July 19, 2011

Mr. Steven G. Frantz, Director
Reed Reactor Facility
3203 SE Woodstock Blvd.
Portland, OR 97202

SUBJECT: EXAMINATION REPORT NO. 50-288/OL-11-01, REED COLLEGE

Dear Mr.Frantz:

During the weeks of May 9 and 16, 2011, the Nuclear Regulatory Commission (NRC) administered an operator licensing examination at your TRIGA Reactor. The examination was conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. 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 Title 10 of the *Code of Federal Regulations* Section 2.390, 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 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. Phillip T. Young, at (301) 415-4094 or via internet e-mail Phillip.Young@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads, Jr., Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-288

Enclosures: 1. Examination Report No. 50-288/OL-11-01
2. Written examination

cc w/o enclosures: See next page

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ADAMS ACCESSION No. ML111440887 **TEMPLATE #:NRR-074**

OFFICE	PROB:CE		IOLB:LA	E	PROB:SC	
NAME	PYoung		CRevelle		JEads	
DATE	6/06/2011		6/20/2011		7/19/11	

OFFICIAL RECORD COPY

cc:

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Portland, OR 97204

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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.: 50-288/OL-11-01

FACILITY DOCKET NO.: 50-288

FACILITY LICENSE NO.: R-112

FACILITY: Reed College Reactor

EXAMINATION DATES: May 1 through 18, 2011

SUBMITTED BY: **/RA/** 6/16/11
Phillip T. Young, Chief Examiner Date

SUMMARY:

The NRC administered an operator licensing examination to fourteen Reactor Operator (RO) and ten Senior Reactor Operator (Upgrade) (SRO-U) candidates. All RO and eight of the SRO passed all portions of their respective examinations. Two of the SRO applicant did not pass the Operating Test portion of their examination.

REPORT DETAILS

1. Examiners:
   Phillip T. Young, Chief Examiner, NRC
   Greg Shoenebeck, Examiner, NRC
   Patrick Isaac, Examiner, NRC

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	14/0	0/0	14/0
Operating Tests	14/0	8/2	22/2
Overall	14/0	8/2	22/2

3. Exit Meeting:
   Phillip T. Young, NRC, Examiner
   Greg Shoenebeck, Examiner, NRC
   Steven G. Frantz, Director
   Robin Bjorkquist, Associate Director of the Reactor

The chief examiner met with the facility staff to discuss the overall administration of the examination. The examiner noted the following weaknesses on the part of the candidates.

1) On the two occasions that the examiner challenged taking a bag and camera into the reactor bay, he was successful until he tried to get a picture of the applicant standing in front of the reactor. Although not allowed to take a picture he was never asked to remove his bag from the reactor bay. Another examiner challenged six RO applicants on taking pictures in the reactor bay. Only two of the six stopped him.
2) During the first week of examinations two occasions of chewing gum in the reactor bay were noted.

3) The majority of the RO applicants demonstrated a weakness in recognizing when the reactor went from sub-critical to critical. After completing the core excess calculation at 5 watts, when asked where the reactor went critical most stated “after power has been stable for two minutes with no rod movement.” Given start-ups where the core excess was not required, the applicants were asked about when the reactor went from sub-critical to critical. The following responses are typical a) when the number of neutrons in one generation exceeds the number in the previous generation, and b) one applicant was asked to tell the examiner when the reactor goes from sub-critical to critical, this applicant declared the reactor initial critical at 84.5% power.

ENCLOSURE 1

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

FACILITY: Reed College Reactor

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 05/09/2011

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
18.00	33.3			A. Reactor Theory, Thermodynamics and Facility Operating Characteristics
17.00 ~~18.00~~	33.3			B. Normal and Emergency Operating Procedures and Radiological Controls
16.00	33.3			C. Facility and Radiation Monitoring Systems
51.00	100.0			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 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's

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

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

$$\ell^* = 1 \; x \; 10^{-4} \; seconds$$

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

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

$$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$$
$$CR_1(-\rho_1) = CR_2(-\rho_2)$$

