, 0.33 each]
Identify each of the Reactor Trips in Column A, with the correct type of trip **FULL** or **ROD-DROP**.

a. Reactor Period less than 3 sec.

b. Reactor Power at 125% of full power.

c. Loss of power to core vent system.

d. Manual scram Bar

e. Loss of chamber high voltage

f. Loss of Secondary Flow

QUESTION (C.4) [1.0]
On one of the area monitors, the green light is lit, the red light is extinguished, and the amber light is on. Which ONE of the following conditions is possible?

a. The detector is saturated.

b. The monitor is reading a level of 2 mr/hr.

c. The monitor is reading 9 mr/hr.

d. The monitor is reading 15 mr/hr.

QUESTION (C.5) [1.0]
How is primary coolant flow rate adjusted?

a. Throttle valve on inlet of primary pump.

b. Throttle valve on outlet of primary pump.

c. Speed adjust of primary pump.

d. Not adjustable, cooling rate controlled by secondary flow rate.

QUESTION (C.6) [1.0]
Which ONE of the following conditions will NOT cause the Rupture Disk to break?

a. Stop and Start Primary Pump.

b. Shut Dump Valve before system completely drained.

c. Rod-Drop.

d. Steam Production.

QUESTION (C.7) [1.0]
A warning light will energize if secondary flow drops to less than ...

a. 180 gpm

b. 160 gpm

c. 140 gpm

d. 120 gpm

QUESTION (C.8) [1.0]
Which ONE of the following conditions is required to clear the secondary flow scram? Power level must drop below ...

a. 1000 watts

b 700 watts

c. 100 watts

d. 1 watt

QUESTION (C.9) [1.0]
What is the purpose of the Spent fuel pit which **DOES NOT** have a special control lock?

a. Storage of removable Pu-Be neutron source.

b. Storage of New (Unirradiated Fuel).

c. Storage of Hurricane Rods.

d. No storage allowed, hole used to check water level.

QUESTION (C.10) [1.0]
The Secondary Cooling System contains two check valves with a drain between. What is the purpose of this valve combination.

a. To prevent backflow from the city water supply to the Well Water tank.

b. To prevent backflow from the secondary system to the city water supply.

c. To prevent inadvertent initiation of City Water secondary flow.

d. To enhance initiation of Well Water secondary flow.

QUESTION (C.11) [1.0]
Which ONE of the following is the material the cladding is composed of?

a. Zircalloy II

b. Zircalloy IV

c. Stainless Steel

d Aluminum

QUESTION (C.12) [1.0]
Which ONE of the following is **NOT** a purpose of the Shield Tank?

a. Experimental Port

b. Cooling for experiments

c. N_2 [illegible] Shielding of core

d. Vent mechanism for contaminated samples.

QUESTION (C.13) [1.0]
The maximum thermal neutron flux in the UFTR is ...

a. 1.8×10^{10} n/cm²/sec

b. 1.8×10^{11} n/cm²/sec

c. 1.8×10^{12} n/cm²/sec

d. 1.8×10^{13} n/cm²/sec

QUESTION (C.14) [1.0]
Which of the listed materials (along with reason) is most of the primary system constructed of?

a. Stainless Steel, low activation properties

b. Aluminum, low activation properties

c. Stainless Steel, short half-life

d. Aluminum, short half-life

QUESTION (C.15) [1.0]
Why is each control blade clutch light depressed following a reactor shutdown, prior to removing the console magnet key?

a. To assure the reactor protection system lower limit switch settings are initiated.

b. To prevent control blade ejection from the core.

c. To assure the control blade motors are deenergized.

d. To prevent a spurious period trip.

QUESTION (C.16) [2.0, 0.4 each]
Match the method for gamma compensation given in column b for the detector(s) (and modes) listed in column B. Note each item in column A will have only one answer, methods in column B may be used more than once.

	Column A		Column B
a.	Fission Chamber & B-10 (WR)	1.	Intrinsic
b.	Fission Chamber in Ion Chamber Mode (WR)	2.	None
c.	Fission Chamber in Cambelling Mode (WR)	~	Active Gamma Comp. (Summing Inversion)
d.	Uncompensated Ion Chamber	4.	Pulse Height Discrimination
e.	Coi.; ensated Ion Chamber	5.	Photomultiplication

QUESTION (C.17) [1.0]
The upper limit switch, period interlock and multiple blade interlock are not in effect for ...

a. any control blade when two clutch lamps are burned out.

b. the regulating blade when power level is less than 1 kW.

c. the regulating blade when power level control is in automatic.

d. any control blade when all control blade down lights are on.

QUESTION (C.18) [1.0]
Which ONE o' the following is NOT a ***Rod Inhibit***?

a. 10% drop in the value of the HV power supply to the detector for NI safety channel #2.

b. 1 cps on the NI Wide Range channels

c. Calibrate switch out of normal for NI safety channel #2..

d. At 10 seconds period on the Wide Range Channels.

Section A R Theory, Thermo, and Facility Characteristics

ANSWER (A.1)
c
REFERENCE (A.1)
Lamarsh, J.R., *Introduction to Nuclear Engineering*, Addison — Wesley Publishing, Reading, Massachusetts, 1983. § 7.2, p. 300.
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 3.3, pp. 3-13 – 3.18.

