June 13, 2005

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-05-01, RHODE ISLAND ATOMIC ENERGY COMMISSION

Dear Mr. Tehan:

During the week of March 14, 2005, the NRC administered an operator licensing examination at your Rhode Island Atomic Energy Commission Reactor. The examination was conducted according to NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1. Examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report at the conclusion of the examination.

In accordance with 10 CFR 2.390 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 Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/reading-rm/adams.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 Mr. Paul Doyle at (301)415-1058 or via internet e-mail pvd@nrc.gov.

Sincerely,

/RA/

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

Docket No. 50-193

Enclosures: 1. Initial Examination Report No. 50-193/OL-05-01
2. Facility comments with NRC Resolution
3. Examination with NRC Resolutions Incorporated

cc w/encls: Please see next page

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Rhode Island Atomic Energy Commission
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MMendonca Facility File (EBarnhill) O-6 F-2

EXAMINATION PACKAGE ACCESSION #: ML043350370
REPORT ACCESSION #: ML051580600 **TEMPLATE #: NRR-074**

OFFICE	RNRP:CE	N	IROB:LA	E	RNRP:SC	
NAME	PDoyle		EBarnhill		PMadden	
DATE	06/9/2005		06/9/2005		06/10/2005	

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cc:

Dr. Vincent C. Rose, Chairman, RIAEC
University of Rhode Island
Chemical Engineering Department
118 Crawford Hall
Kingston, RI 02881

Dr. Harry Knickle, Chairman
Nuclear and Radiation Safety Committee
University of Rhode Island
College of Engineering
102 Bliss Hall
Kingston, RI 02881

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-05-01

FACILITY DOCKET NO.: 50-193

FACILITY LICENSE NO.: R-95

FACILITY: Rhode Island Atomic Energy Commission

EXAMINATION DATES: March 17, 2005

SUBMITTED BY: **/RA/** 6/9/05
Paul V. Doyle Jr., Chief Examiner Date

SUMMARY:

On March 17, 2005 the NRC administered an operator licensing examination to one Senior Reactor Operator (Instant) candidate. The candidate passed all portions of his respective examination.

REPORT DETAILS

1. Examiners:
   Paul V. Doyle Jr., 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:
   Paul Doyle, NRC, Examiner
   Terrence Tehan, RINSC, Director
   Jeff Davis, RINSC

   During the exit meeting the examiner thanked the facility staff for their support in the administration of the examination.

ENCLOSURE 1

Facility Comments with NRC Resolution

Facility Comment **Question A.18:**

We don't really pay any attention to Samarium because it is insignificant in terms of reactivity.

NRC Resolution:

Agree with comment in part. Although samarium has little effect on reactor operation, it is however, a process going on in the core. No change to the examination.

Facility Comment **Question B.15:**

With maximum power at 2 MW, 15 kW represents 15 kW/2 MW *100% = 0.75% difference between actual power and indicated power. Therefore, we probably wouldn't adjust detectors.

NRC Resolution:

Agree with comment answer key changed to make choice “d” correct.

Facility Comment **Question C.4:**

Our new Start-up Channel uses the fission chamber detector that is also used for the Log N Power and Log N Period Channels. I don't think that there is a discriminator associated with it. The answer to this question makes it sound like a discriminator magically knows which pulses are generated by gamma ray interactions, and which pulses are generated by neutron events. Discriminators just filter out pulses that are below the threshold height.

NRC Resolution:

Disagree with comment. The choice does NOT imply “magic”. Choice B clearly states that a gamma event would produce a relatively small pulse compared to a pulse due to neutron events. And although the “new” fission chambers with cambelling circuits now will are being used to provide wide-range power indication, typically they DO contain a discriminating circuit to be able to register very low power levels.

Facility Comment **Question C.9:**

I would have used a GM detector to look for contamination. The radiation field strength will be unchanged from when the experimenter was handling the sample vial. The big unknown will be where the contamination is. A thin window GM detector will be good for detecting beta, as well as gamma.

NRC Resolution:

Agree with comment. Answer key changed to make both choices “a” or “d” correct.

Facility Comment **Question C.16:**

The "Test" position of the Master Switch allows the operator to do everything except get magnet current. Therefore, answers b and c could be correct answers.

NRC Resolution:

Agree with comment answer key changed to make choices “b” or “c” correct.

