July 14, 2004

Mr. Terrence Tehan, Director
Nuclear Science Center
Rhode Island Atomic Energy Commission
16 Reactor Road
Narragansett, RI 02882

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-193/OL-04-01, RHODE ISLAND ATOMIC ENERGY COMMISSION

Dear Mr. Tehan:

During the week of June 14, 2004, the NRC administered operator licensing examinations at your facility. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/indesx.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Patrick Isaac at 301-415-1019 or via Internet e-mail at pxi@nrc.gov.

Sincerely,

/RA/

Patrick M. Madden, Section Chief
Research and Test Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-193

Enclosures: 1. Initial Examination Report No. 50-193/OL-04-01
2. Examination and answer key

cc w/enclosures:
Please see next page

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OFFICE	RNRP:CE		IEHB:LA	E	RNRP:SC	
NAME	PIsaac:vxj		EBarnhill		PMadden	
DATE	07/ 8 /2004		07/ 12 /2004		07/ 13 /2004	

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cc:

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University of Rhode Island
College of Engineering
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Mr. Jack Ferruolo
State Radiation Control Officer
Rhode Island Department of Health
Division of Occupational and Radiological Health
3 Capitol Hill Cannon
Providence, RI 02808-5097

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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

REPORT NO.: 50-193/OL-04-01

FACILITY DOCKET NO.: 50-193

FACILITY LICENSE NO.: R-95

FACILITY: Rhode Island Atomic Energy Commission

EXAMINATION DATES: June 16, 2004

EXAMINER: Patrick Isaac, Chief Examiner

SUBMITTED BY: **/RA/** 07/07/2004
Patrick Isaac, Chief Examiner Date

SUMMARY:

During the week of June 14, 2004, NRC administered Operator Licensing Examinations to two Reactor Operator (RO) candidates. One candidate failed both the written examination and the operating test. The other candidate passed all portions of the examinations.

REPORT DETAILS

1. Examiners:
   Patrick J. Isaac, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**1/1**	**N/A**	**1/1**
Operating Tests	**1/1**	**N/A**	**1/1**
Overall	**1/1**	**N/A**	**1/1**

3. Exit Meeting:

   Mr. Terence Tehan, Director
   Mr. Wayne Simoneau, Assistant Director, RINSC
   Patrick Isaac, Chief Examiner

   The facility commented on a well constructed and fair examination. There were no generic concerns raised by the examiner.

ENCLOSURE 1

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

FACILITY: Rhode Island Nuclear Science Center

REACTOR TYPE: POOL

DATE ADMINISTERED: 2004/06/15

CANDIDATE: ______________________________

INSTRUCTIONS TO CANDIDATE:
Answers are to be written on the answer sheet provided. Attach all answer sheets to the examination. Point values are indicated in parentheses for each question. A 70% in each category is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF 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.**	**FACILITY 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

ENCLOSURE 2

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.

EQUATION SHEET

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

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

$\dot{Q} = \dot{m} \Delta h$

$SCR = S/(1-Keff)$

$\dot{Q} = UA \Delta T$

$CR_1 (1-Keff)_1 = CR_2 (1-Keff)_2$

$SUR = \frac{26.06 (\lambda_{eff}\rho)}{(\beta - \rho)}$

$M = \frac{(1-Keff)_0}{(1-Keff)_1}$

$SUR = 26.06/\tau$

$M = 1/(1-Keff) = CR_1/CR_0$

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

$SDM = (1-Keff)/Keff$

$P = P_0 e^{(t/\tau)}$

$Pwr = W_f \dot{m}$

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

$\ell^* = 1 \times 10^{-5}$ seconds

$\tau = (\ell^*/\rho) + [(\bar{\beta}-\rho)/\lambda_{eff}\rho]$

$\tau = \ell^*/(\rho-\bar{\beta})$

$\rho = (Keff-1)/Keff$

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

$\rho = \Delta Keff/Keff$

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

$\bar{\beta} = 0.0070$

$DR_1D_1^2 = DR_2D_2^2$

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

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

DR ≡ R/hr, Ci ≡ Curies, E ≡ Mev, R ≡ feet

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 hp = 2.54×10^3 BTU/hr

1 Mw = 3.41×10^6 BTU/hr

1 BTU = 778 ft-lbf

°F = 9/5°C + 32

1 gal H_2O ≈ 8 lbm

°C = 5/9 (°F - 32)