ANSWER (A.2)
b
REFERENCE (A.2)

$$\frac{9^{\circ}F \times 0.0005 \frac{\Delta K}{K-^{\circ}F}}{0.001 \frac{\Delta K}{K-inch}} = 4.5 \text{ inches}$$

ANSWER (A.3)
c
REFERENCE (A.3)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, §§ 3.161 – 3.163, pp. 190 – 191.
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, Chapt. 5, pp. 5-1 – 5-28.

ANSWER (A.4)
d
REFERENCE (A.4)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, §§ 5.56 – 5.80, pp. 250 – 260.
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, §§ 8.1 – 8.4, pp. 8-3 – 8-14.

ANSWER (A.5)
a
REFERENCE (A.5)
Glasstone, S. And Sesonske, A. *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, §
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, §

ANSWER (A.6)
d
REFERENCE (A.6)
$2.5 = 0.0175 ΔK/K. K_{eff} = 1/(1.0175) = 0.9828
$1 - K_{eff2} = (1 - K_{eff1}) \times CR_1/CR_2 \rightarrow K_{eff2} = 1 - [(1 - K_{eff1})CR_1/CR_2$
$K_{eff2} = 1 - [(1 - 0.9828)15/30] = 1 - [0.0172 \times 0.5] = 1 - 0.0086 = 0.9914$
$\rho = (0.9914 - 0.9828)/(0.9914 \times 0.9828) = 0.008826 =$ $1.26

ANSWER (A.7)
b
REFERENCE (A.7)
REFERENCE:
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, §§ 2.108 – 2.116, pp. 77 – 81
Lamarsh, J.R., *Introduction to Nuclear Engineering*, Addison — Wesley Publishing, Reading, Massachusetts, 1983. § 3.2, pp. 45 – 51.
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 2.5, pp. 2-36 – 2.44

ANSWER (A.8)
d
REFERENCE (A.8)
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, §

ANSWER (A.9)
b
REFERENCE (A.9)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, § 5.47, p. 246
Lamarsh, J.R., *Introduction to Nuclear Engineering*, Addison — Wesley Publishing, Reading, Massachusetts, 1983. § 7.1, p. 289
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 4.6, p. 4-16.

ANSWER (A.10)
c
REFERENCE
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, §§ 2.70 – 2.74, pp. 65 – 66
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 5.2, p. 5-2.

ANSWER (A.11)
c
REFERENCE (A.11)
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 5.6, p. 5-25.

ANSWER (A.12)
b
REFERENCE (A.12)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, § 1.52, p. 16.
Lamarsh, J.R., *Introduction to Nuclear Engineering*, Addison — Wesley Publishing, Reading, Massachusetts, 1983. § 3.7, Table 3.6, p. 77
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 3.2.1, p. 3-5.

ANSWER (A.13)
a
REFERENCE (A.13)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, § 5.31, p. 240.
Lamarsh, J.R., *Introduction to Nuclear Engineering*, Addison — Wesley Publishing, Reading, Massachusetts, 1983. § 7.1, pp. 286 – 289.
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 4.7, p. 4-21

ANSWER (A.14)
a
REFERENCE (A.14)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, § 5.18, p. 234

ANSWER (A.15)
c
REFERENCE (A.15)
Glasstone, S. and Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, §§ 5.224 — 5.229, pp. 306 — 307.

ANSWER (A.16)
d
REFERENCE (A.16)
Glasstone, S. and Sesonske, A, *Nuclear Reactor Engineering*, Kreiger Publishing, Malabar, Florida, 1991, § 3.161 — 3.163, pp. 190 — 191.
$CR_1/CR_2 = (1 - K_{eff2})/(1 - K_{eff1})$
$1/32\ (1 - 0.95) = 1 - K_{eff2}$
$1 - 0.05/32 = K_{eff2}$
$K_{eff2} = 0.9984$

ANSWER (A.17)
b
REFERENCE (A.17)
Glasstone, S. and Sesonske, A, *Nuclear Reactor Engineering,* Kreiger Publishing, Malabar, Florida, 1991, §§ 5.56 — 5.80, pp. 250 — 260.
Lamarsh, J.R., *Introduction to Nuclear Engineering,* Addison-Wesley Publishing, Reading, Massachusetts, 1983. § 7.4, pp. 316 — 322.
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, §§ 8.1 —8.4, pp. 8-3 — 8-14.

ANSWER (A.18)
c
REFERENCE (A.18)
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, § 6.2.3, p. 6-4.

ANSWER (A.19)
a
REFERENCE (A.19)
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, Chapt. 2 pp. 2-36

ANSWER (A.20)
a
REFERENCE (A.20)
Glasstone, S. And Sesonske, A, *Nuclear Reactor Engineering,* Kreiger Publishing, Malabar, Florida, 1991, §§ 3.161 – 3.163, pp. 190 – 191.
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, Chapt 5, pp. 5-1 – 5-28.