ENCLOSURE 2

OPERATOR LICENSING EXAMINATION

With Answer Key

RHODE ISLAND NUCLEAR SCIENCE CENTER

March 17, 2005

ENCLOSURE 3

QUESTION A.01 [2.0 points, ½ each]
The listed isotopes are all potential daughter products due to the radioactive decay of $_{35}Br^{87}$. Identify the type of decay necessary (Alpha, Beta, Gamma or Neutron emission) to produce each of the isotopes.

a. $_{33}As^{83}$

b. $_{35}Br^{86}$

c. $_{35}Br^{87}$

d. $_{36}Kr^{87}$

QUESTION A.02 [1.0 point]
What is the definition of reactivity? A measure of the …

a. number of neutrons being produced in the core.

b. number of neutrons being absorbed by the fuel.

c. reactor's multiplication factor.

d. reactor's departure from critical.

QUESTION A.03 [2.0 points, ½ each]
Using the drawing of the Integral Rod Worth Curve provided, identify each of the following reactivity worths.

a. Total Rod Worth

b. Actual Shutdown Margin

c. Technical Specification Shutdown Margin Limit

d. Excess Reactivity

1. B - A
2. C - A
3. C - B
4. D - C
5. E - C
6. E - D
7. E - A

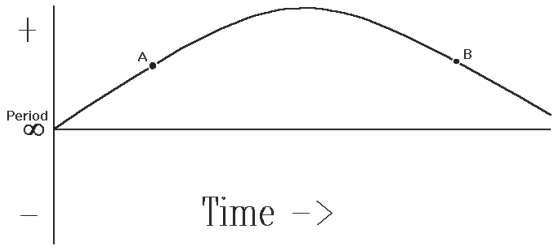
QUESTION A.04 [1.0 point]
Shown below is a trace of reactor period as a function of time. Between points A and B reactor power is:

a. continually increasing.

b. continually decreasing.

c. increasing, then decreasing.

d. constant.



QUESTION A.05 [1.0 point]
What is the kinetic energy range of a thermal neutron?

a. > 1 MeV

b. 100 KeV – 1 MeV

c. 1 eV – 100 KeV

d. < 1 eV

QUESTION A.06 [1.0 point]
Which ONE of the following statements is correct with respect to why Xenon peaks following a shutdown?

a. Delayed neutrons continue causing fissions increasing the “direct” Xenon.

b. The decay constant for Xenon is longer than the decay constant for Iodine.

c. The decay constant for Xenon is longer than the decay constant for Cesium.

d. The decay constant for Cesium is essentially zero.

QUESTION A.07 [1.0 point]
Suppose the temperature coefficient of a core is -2.5×10^{-4} ΔK/K/EC and the average control rod worth of the regulating control rod is 5.895×10^{-3} ΔK/K/inch. If the temperature ***INCREASES*** by 50EC what will the automatic control command the regulating rod to do? Select the answer that is closest to the calculated value.

a. 5.6 inches in

b. 2.1 inches out

c. 0.5 inches in

d. 4.3 inches out

QUESTION A.08 [1.0 point]
Given the following data, which ONE of the following is the closest to the half life of the material?

TIME	ACTIVITY
0	2400 cps
10 min.	1757 cps
20 min.	1286 cps
30 min.	941 cps
60 min.	369 cps

a. 11 minutes

b. 22 minutes

c. 44 minutes

d. 51 minutes

QUESTION A.09 [1.0 point]
During a fuel loading of the core, as the reactor approaches criticality, the value of 1/M:

a. Increases toward one

b. Decreases toward one

c. Increases toward infinity

d. Decreases toward zero

QUESTION A.10 [1.0 point]
Which ONE of the following is the major source of energy released during fission?

a. Prompt gamma rays

b. Fission fragments

c. Neutrinos

d. Fission neutrons

QUESTION A.11 [1.0 point]
Which one of the following is the definition of the ***FAST FISSION FACTOR***?

a. The ratio of the number of neutrons produced by fast fission to the number produced by thermal fission

b. The ratio of the number of neutrons produced by thermal fission to the number produced by fast fission

c. The ratio of the number of neutrons produced by fast and thermal fission to the number produced by thermal fission

d. The ratio of the number of neutrons produced by fast fission to the number produced by fast and thermal fission

QUESTION A.12 [1.0 point]
In a reactor at full power, the thermal neutron flux (φ) is 2.5 x 10^{12} neutrons/cm^2/sec. and the macroscopic fission cross-section G_f is 0.1 cm^{-1}. The fission reaction rate is:

a. 2.5 x 10^{11} fissions/sec.

b. 2.5 x 10^{13} fissions/sec.

c. 2.5 x 10^{11} fissions/cm^3/sec.

d. 2.5 x 10^{13} fissions/cm^3/sec.