A N S W E R   S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ___

002 a b c d ___

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

020 a b c d ___

(***** END OF CATEGORY A *****)

A N S W E R   S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ___

002 a b c d ___

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

020 a b c d ___

(***** END OF CATEGORY B *****)

C.   PLANT AND RAD MONITORING SYSTEMS

A N S W E R   S H E E T

Multiple Choice   (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ___

002 a b c d ___

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

020 a b c d ___

(***** END OF CATEGORY C *****)
(********** END OF EXAMINATION **********)

Section A: Ɽ Theory, Thermo & Fac. Operating Characteristics

QUESTION (A.1) [1.0]

Given a source strength of 100 neutrons per second (N/sec) and a multiplication factor of 0.8, the expected stable neutron count rate would be?

a. 125 N/sec

b. 250 N/sec

c. 400 N/sec

d. 500 N/sec

QUESTION (A.2) [1.0]

An element decays at a rate of 20% per day. Determine its half-life.

a. 3 hr.

b. 75 hr.

c. 108 hr.

d. 158 hr.

QUESTION (A.3) [1.0]

The reactor has scrammed following an extended period of operation at full power.
Which one of the following accounts for generation of a majority of the heat one (1) hour after the scram?

a. Spontaneous fissions

b. Delayed neutron fissions

c. Alpha fission product decay

d. Beta fission product decay

QUESTION (A.4) [1.0]

In a subcritical Rx, Keff is increased from 0.861 to 0.946. Which one of the following is the amount of reactivity that was added to the core?

a. 0.090 delta-K/K

b. 0.220 delta-K/K

c. 0.104 delta-K/K

d. 0.125 delta-K/K

QUESTION (A.5) [1.0]

Which one of the following factors is the most significant in determining the differential worth of a control rod?

a. The rod speed.

b. Reactor power.

c. The flux shape.

d. The amount of fuel in the core.

QUESTION (A.6) [1.0]

With a 30 second period, power would double in approximately:

a. 15 seconds

b. 21 seconds

c. 30 seconds

d. 60 seconds

QUESTION (A.7) [1.0]

Which one of the following describes how delayed neutrons affect control of the reactor?

a. More delayed neutrons are produced than prompt neutrons resulting in a longer time to reach a stable subcritical countrate.

b. Delayed neutrons are born at higher energies than prompt neutrons resulting in a shorter reactor period from increased leakage.

c. Delayed neutrons take longer to thermalize than prompt neutrons resulting in a longer reactor period.

d. Delayed neutrons increase the average neutron lifetime resulting in a longer reactor period.

QUESTION (A.8) [1.0]

Assume that reactor power is 50% and equilibrium Xenon is attained. Reactor power is then increased to 100%. Which one of the following correctly describes the new equilibrium Xenon value?

a. The 100% equilibrium xenon is half the 50% value

b. The 100% equilibrium xenon is equal to the 50% value.

c. The 100% equilibrium xenon is higher than the 50% value but not twice as high.

d. The 100% equilibrium xenon is twice as high as the 50% value.

QUESTION (A.9) [1.0]

Excess reactivity is the amount of reactivity:

a. associated with samples.

b. needed to achieve prompt criticality.

c. available above that which is required to make the reactor subcritical.

d. available above that which is required to keep the reactor critical.

QUESTION (A.10) [1.0]

The term "prompt jump" refers to:

a. the instantaneous change in power due to raising a control rod.

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

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

d. a negative reactivity insertion which is less than Beta-effective.

QUESTION (A.11) [1.0]

If reactor power is increasing by a decade every minute, it has a period of:

a. 13 sec

b. 26 sec

c. 52 sec

d. 65 sec

QUESTION (A.12) [1.0]

Which one of the following is the primary reason a neutron source is installed in the core?

a. To allow for testing and irradiation of experiments when the reactor is shutdown.

b. To supply the neutrons required to start the chain reaction for subsequent reactor startups.

c. To provide a neutron level high enough to be monitored for a controlled reactor startup.

d. To increase the excess reactivity of the reactor which reduces the frequency for refueling.

QUESTION (A.13) [1.0]

A subcritical reactor is being started up. A control rod is raised in four equal steps. Which statement most accurately describes the expected reactor response?

a. Power increases by the same amount for each withdrawal.

b. Each withdrawal will add the same amount of reactivity.

c. The time for power to stabilize after each successive withdrawal increases.

d. A lower critical rod height is attained by decreasing the time intervals between withdrawals.