ANSWER (B.1)
b
REFERENCE (B.1)
10CFR20.1201(a)(1)
$5000 \text{ mr} \times \frac{1 \text{ hr}}{10 \text{ mr}} \times \frac{\text{day}}{4 \text{ hr}} = 125 \text{ days}$

ANSWER (B.2)
c
REFERENCE (B.2)
10 CFR 55.53.e.

ANSWER (B.3)
c
REFERENCE (B.3)
Technical Specification § 1 Definitions

ANSWER (B.4)
c
REFERENCE (B.4)
10 CFR 20.1004

ANSWER (B.5)
c
REFERENCE (B.5)
A Geiger Mueller detector is not sensitive to energy level.

ANSWER (B.6)
d
REFERENCE (B.6)
$I = I_0 e^{-\lambda d}$ or $I = I_0 (-10^{d/4})$ $I = 6 (-10^{1/4}) = 3.37$

ANSWER (B.7)
d
REFERENCE (B.7)
$I = I_0 e^{-\lambda t}$ where $\lambda = 0.693/t_{1/2}$ $\ln (1/4.5) = -[(0.693/15) * t]$
$t = 32.6$ hours

ANSWER (B.8)
b
REFERENCE (B.8)
10 CFR 20.1206

ANSWER (B.9)
c
REFERENCE (B.9)
University of Florida Emergency Plan, § 3.12

ANSWER (B.10)
b
REFERENCE (B.10)
University of Florida Emergency Plan, § 7.3.2

ANSWER (B.11)
d
REFERENCE (B.11)
SOP-0.6, § 7.1.2.2

ANSWER (B.12)
a, Check; b, Test; c, Check; d, Calibration
REFERENCE (B.12)
Technical Specifications, § 1.0 Definitions

ANSWER (B.13)
a
REFERENCE (B.13)
SOP A.2, § 4.0
ANSWER (B.14)
b
REFERENCE (B.14)
SOP A.8, § 4.6.5

ANSWER (B.15)
b, c
REFERENCE (B.15)
DESIGN AND OPERATING CHARACTERISTICS OF THE UFTR, p. 22.

ANSWER (B.16)
b
REFERENCE (B.16)
10CFR20.1003

ANSWER (B.17)
d
REFERENCE (B.17)
SOP A.2, p. 3 of 11, § 4.2.2

ANSWER (B.18)
d
REFERENCE (B.18)
SOP A.2, p. 3 of 11, § 4.2.4

ANSWER (B.19)
b
REFERENCE (B.19)
SOP A.2, p. 4 of 11, § 4.4.2

ANSWER (C.1) ***DELETED***

REFERENCE (C.1)
SOP A.6, §§ 4.2 & 4.2.1

ANSWER (C.2)
b
REFERENCE (C.2)
SOP A.8 § 4.3.

ANSWER (C.3)
a, Full; b, Full; c, Rod-Drop; d, Rod-Drop; e, Full; f, Rod-Drop
REFERENCE (C.3)
Table 3.1, Specifications for reactor safety system trips, also similar to Facility Question 5 in Reactor Protection System Section.

ANSWER (C.4)
c
REFERENCE (C.4)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, pp. 11, 12.

ANSWER (C.5)
b
REFERENCE (C.5)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, p. 17

ANSWER (C.6)
c
REFERENCE (C.6)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, pp. 18, 19

ANSWER (C.7)
c
REFERENCE (C.7)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, pp. 20

ANSWER (C.8)
b
REFERENCE (C.8)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, p. 20

ANSWER (C.9)
c
REFERENCE (C.9)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, p. 30

ANSWER (C.10)
b
REFERENCE (C.10)
DESIGN & OPERATING CHARACTERISTICS OF THE UFTR, Figure 28.

ANSWER (C.11)
d
REFERENCE (C.11)
UFTR DESIGN & OPERATING CHARACTERISTICS , Rewording of 2/21/96 requal exam question #3.

ANSWER (C.12)
d
REFERENCE (C.12)
UFTR DESIGN & OPERATING CHARACTERISTICS Rewording of 2/21/96 requal exam, question #11.

ANSWER (C.13)
c
REFERENCE (C.13)
UFTR DESIGN & OPERATING CHARACTERISTICS Rewording of 2/21/96 requal exam, question #17.

ANSWER (C.14)
d
REFERENCE (C.14)
UFTR DESIGN & OPERATING CHARACTERISTICS, Rewording of 2/21/96 requal exam, question #23.

ANSWER (C.15)
a
REFERENCE (C.15)
UFTR DESIGN & OPERATING CHARACTERISTICS 8/16/90 requal exam, question #9.

ANSWER (C.16)
a, 4; b, 2; c, 1; d, 2; e, 3
REFERENCE (C.16)
UFTR DESIGN & OPERATING CHARACTERISTICS 82/16/90 requal exam, question #12.

ANSWER (C.17)
c
REFERENCE (C.17)
UFTR DESIGN & OPERATING CHARACTERISTICS 8/16/90 requal exam, question #27.

ANSWER (C.18)
a
REFERENCE (C.18)
Lecture Notes UFTR Instrumentation and Control pp. 5 through 8.