QUESTION A.13 [1.0 point]
The number of neutrons passing through a one square centimeter of target material per second is the definition of which one of the following?

a. Neutron Population (np)

b. Neutron Impact Potential (nip)

c. Neutron Flux (nv)

d. Neutron Density (nd)

QUESTION A.14 [1.0 point]
Which ONE of the following explains the response of a ***SUBCRITICAL*** reactor to equal insertions of positive reactivity as the reactor approaches criticality? Each insertion causes a …

a. ***SMALLER*** increase in the neutron flux resulting in a ***LONGER*** time to stabilize.

b. ***LARGER*** increase in the neutron flux resulting in a ***LONGER*** time to stabilize.

c. ***SMALLER*** increase in the neutron flux resulting in a ***SHORTER*** time to stabilize.

d. ***LARGER*** increase in the neutron flux resulting in a ***SHORTER*** time to stabilize.

QUESTION A.15 [1.0 point]
Which ONE of the following atoms will cause a neutron to lose the most energy in an elastic collision?

a. Uranium^{238}

b. Carbon^{12}

c. Hydrogen^{2}

d. Hydrogen^{1}

QUESTION A.16 [1.0 point]
A thin foil target of 10% copper and 90% aluminum is in a thermal neutron beam. Given $\sigma_{a\,Cu}$ = 3.79 barns, $\sigma_{a\,Al}$ = 0.23 barns, $\sigma_{s\,Cu}$ = 7.90 barns, and $\sigma_{s\,Al}$ =1.49 barns, which ONE of the following reactions has the highest probability of occurring? A neutron …

a. scattering reaction with aluminum

b. scattering reaction with copper

c. absorption in aluminum

d. absorption in copper

QUESTION A.17 [1.0 point]
When performing rod calibrations, many facilities pull the rod out a given increment, then measure the time for reactor power to double (doubling time), then calculate the reactor period. If the doubling time is 42 seconds, what is the reactor period?

a. 29 sec

b. 42 sec

c. 61 sec

d. 84 sec

QUESTION A.18 [1.0 point]
Which ONE of the following statements concerning reactor poisons is NOT true?

a. Following shutdown, Samarium concentration will increase to some value then stabilize.

b. Following shutdown, Xenon concentration will initially increase to some value then decrease exponentially

c. During reactor operation, Samarium concentration is independent of reactor power level.

d. During reactor operation, Xenon concentration is dependent on reactor power level.

QUESTION B.1 [1.0 point]
An experimenter wishes to irradiate three specimens with reactivity worths of 0.0010 Δk/k (moveable), 0.0022 Δk/k (fixed) and 0.0027 Δk/k (fixed). Can these specimens be placed in the reactor as UNSECURED experiments and why (why not).

a. Yes, the sum of the three specimens is less than 0.025 Δk/k.

b. No, the sum of the three specimens is greater than 0.006 Δk/k.

c. Yes, each specimen is less than 0.008 Δk/k.

d. No, the moveable experiment specimen is greater than 0.0008 Δk/k.

QUESTION B.2 [1.0 point]
10CFR50.54(x) states: *"A licensee may take reasonable action that departs from a license condition or a technical specification (contained in a license issued under this part) in an emergency when this action is immediately needed to protect the public health and safety and no action consistent with license conditions and technical specifications that can provide adequate or equivalent protection is immediately apparent.* 10CFR50.54(y) states that the minimum level of management which may authorize this action is …

a. any Reactor Operator licensed at facility

b. any Senior Reactor Operator licensed at facility

c. Facility Manager (or equivalent at facility).

d. NRC Project Manager

QUESTION B.3 [1.0 point]
Which ONE of the following is the 10 CFR 20 definition of **TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)**?

a. The sum of the deep does equivalent and the committed effective dose equivalent.

b. The dose that your whole body receives from sources outside the body.

c. The sum of the external deep dose and the organ dose.

d. The dose to a specific organ or tissue resulting from an intake of radioactive material.