QUESTION (A.14) [1.0]

The T.S. require a minimum Shutdown Margin (SDM) of 1.0 %ΔK/K for a specific core and control rods configuration. Assuming no experiment in the core, Xenon free conditions, and the following worths, which one of the following is the calculated SDM?

		worth %ΔK/K
Shim-Safety Blade #1:	2.41	
Shim-Safety Blade #2:	2.32	
Shim-Safety Blade #3:	2.49	
Shim-Safety Blade #4:	2.60	
Regulating rod:	0.084	
Excess Reactivity:	3.42	

a. 9.90%

b. 6.48%

c 6.40%

d. 3.80%

QUESTION (A.15) [1.0]

Which one of the following describe the difference between a moderator and reflector?

a. A reflector increases the fast non-leakage factor and a moderator increases the thermal utilization factor.

b. A reflector increases the neutron production factor and a moderator increases the fast fission factor.

c. A reflector decreases the thermal utilization factor and a moderator increases the fast fission factor.

d. A reflector decreases the neutron production factor and a moderator decreases the fast non-leakage factor.

QUESTION (A.16) [1.0]

During the neutron cycle from one generation to the next, several processes occur that may increase or decrease the available number of neutrons.

SELECT from the following the six-factor formula term that describes an INCREASE in the number of neutrons during the cycle.

a. Thermal utilization factor.

b. Resonance escape probability.

c. Thermal non-leakage probability.

d. Fast fission factor.

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]

Following a scram, the value of the stable reactor period is:

a. approximately 50 seconds, because the rate of negative reactivity insertion rapidly approaches zero.

b. approximately -10 seconds, as determined by the rate of decay of the shortest lived delayed neutron precursors.

c. approximately -80 seconds, as determined by the rate of decay of the longest lived delayed neutron precursors.

d. infinity, since neutron production has been terminated.

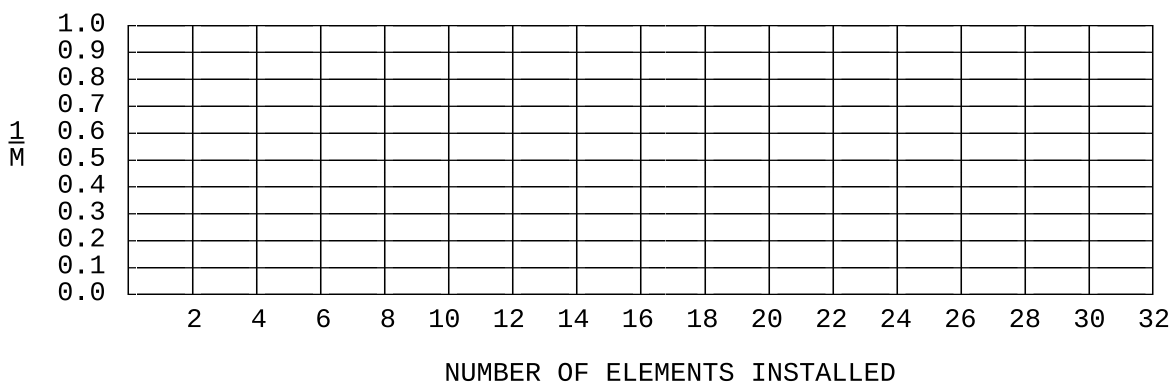
QUESTION (A.19) [1.0]

The following data was obtained during a reactor fuel load.

No. of Elements	Detector A (cps)
0	20
8	25
12	33
16	38
20	72
24	134

Which one of the following is the number of fuel elements required to make the reactor critical? (The attached figure may be used to determine the correct response.)

a. 22
b. 24
c. 28
d. 32



QUESTION (A.20) [1.0]

The reactor is operating at 100 KW. The reactor operator withdraws the Regulating Rod allowing power to increase. The operator then inserts the same rod to its original position, decreasing power.
In comparison to the rod withdrawal, the rod insertion will result in:

a. a longer period due to long lived delayed neutron precursors.

b. a shorter period due to long lived delayed neutron precursors.

c. the same period due to equal amounts of reactivity being added.

d. the same period due to equal reactivity rates from the rod.