QUESTION B.4 [1.0 point]
Many research reactors use different methods to reduce the dose due to N^{16} at the pool top. If the method used keeps the N^{16} ten (10) feet below the surface of the water, and a half-thickness for the N^{16} gamma(s) is one foot for water, then the dose due to N^{16} is reduced (approximately) by a factor of … (Note: Neglect any reduction in dose rate due to half-life.)

a. 20

b. 100

c. 200

d. 1000

QUESTION B.5 [1.0 point]
Which ONE of the following is the definition of ***Emergency Action Level***?

a. a condition that calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.

b. Specific instrument readings, or observations; radiation dose or dose rates; or specific contamination levels of airborne, waterborne, or surface-deposited radioactive materials that may be used as thresholds for establishing emergency classes and initiating appropriate emergency methods.

c. classes of accidents grouped by severity level for which predetermined emergency measures should be taken or considered.

d. a document that provides the basis for actions to cope with an emergency. It outlines the objectives to be met by the emergency procedures and defines the authority and responsibilities to achieve such objectives.

QUESTION B.6 [1.0 point]
The drop time for the control rods were last measured on July 31, 2004. Which one of the following dates is the latest the maintenance may be performed again without exceeding a Technical Specifications requirement? (Assume no movement within core.)

a. Feb. 14, 2005

b. Jul. 31, 2005

c. Oct. 31, 2005

d. Jan. 31, 2006

QUESTION B.7 [2.0 points, 0.5 each]
Match the 10CFR55 requirements for maintaining an active operator license in column A with the corresponding time period from column B.

	Column A	Column B
a.	Renew License	1 year
b.	Medical Exam	2 years
c.	Pass Requalification Written Examination	4 years
d.	Pass Requalification Operating Test	6 years

QUESTION B.8 [1.0 point]
Which ONE of the following types of experiments may NOT be irradiated within the confines of the pool?

a. explosive materials

b. fueled experiments

c. materials corrosive to reactor components

d. cryogenic liquids

QUESTION B.9 [1.0 points]
Which ONE of the following correctly defines a Safety Limit?

a. Limits on important process variables which are found to be necessary to reasonably protect the integrity of the principal barriers which guard against the uncontrolled release of radioactivity.

b. The Lowest functional capability of performance levels of equipment required for safe operation of the facility.

c. Settings for automatic protective devices related to those variables having significant safety functions.

d. a measuring or protective channel in the reactor safety system.

QUESTION B.10 [1.0 point]
The CURIE content of a radioactive source is a measure of

a. the number of radioactive atoms in the source.

b. the amount of energy emitted per unit time by the source

c. the amount of damage to soft body tissue per unit time.

d. the number of nuclear disintegrations per unit time.

QUESTION B.11 [2.0 points, ½ each]
Identify each of the following reactor plant limitations as a Safety Limit (SL), Limiting Safety System Setting (LSSS) or a Limiting Condition for Operation (LCO). (Choices may be used more than once or not at all.)

a. Excess reactivity above the reference core condition will be no more than 4.7% Δk/k.

b. The True Value of Reactor thermal power, (P), shall not exceed 2.4 MW

c. The regulating rod shall be worth no more than 0.6% Δk/k in reactivity

d. $T_{P(max)}$ = 126EF

QUESTION B.12 [1.0 point]
Which of the following individuals may authorize by his initials implementation of temporary changes to the operational procedures? (select one)

a. Any SRO in the absence of the Reactor Facility Director.

b. Only the Director or the Assistant Director

c. Only the Reactor Facility Director or the Radiation Protection Officer

d. The Designated Senior Operator in the absence of the Reactor Facility Director

QUESTION B.13 [1.0 point]
While working in an area marked "Caution, Radiation Area," you discover your dosimeter is off scale and leave the area. Assuming you had been working in the area for 45 minutes, what is the maximum dose you would have received?

a. 3.8 mr

b. 35.6 mr

c. 75 mr

d. 100 mr

QUESTION B.14 [2.0 points, ½ each]
For each of the conditions listed in column A, identify the appropriate action (**Shutdown** Rx, **Maintain** at Power, **Scram** (manual or automatic).

a. Reactor power increases from 95% to 97% while pool is filling.

b. Reactor power decreases unexpectedly from 95% to 92% .

c. The alarm for the high Neutron flux on one of the safety chanels becomes inoperable due to a faulty relay.

d. The temperature of the coolant leaving the core reaches 120EF.

e. Primary flow indication begins to decrease due to a detector failure (assume a pin-hole leak in the Δp cell diaphragm.

QUESTION B.15 [1.0 point]
During a power calibration indicated power differed from calculated power by 15 K watts. Which one of the following actions is required for the Linear Power and Percent Power channels?

a. Adjust the detector high voltage on the detectors.

b. Adjust the compensating voltages on the detectors.

c. Adjust the detector heights.

d. No adjustment necessary.

QUESTION B.16 [1.0 point]
A room contains a source which, when exposed, results in a general area dose rate of 175 millirem per hour. This source is scheduled to be exposed continuously for 25 days. Select an acceptable method for controlling radiation exposure from the source within this room.

a. Post the area with words “Danger-Radiation Area”.

b. Equip the room with a device to visually display the current dose rate within the room.

c. Equip the room with a motion detector that will alarm in the control room.

d. Lock the room to prevent inadvertent entry into the room.

QUESTION B.17 [1.0 point]
After receiving your license to maintain it active you must perform the duties of an SRO for a minimum of ___ hours per quarter

a. 2

b. 4

c. 20

d. 40

QUESTION C.1 [1.0 point]
Which ONE of the following statements is the purpose of the holdup tank in the primary system?

a. To allow for the decay of N^{16}.

b. To allow for the decay of H^{3}.

c. To provide a surge volume for the pool upon startup of primary coolant pumps.

d. To provide for a large source of makeup water for a pool leak.

QUESTION C.2 [2.0 points, 0.5 each]
Match the problems on the left with its possible plant conditions on the right. (No changes to any equipment have been made, e.g. no valves manipulated)

Symptom	Cause
a. High radiation level in demineralizer tanks	1. Resin separation (channeling)
b. High radiation level on demineralizer outlet	2. Fission product release
c. High flow through demineralizer tanks	3. High water temperature
d. High pressure on demineralizer inlet	4. Clogging

QUESTION C.3 [1.0 point]
Which one of the following is NOT a reason for having excess reactivity in the core?

a. Fission Product poisons buildup

b. Pool Temperature changes

c. Insertion of Experiments

d. The use of a neutron source

QUESTION C.4 [1.0 point]
Which ONE of the following is the main function performed by the DISCRIMINATOR circuit in the Startup Channel?

A. To generate a current signal equal and of opposite polarity as the signal due to gammas generated within the Startup Channel Detector.

B. To filter out small pulses due to gamma interactions, passing only pulses due to neutron events within the Startup Channel Detector.

C. To convert the linear output of the Startup Channel Detector to a logarithmic signal for metering purposes.

D. To convert the logarithmic output of the metering circuit to a δt (delta time) output for period metering purposes.

QUESTION C.5 [1.0 point]
Which ONE of the following is the Blade Withdrawal Interlock?

A. Low source count rate < 3 cps

B. High flux - 105%

C. Period - 45 seconds

D. Source Range Signal/noise ratio of 2

QUESTION C.6 [1.0 point]
WHICH ONE of the following detectors is used primarily to measure N^{16} release to the environment?

a. NONE, N^{16} has too short a half-life to require environmental monitoring.

b. Stack Gas Monitor

c. Stack Particulate Monitor

d. Bridge Area Monitor

QUESTION C.7 [1.0 point]
WHICH ONE of the following poisons is used in the four control blades?

a. Borated Graphite

b. Boron-Carbide

c. Hafnium

d. Stainless Steel.

QUESTION C.8 [1.0 point]
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

QUESTION C.9 [1.0 point]
An experimenter drops and breaks open a sample vial in a laboratory room. He immediately runs out of the room and closes the door. You are called in to assist in the cleanup. **Prior** to opening the door you would take a reading using a(n)

a. Ion Chamber portable radiation detector to determine the radiation field strength.

b. Geiger-Müller portable radiation detector to determine the radiation field strength.

c. Ion Chamber portable radiation detector to determine whether contamination is present.

d. Geiger-Müller portable radiation detector to determine whether contamination is present.

QUESTION C.10 [1.0 point]
Which ONE of the following is the actual design feature which prevents siphoning of pool water on a failure of the primary system?

a. The suction and return line each contain a siphon break valve and stand-pipe.

b. All primary system pipes end three feet below the water surface.

c. The suction and discharge lines both contain anti-siphon loops, which go to above the water level then out thruough the pool wall.

d. The suction and return line each contain a valve which will inject service air into the loop.

QUESTION C.11 [1.0 point]
Which ONE of the following methods is used to determine if there is a leak in the heat exchanger?

a. Routine checks of the secondary coolant for Na^{24}.

b. Pool level will decrease due to leakage into the secondary.

c. Decrease in secondary makeup, due to water from primary.

d. Routine checks of the secondary coolant for O^{19}.

QUESTION C.12 [1.0 point]
Which one of the following fans will come on or remain on upon activation of a confinement signal?

a. The Off-Gas Blower

b. The Dilution air Blower

c. The Pneumatic System Blower

d. The Normal Ventilation Exhaust Fan

QUESTION C.13 [1.0 point]
Which ONE of the following is the method used to reduce Ar^{41} dose from the pneumatic tube system?

a. Blower exhausts through a HEPA filter and eventually into the stack.

b. A Nitrogen purge is maintained on the system.

c. A CO_2 purge is maintained on the system

d. Lead shielding on the receiver station.