***** END OF SECTION A *****

QUESTION (B.1) [1.0]

A point source of gamma radiation measures 50 mr/hr at a distance of 5 ft.
What is the exposure rate (mr/hr) from the source at a distance of 10 ft.

a. 25 mr/hr

b. 12.5 mr/hr

c. 6.25 mr/hr

d. 17.5 mr/hr

QUESTION (B.2) [1.0]

In accordance with 10 CFR Part 50.54(x), under what conditions can an operator take reasonable action that departs from a license condition or a Technical Specification?

a. In any emergency.

b. In an emergency, when the action is needed to protect health and safety and no other action is immediately apparent.

c. In an emergency declared by the Emergency Director.

d. In an emergency declared by the Emergency Director along with the approval of the Senior Reactor Operator on site.

QUESTION (B.3) [1.0]

Which one of the following does NOT require NRC approval for changes?

a. License

b. Requalification plan

c. Emergency Implementation Procedures

d. Emergency Plan

QUESTION (B.4) [1.0]

In accordance with the ALARA program at RINSC, any radiation exposure during one monitoring period in excess of ______ must be brought to the attention of the RSO and, following investigation, the Nuclear and Radiation Safety Committee.

a. 5 mrem

b. 100 mrem

c. 500 mrem

d. 5000 mrem

QUESTION (B.5) [1.0]

Which one of the followings correctly describes the term “ALI” ?

a. The sum of the products of the dose equivalent to the organ and the weighing factors applicable to each of the body organs that are irradiated.

b. The smaller value of intake of a given radionuclide in a year by a reference man that would result in a committed dose equivalent of 5 rem.

c. A unit of measurement of radioactivity.

d. The limit on concentration of certain radionuclides listed in 10 CFR 20 that could result in an annual dose in excess of 5 rem.

QUESTION (B.6) [1.0]

The following measurements are made from a beta-gamma point source:
2 R/hr at six inches 0.5 mR/hr at ten feet.
What are the relative fractions of betas and gammas emitted?

a. (1800/200) = 9

b. (2000/200) = 10

c. (1800/20) = 90

d. (2200/200) = 11

QUESTION (B.7) [1.0]

A sample reading 1 R/hour is placed behind a 2-centimeter lead shield. What will be the resulting exposure rate? Assume no buildup and a linear attenuation equal to 0.52 cm^{-1}.

a. 0.63 R/hr

b. 3.60 R/hr

c. 0.36 R/hr

d. 36 R/hr

QUESTION (B.8) [1.0]

If you had to choose the one resulting in the least dose you would:

a. Take one REM of occupational Gamma exposure.

b. Submerse yourself in AR-41 for 400 occupational DAC-hours.

c. Ingest or inhale 0.02 ALI of a nontoxic radioactive substance.

d. Wear Breathing apparatus while performing b. above.

QUESTION (B.9) [1.0]

Limiting Safety System Settings (LSSS) are …

a. limits on very important process variables which are found to be necessary to reasonably protect the integrity of certain physical barriers which guard against the uncontrolled release of radioactivity.

b. settings for automatic protective devices related to those variable having significant safety functions that are chosen so that automatic actions will prevent exceeding a safety limit.

c. settings for ANSI 15.8 suggested reactor scrams and/or alarms which form the protective system for the reactor or provide information which requires manual protective action to be initiated.

d. the lowest functional capability or performance levels of equipment required for safe operation of the reactor.

QUESTION (B.10) [1.0]

Which one of the following lists required reactor scrams associated with the Technical Specification Safety Limits for the natural convection mode?

a. Reactor thermal power.
Pool water temperature.
Height of water above the top of the core.

b. Reactor thermal power.
Reactor coolant exit temperature.
Height of water above the center line of the core.

c. Reactor thermal power.
Height of water above the top of the core.
Primary coolant flow through the core.

d. Primary coolant flow through the core.
Height of water above the top of the core.
Pool water temperature.

QUESTION (B.11) [1.0]

Consider two point sources, each having the same curie strength. Source A's gammas have an energy of 1 MEV whereas Source B's gamma have an energy of 2 MEV. You obtain a reading from the same Geiger counter 10 feet from each source. Concerning the two readings, which one of the following statements is correct?

a. The reading from Source B is four times that of Source A.

b. The reading from Source B is twice that of Source A.

c. Both readings are the same.

d. The reading from Source B is half that of Source A.

QUESTION (B.12) [1.0]

Argon-41 is produced by neutron absorption of argon-40. Argon-41 decays by:

a: a 1.3 MeV gamma with a half life of 1.8 hours.

b. a 6.1 MeV gamma with a half-life of 7 seconds.

c. neutron emission with a half-life of 1.8 hours.

d. a 1.3 MeV beta with a half-life of 7 seconds.

QUESTION (B.13) [1.0]

Assuming the reactor is operating at 95% power, which one of the following situations does NOT require a reactor scram or shutdown?

a. Reactor power drops unexpectedly to 92%.

b. Reactor power increases to 97% as the pool water temperature increases.

c. The alarm for the high neutron flux on one of the compensated ion chamber safety channels becomes inoperable due to a faulty relay.

d. Primary flow indication begins to decrease due to a detector failure. (Assume pin hole leak in the dp cell diaphragm.)

QUESTION (B.14) [1.0]

The reactor is in steady-state power at 90% when you, the operator, notice that the Emergency Generator is inoperable. Which one of the following describes the correct action you should take?

a. Shutdown the reactor. Technical Specifications (T.S.) do not allow operations of the reactor without it.

b. Continue operation. T.S. allow the unit to be out of service for up to 7 days.

c. Continue operation. Within 24 hours of recognition of failure, replace the unit with a portable generator.

d. Continue operation as long as a minimum of two licensed operators are in the control room at all times.

QUESTION (B.15) [1.0]

Who in the organizational chain may authorized an experimenter to insert and remove his own experiments?

a. SRO

b. HP

c. Assistant Director.

d. Reactor Utilization Committee

QUESTION (B.16) [1.0]

Which one of the following statements is TRUE concerning experiments?

a. Explosive materials shall be doubly encapsulated..

b. The reactivity worth of any moveable experiment shall not exceed 0.06 ΔK/K.

c. All materials to be irradiated shall be either corrosion resistant or encapsulated within corrosion resistant containers.

d. The total reactivity worth of moveable and secured experiments shall not exceed 0.0798 ΔK/K.

QUESTION (B.17) [1.0]

Following an irradiation of a specimen, the resulting radioisotope is expected to equal 200 curies. The radioisotope will decay by the emission of two gamma rays per disintegration with energies of 1.10 MeV and 1.29 MeV.

Which one of the following is the radiation exposure rate (R/hr) at one (1) foot from the specimen with no shielding?

a. 1708 R/hr

b. 2868 R/hr

c. 3405 R/hr

d. 5736 R/hr

QUESTION (B.18) [1.0]

The secondary circulating pump fails while the reactor is at 100% power with all rods in manual control. Assume that all systems operate normally and no operator action is taken. Which one of the following is the expected outcome?

a. Low flow alarm on the secondary coolant system. Reactor power stays at 100%.

b. Pool inlet temperature increases. Reactor power decreases due to the negative temperature coefficient. An equilibrium is reached and reactor power stays at around 95%.

c. Primary coolant inlet temperature increases to the scram setpoint and the reactor scrams.

d. Primary coolant exit temperature goes up to alarm setpoint and scrams the reactor at the scram setpoint.

QUESTION (B.19) [1.0]

A small radioactive source is to be stored in the reactor building. The source is estimated to contain 2 curies and emit a 1.33 Mev gamma. Assuming no shielding was to be used, a Radiation Area barrier would have to be erected from the source at a distance of approximately:

a. 6 inches

b. 12 inches

c. 21 inches

d. 57 feet

QUESTION (B.20) [1.0]

You are giving a tour to twelve students. The students are divided into three groups of four; each group led by a NRL staff member. How many pocket dosimeters must be issued?

a. None, since they won’t get any dose.

b. Fifteen, one for each NRL staff member and student.

c. Twelve, one for each student.

d. Three, one for each group.

(*** End of Section B ***)

Section C: Plant and Rad Monitoring Systems

QUESTION (C.1) [1.0]

While operating in the Forced Convection Flow Mode which one of the following will result in a reactor scram?

a. Primary Coolant Flow = 1700 gpm

b. Coolant Inlet Temperature = 118°F

c. Log N amplifier high voltage at 40 volts

d. Pool Level is 24.5 ft. above the fuel.

QUESTION (C.2) [1.0]

Which one of the following actions may stop a leak from a beam port vent line ?

a. Installing the cover flange on the tube end.

b. Plugging the outer tube instrument leads hole.

c. Installing the outer tube concrete filled plugs.

d. Closing the beam port shutter.