QUESTION C.14 [1.0 point]
The reactor is operating at 2 Megawatts, when the operating SECONDARY coolant pump trips on overload. Assuming NO OPERATOR ACTION, which ONE of the following trips would most likely cause a reactor scram?

a. High Flux

b. Short Period

c. High Coolant Inlet Temperature

d. Low Secondary Flow

QUESTION C.15 [1.0 point] QUESTION DELETED DURING EXAM ADMINISTRATION (DUPLICATE)

a.

b.

c.

d.

QUESTION C.16 [1.0 point]
The "TEST" position of the Master Switch allows:

a. insertion of scram signals without deenergizing the scram magnets.

b. control power and lamp indication operability testing.

c. control blade drive motion without energizing the scram magnets.

d. control blade drive motion with energized scram magnets

QUESTION C.17 [1.0 point]
Which ONE of the following safety system protective functions (Scrams) is NOT bypassed when the Power Level Selector Switch is in the 0.1 Mwatt position?

a. High temperature Reactor Coolant Inlet

b. No flow Thermal Column

c. Bridge Misalignment

d. Low Pool Water Level

QUESTION C.18 [1.0 point]
Which ONE of the following scrams is the only one that could be an ***ELECTRONIC SCRAM***?

a. Gate

b. Seismic

c. Bridge

d. Reactor Period

QUESTION C.19 [1.0 point]
Which ONE of the following is the method used to minimize water loss due to a leak in the pneumatic tube system?

a. Manual Ball Valves

b. Automatic Gate Valves.

c. None required, air pressure generated by the blower will prevent water loss.

d. Non required. Due to the low diameter of the piping, the makeup system will easily keep up with the leak

A.01 a, alpha; b, neutron; c, gamma; d, Beta
Ref: RIAEC Rx Theory Notes

A.02 d
REF: Note 1

A.03 a, 7; b, 5; c, 6; d, 2
REF: Standard NRC Question

A.04 a
REF: Standard NRC question

A.05 d
REF: Note 1

A.06 b
REF: Note 1

A.07 B
REF: The temperature increase will result in a change in reactivity of: -2.5×10^{-4} ΔK/K/EC × 50EC = -1.25×10^{-2} ΔK/K. Since the temperature rise results in a negative reactivity insertion, the control rod will need to drive out to add positive reactivity. D = $(1.25 \times 10^{-2}$ ΔK/K) ÷ $(5.895 \times 10^{-3}$ ΔK/K/inch) = 2.12 inches

A.08 b
REF: Note 1

A.09 d
REF: Note 1

A.10 b
REF: Note 1

A.11 c
REF: Note 1

A.12 c
REF: $R = \varphi G_f = (2.5 \times 10^{12}) \times 0.1 = 2.5 \times 10^{11}$

A.13 c
REF: Note 1

A.14 b
REF: Note 1

A.15 d
REF: Note 1

A.16 a
REF: Note 1

A.17 c
REF: ln (2) = -time/τ τ = time/(ln(2)) = 60.59 . 61 seconds

A.18 c
REF: Note 1

NOTE 1: RIAEC Rx Theory Notes do not lend themselves to easy reference. The same chapters and page numbers are used multiple times.

B.1 d
REF: Technical Specifications, § 3.1.4

B.2 b
REF: 10CFR50.54(y)

B.3 a
REF: 10 CFR 20.1003 Definitions

B.4 d
REF: Basic Radiological Controls knowledge: “Half-Thickness and Tenth-Thickness". 2^{10} = 1024 . 1000

B.5 b
REF: ~~Emergency Plan, § 2.0 Definitions, p. 2-1.~~ Emergency Plan NOT provided.

B.6 c
REFERENCE T.S. §§ 4.2(4) & 1.38

B.7 a, 6; b, 2; c, 2; d, 1
REF: 10CFR55.

B.8 a
REF: Technical Specification 3.8

B.9 a
REF: Technical Specifications § 1.29, Definition: *Safety Limit.*

B.10 d
REF: Standard Health Physics Definition. (Also 10CFR20.xxxx)

B.11 a, LCO; b, SL; c, LCO; d, LSSS
REF: Technical Specifications 2.1, 2.2 and 3.1.