QUESTION (C.3) [1.0]

Which of the following actions should NOT automatically occur when an evacuation button is depressed?

a. The dilution air blower turns off.

b. The off gas and rabbit blowers turn off.

c. The air conditioning and normal ventilation fans turn off.

d. The dampers on the ventilation ducts leading outside confinement close.

Section C: Plant and Rad Monitoring Systems

QUESTION (C.4) [1.0]

Which one of the following is the reason for the pool level scram setpoint?

a. To assure that an acceptable pool volume is available to provide cooling in the Natural Convection Mode.

b. To prevent incipient boiling event if transient power rises to the thermal power trip limit.

c. To assure that an adequate pool volume is available to provide cooling of the core in the event of a loss of coolant accident.

d. To maintain an adequate pool level for the dash-pot action of the control blades in the event of a scam.

QUESTION (C.5) [1.0]

What is the maximum acceptable time between the initiation of a scram signal, and the time that any shim safety rod is fully inserted in the core?

a. 1000 msec.

b. 800 msec.

c. 400 msec.

d. 200 msec.

QUESTION (C.6) [1.0]

Which one of the following does NOT trigger an interlock that prevents the withdrawal of the shim safety blades during start-up?

a. Master switch in “Test”

b. Start up counter in motion

c. Start up counter recorder off

d. Start up counter reading less than 3 cps

Section C: Plant and Rad Monitoring Systems

QUESTION (C.7) [1.0]

Which one of the following will limit the size of the leakage area in the event of a coolant leak due to failure of the Through Tube?

a. Fixed experiment barriers.

b. Flanges at each end of through tube.

c. Anti-siphon valves.

d. Through tube shutter.

QUESTION (C.8) [1.0]

The Delay Tank is vented ...

a. into the suction line of the reactor room exhaust blower

b. into the suction of the off-gas blower

c. into the suction of the dilution air blower

d. directly to the base of the stack

QUESTION (C.9) [1.0]

Which of the following electrical loads is POWERED by the Nuclear Center Generator when normal power is lost?

a. Sump Pump

b. Stack Monitor (CAM)

c. Primary Coolant Pump

d. Console Power

Section C: Plant and Rad Monitoring Systems

QUESTION (C.10) [1.0]

Which one of the following is NOT a function of the Primary Makeup Water system?

a. A check valve prevents primary water from back flowing through the makeup system

b. A drop in the water level of one inch opens a solenoid valve to allow water flow into the pool.

c. A control room alarm is generated at -1.5 inches to warn of decreasing pool levels.

d. A low level alarm is sent to a security company off campus.

QUESTION (C.11) [1.0]

Which one of the following describes the detector that provides the “% Full Power” signal to the Automatic Power Level channel?

a. Geiger-Mueller

b. Fission chamber

c. Gamma ion chamber

d. Compensated ion chamber

QUESTION (C.12) [1.0]

Loss of which ONE of the services listed below requires the operator to shutdown and secure the reactor?

a. City water supply.

b. Demineralized water..

c. Building heating system.

d. Building telephones.

QUESTION (C.13 [1.0]

Which of the following safety systems is NOT bypassed when the Power Level Selector Switch is in the 0.1 MW position?

a. The low pool level scram.

b. The primary coolant low flow rate scram.

c. The bridge low power position scram.

d. The primary coolant outlet temperature scram.

QUESTION (C.14) [1.0]

The reactor is operating with the servo control system maintaining power at 500 kw when compensating voltage is lost to the Linear Level Compensated Ion Chamber. Which one of the following describes the response of the plant to this malfunction?

a. Indicated power will decrease, resulting in the automatic control system dropping out of automatic control.

b. Indicated power will decrease, resulting in the control rod being withdrawn from the core.

c. Indicated power will increase, resulting in the control rod being driven inward.

d. Indicated power will remain constant.

QUESTION (C.15) [1.0]

Approximately, what is the flow rate of the automatic pool water make-up system?

a. 2 gallons/minute

b. 5 gallons/minute

c. 20 gallons/minute

d. 31 gallons/minute

Section C: Plant and Rad Monitoring Systems

QUESTION (C.16) [1.0]

In the forced convection mode and at power levels in excess of 0.1 MW, how many grid positions can be vacant in a fully loaded core?

a. zero.

b. one.

c. two.

d. six.

QUESTION (C.17) [1.0]

The cladding material for the LEU fuel element is...?

a. 6061 Al

b. B_4C clad with AL

c. U_3Si_2-Al

d. Type 304 Stainless Steel

QUESTION (C.18) [1.0]

What is the reactor pool conductivity limit?

a. $\leq$ 2 micromho/cm

b. $\leq$ 4 micromho/cm

c. $\leq$ 6 micromho/cm

d. $\leq$ 8 micromho/cm

Section C: Plant and Rad Monitoring Systems

QUESTION (C.19) [1.0]

A short period scram is initiated when the Log N Period channel senses a period that is ...

a. $\leq$4 seconds

b. $\leq$5 seconds

c. $\leq$6 seconds

d. $\leq$7 seconds.

QUESTION (C.20) [1.0]

How many plates does a LEU fuel element have?

a. 4

b. 12

c. 18

d. 22

(*** End of Examination ***)

*ANSWER (A.1)
d
*REFERENCE
CR= S/(1-K)

*ANSWER (A.2)
b
*REFERENCE
$A = A_o e^{-\lambda t}$ $\lambda = .693/T2$ $\ln(A/A_o) = -.693t/T2$ $T2 = -.693t/\ln 0.8 = 75$ hr

*ANSWER (A.3)
d
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988 pg. 3-4

*ANSWER (A.4)
c
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 3.3.4, p. 3-21.

*ANSWER (A.5)
c
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, § 7.6, p. 7-15.

*ANSWER (A.6)
b
*REFERENCE
Glasstone, *Nuclear Reactor Engineering*, Chapter 5, Section 5.18

*ANSWER (A.7)
d
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988

*ANSWER (A.8)
c
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, §§ 8.2 — 8.4, pp. 8-3 — 8-14, Fig. 8-2

*ANSWER (A.9)
d
*REFERENCE
Glasstone and Sesonske, *Nuclear Reactor Engineering*, Chapter 5, Section 5.114

*ANSWER (A.10)

a
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988

*ANSWER (A.11)
b
*REFERENCE
Glasstone, S. and Sesonske, A, *Nuclear Reactor Engineering,* Kreiger Publishing, Malabar, Florida, 1991,
$P = P_o e^{t/T}$ $10 = 1e^{60/T}$ ln 10 = 60/T 2.3 = 60/T T = 60/2.3 T = 26 seconds

*ANSWER (A.12)
c
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, § 5.2 (b), p. 5-4.

*ANSWER (A.13)
c
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Subcritical Multiplication

*ANSWER (A.14)
d
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 6.2.3 p. 6-4.
RINSC Training Manual - Pg. I-54 & T.S. 3.1
SDM (cold/clean) = Total Rod worth - K_{excess} - Most reactive blade - Reg Rod
SDM = (2.41 + 2.32 + 2.49 + 2.60 + 0.084) - 3.42 - 2.60 - 0.084 = 3.80%

*ANSWER (A.15)
a
*REFERENCE
Glasstone & Sesonke, *Nuclear Reactor Engineering*, Chapter 1

*ANSWER (A.16)
d
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, Subcritical Multiplication

*ANSWER (A.17)
b
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, §§ 8.1 —8.4, pp. 8-3 — 8-14.

*ANSWER (A.18)
c

*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 4.6, p. 4-16.

*ANSWER (A.19)
c
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 5.5, pp. 5-18 — 5-25.

*ANSWER (A.20)
a
*REFERENCE
Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, §§ 3.2.2 — 3.2.3, pp. 3-7 — 3-12.

(*** End of Section A ***)

Section B Normal/Emerg. Procedures & Rad Con

*ANSWER (B.1)
b
*REFERENCE
$Dr_1D_1^2 = Dr_2D_2^2$
$Dr_2 = Dr_1D_1^2 / D_2^2$ = (50 mr/hr x 5 ft^2)/10 ft^2 = 12.5 mr/hr

*ANSWER (B.2)
b
REFERENCE
10 CFR 50.54 (x)

*ANSWER (B.3)
c
*REFERENCE
10 CFR 50.54 (q); 10 CFR 50.59; 10 CFR 55.59

*ANSWER (B.4)
b
*REFERENCE
RINSC Radiation Safety Guide pg. 3

*ANSWER (B.5)
b
*REFERENCE
RINSC Radiation Safety Guide pg. 58

*ANSWER (B.6)
a
*REFERENCE
Assume beta will not travel 10 feet in air, therefore 0.5 mr is gamma. Gamma dose at ½ ft is:

(DR1) (R12) = (DR2) (R22) → DR2 = (DR1) (R12) / R22 = 0.5 mr x 10 ft2 / 0.5 ft2 = 200 mr/hr

Therefore, beta contribution at ½ ft is 2000 - 200 = 1800 mr/hr.