B.12 b
REF: Facility Technical Specification Table 3.1

B.13 c
REF: 10 CFR 20.1003 Maximum dose in a radiation area is 100 mr/hr. 100 mr/hr × 0.75 hr = 75 mr.

B.14 a, MAINTAIN; b, SHUTDOWN; c, MAINTAIN; d, MAINTAIN; e, SCRAM
REF: Examination administered 1993.2.

B.15 ~~c~~ d Answer changed per facility comment.
REF: 1997 NRC Exam

B.16 d
REF: 10 CFR 20.1601

B.17 b
REF: 10CFR55.

C.1 a
REF: Draft SAR § 5.2.1.3.

C.2 a, 2; b, 3; c, 1; d, 4
REF: New NRC Question, 3rd verification.

C.3 d
REF: Standard NRC question.

C.4 b
REF: Standard NRC question.

C.5 a
REF: Technical Specifications Table 3.2.

C.6 a
REF: Standard NRC Question.

C.7 b
REF: Draft SAR § 4.2.2, 1st ¶.

C.8 a
REF: NRC Exam administered 1993. Rhode Island supplied questions § E.4 Draft SAR Figure 8-2

C.9 a or d Second correct answer added per facility comment.
REF: Standard NRC Question

C.10 c
REF: SAR § 4.2.2 Primary Coolant System, 5th ¶.

C.11 a
REF: Tech Specs

C.12 b
REF: Draft SAR

C.13 a
REF: Draft SAR, § 10.3.1

C.14 c
REF: Standard NRC Question

C.15 QUESTION DELETED DURING EXAMINATION ADMINISTRATION (DUPLICATE)
REF:

C.16 c or b Second correct answer added per facility comment.
REF: Draft SAR § 7.2.3, p. 7-3.

C.17 d
REF: Technical Specification 3.2, Specification 1.

C.18 d
REF: NRC Exam administered 1993, also, GE Operation and Maintenance Manual I 1.5.11, Scram Circuits p 1-63.

C.19 a
REF: Draft SAR § 10.2.3.1 last ¶

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

FACILITY: Rhode Island Nuclear Science Center

REACTOR TYPE: GE Pool

DATE ADMINISTERED: 2005/03/17

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 Candidates 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. 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

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 only 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.

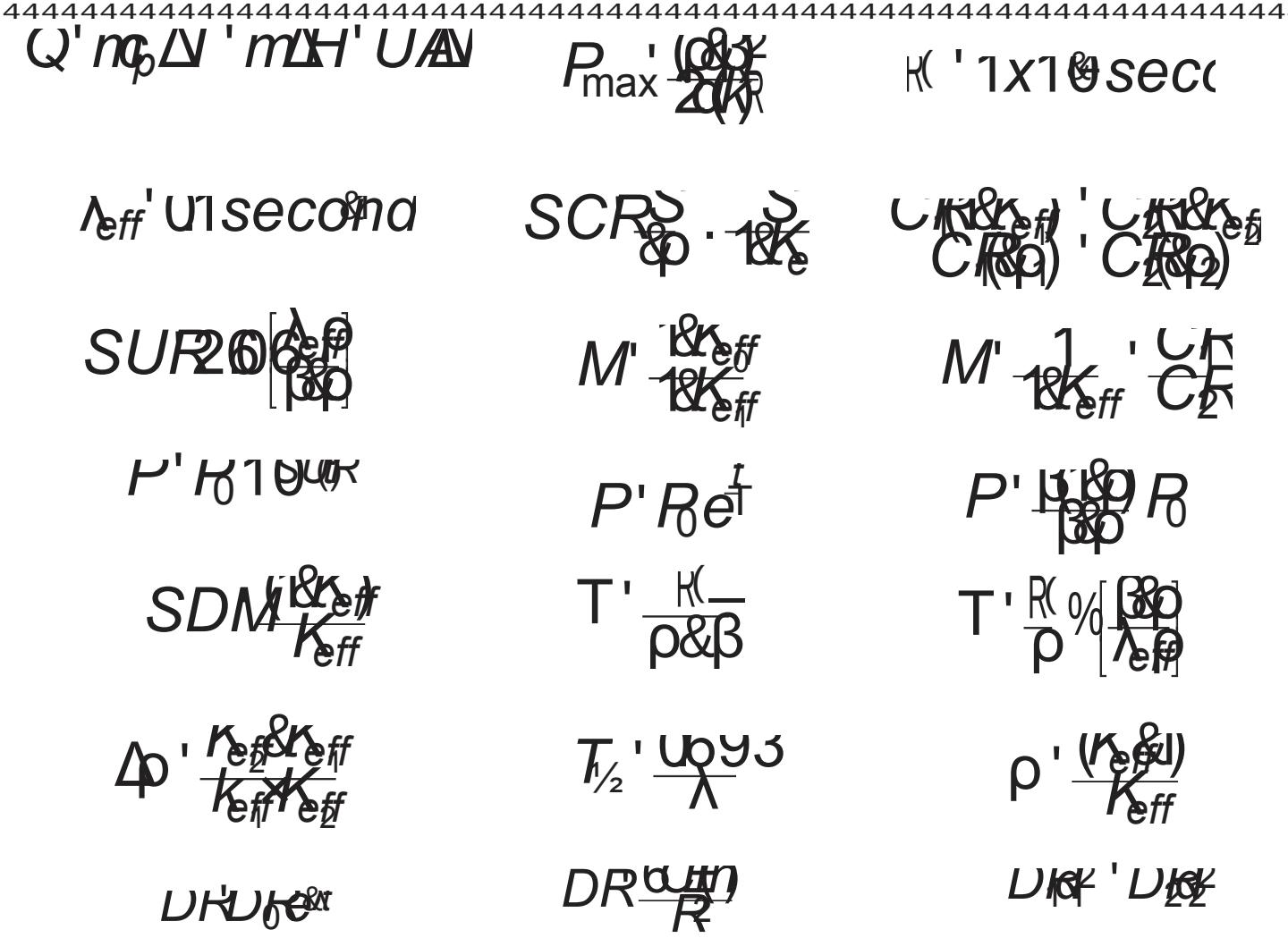
10. Ensure all information you wish to have evaluated as part of your answer is on your answer sheet. Scrap paper will be disposed of immediately following the examination.