Beta contribution/Gamma contribution = 1800/200 = 9

*ANSWER (B.7)
c
*REFERENCE
I=Ioe-μχ → I=1R/hr e(-0.52 x 2) = 0.36 R/hr

*ANSWER (B.8)
c
*REFERENCE
10CFR20 SUBPART C, APPENDIX B

*ANSWER (B.9)
b
*REFERENCE
Tech. Specs, Definitions 1.7

*ANSWER (B.10)
a
*REFERENCE
T.S. 2.2.2

*ANSWER (B.11)
c
*REFERENCE
GM is not sensitive to energy.

*ANSWER (B.12)
a
*REFERENCE
NPP Health Physics pg. 5-20

*ANSWER (B.13)
c
*REFERENCE
RINSC Operating Procedures p 8-2

*ANSWER (B.14)
a
*REFERENCE
T.S. Table 3.2, pg. 14

*ANSWER (B.15)
c
*REFERENCE
Operating Procedures 12-1, 12-2

*ANSWER (B.16)
c
*REFERENCE
T.S. 3.8

*ANSWER (B.17)
b
*REFERENCE
R = 6 C E n R = 6 (200 ci) (1.10 + 1.29 MeV) (1 disintegration)
R = 2868 R/hr

*ANSWER (B.18)
d
*REFERENCE
Technical Specification, p. 12, Table F-1.
Rhode Island: Safeguards Report for Rhode Island Open Pool Reactor, paragraph 2.2.3, p. 26.

*ANSWER (B.19)
d
*REFERENCE
DR= 6CE/(f)(f) = 0.005 = 6(2)(1.33)/x2, x2 = 3192, x = 56.5 feet

*ANSWER (B.20)
d
*REFERENCE
RINSC Radiation Safety Guide, pg. 38

(*** End of Section B ***)

C. PLANT AND RAD MONITORING SYSTEMS

*ANSWER (C.1)
c
*REFERENCE
T.S. 2.2

*ANSWER (C.2)
d
*REFERENCE
SAR LEU Conversion - Beamport Description

*ANSWER (C.3)
a
*REFERENCE
RINSC T.S. 4.4, 4.5, 4.6

*ANSWER (C.4)
c
*REFERENCE
T.S. 2.2 Bases

*ANSWER (C.5)
a
*REFERENCE
T.S. 3.2.3

*ANSWER (C.6)
c
*REFERENCE
Requal Exam Question Bank.

*ANSWER (C.7)
b
*REFERENCE
SAR (HEU to LEU Conv.); Loss of Coolant Analysis pg. 17

*ANSWER (C.8)
a
*REFERENCE
SAR System Description

*ANSWER (C.9)
a
*REFERENCE
SAR Fig. 6-1

C. PLANT AND RAD MONITORING SYSTEMS

*ANSWER (C.10)
c
*REFERENCE
SAR sect. 5.5 & SOP App. W “Alarm, Scram, and Interlock Checks”

*ANSWER (C.11)
d
*REFERENCE
SAR Sect. 7.2.8

*ANSWER (C.12)
a
*REFERENCE
RINSC, Emergency Plan Implementing Procedures, § 3.3 Utilities Failure

*ANSWER (C.13)
a
*REFERENCE
T.S. Table 3.1

*ANSWER (C.14)
c
*REFERENCE
Gladstone & Sesonske, Nuclear Reactor Engineering 3rd Edition, sect. 5.254

*ANSWER (C.15)
b
*REFERENCE
SAR Section 13.2.3

*ANSWER (C.16)
a
*REFERENCE
T.S. 3.1 Specifications 9

*ANSWER (C.17)
a
*REFERENCE
Fig. 3 - SAR for the LEU fuel conversion.

C. PLANT AND RAD MONITORING SYSTEMS

*ANSWER (C.18)
a
*REFERENCE
T.S. 3.3.A.2

*ANSWER (C.19)
a
*REFERENCE
RINSC supplied Requal Exam Question

*ANSWER (C.20)
d
*REFERENCE
RINSC supplied Requal Exam Question

(*** End of Section C ***)
(***** End of Examination *****)