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

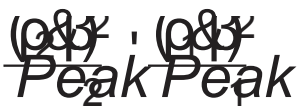
12. There is a time limit of three (3) hours for completion of the examination.

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.

EQUATION SHEET



DR – Rem, Ci – curies, E – Mev, R – feet



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

1 Horsepower = 2.54 x 10^{3} BTU/hr

1 BTU = 778 ft-lbf

1 gal (H_2O) . 8 lbm

c_P = 1.0 BTU/hr/lbm/EF

1 kg = 2.21 lbm

1 Mw = 3.41 x 10^{6} BTU/hr

EF = 9/5 EC + 32

EC = 5/9 (EF - 32)

c_p = 1 cal/sec/gm/EC

A.1a α β γ n ___

A.1b α β γ n ___

A.1c α β γ n ___

A.1d α β γ n ___

A.2 a b c d ___

A.3a 1 2 3 4 5 6 7 ___

A.3b 1 2 3 4 5 6 7 ___

A.3c 1 2 3 4 5 6 7 ___

A.3d 1 2 3 4 5 6 7 ___

A.4 a b c d ___

A.5 a b c d ___

A.6 a b c d ___

A.7 a b c d ___

A.8 a b c d ___

A.9 a b c d ___

A.10 a b c d ___

A.11 a b c d ___

A.12 a b c d ___

A.13 a b c d ___

A.14 a b c d ___

A.15 a b c d ___

A.16 a b c d ___

A.17 a b c d ___

A.18 a b c d ___

B.1 a b c d ___

B.2 a b c d ___

B.3 a b c d ___

B.4 a b c d ___

B.5 a b c d ___

B.6 a b c d ___

B.7a 1 2 4 6 ___

B.7b 1 2 4 6 ___

B.7c 1 2 4 6 ___

B.7d 1 2 4 6 ___

B.8 a b c d ___

B.9 a b c d ___

B.10 a b c d ___

B.11a SL LSSS LCO ___

B.11b SL LSSS LCO ___

B.11c SL LSSS LCO ___

B.11d SL LSSS LCO ___

B.12 a b c d ___

B.13 a b c d ___

B.14a Shutdown Maintain Scram _____

B.14b Shutdown Maintain Scram _____

B.14c Shutdown Maintain Scram _____

B.14d Shutdown Maintain Scram _____

B.15 a b c d ___

B.16 a b c d ___

B.17 a b c d ___

C.1 a b c d ___

C.2a 1 2 3 4 ___

C.2b 1 2 3 4 ___

C.2c 1 2 3 4 ___

C.2d 1 2 3 4 ___

C.3 a b c d ___

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.16 a b c d ___

C.17 a b c d ___

C.18 a b c d ___

C.19 a b c d ___