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

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

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

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

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

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

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

EQUATION SHEET's

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

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

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

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

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

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

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

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

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

EQUATION SHEET's

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

1 Curie = 3.7×10^{10} dis/sec

1 kg = 2.21 lbm

1 Horsepower = 2.54×10^{3} BTU/hr

1 Mw = 3.41×10^{6} BTU/hr

1 BTU = 778 ft-lbf

$^{\circ}F = 9/5\,^{\circ}C + 32$

1 gal (H_2O) ≈ 8 lbm

$^{\circ}C = 5/9\,(^{\circ}F - 32)$

$c_P = 1.0$ BTU/hr/lbm/$^{\circ}F$

$c_p = 1$ cal/sec/gm/$^{\circ}C$

Section A - Reactor Theory, Thermo & Facility Operating Characteristics

Question A.001 (1.0 point) {1.0}
As power level increases, the Prompt Negative Temperature Coefficient (PNTC) causes:

a. 238U to absorb neutrons over a wider range, thus decreasing the number of neutrons available for fission with 235U.

b. The hydrogen atoms in the ZrH2 to slow down more neutrons.

c. More thermal neutron absorption by the moderator.

d. Doppler resonance effects to decrease.

Answer: A.001 a.
Reference: Reed Requal Exam

Question A.002 (1.0 point) {2.0}
Which alteration or change to the core will most strongly affect the thermal utilization factor.

a. Addition of U238

b. Removal of moderator.

c. Removal of a control rod.

d. Build up of fission products in fuel.

Answer: A.002 c.
Reference: Reed Reactor Training Manual

Question A.003 (1.0 point) {3.0}
Which ONE of the following is the reason for the 80 second period following a reactor scram?

a. U-235 affinity for source neutrons.

b. Fuel temperature coefficient adding positive reactivity.

c. Longest lived delayed neutron precursors decay constant.

d. Amount of negative reactivity added on a scram exceeds the shutdown margin.

Answer: A.003 c.
Reference: RRF Training Manual

Section A - Reactor Theory, Thermo & Facility Operating Characteristics

Question A.004 (1.0 point) {4.0}
Which ONE of the following is a correct statement concerning the factors affecting control rod worth?

a. As Rx power increases rod worth increases.

b. Fuel burn up causes the rod worth for periphery rods to decrease.

c. Fuel burn up causes the rod worth to increase in the center of the core.

d. The withdrawal of a rod causes the rod worth of the remaining inserted rods to increase.

Answer: A.004 d.
Reference: Reed Training Manual

Question A.005 (1.0 point) {5.0}
The reactor is shutdown by 5% delta-K/K with a count rate of 100 cps on the start up channel. Rods are withdrawn until the count rate is 1000 cps. Which ONE of the following is the condition of the reactor after the rods are withdrawn?

a. Critical with Keff = 1.0

b. Subcritical with Keff = 0.995

c. Subcritical with Keff = 0.950

d. Supercritical with Keff = 1.005

Answer: A.005 b.
Reference: Reed Training Manual

Question A.006 (1.0 point) {6.0}
In a just critical reactor, removing one dollar worth of reactivity will cause:

a. The resultant period to be a function of the prompt neutron lifetime.

b. The prompt neutron term to become unimportant

c. The reactor period to be equal to $(\beta-\rho)/\lambda\rho$

d. A sudden drop in neutron flux.

Answer: A.006 a.
Reference: Reed Operator Requal Exam

Question A.007 (1.0 point) {7.0}
Which statement illustrates a characteristic of Subcritical Multiplication?

a. As Keff approaches unity (1), for the same increase in Keff, a greater increase in neutron population occurs.

b. The number of neutrons gained per generation gets larger for each succeeding generation.

c. The number of fission neutrons remain constant for each generation.

d. The number of source neutrons decreases for each generation.

Answer: A.007 a
Reference: RRF Training Manual

Question A.008 (1.0 point) {8.0}
The reactor was shut down after an extended two week, high power, run at 200 kw to irradiate a specimen. How long will it take for the MAXIMUM Xenon poison effect to occur?

a. Immediately.

b. 8 to 12 hours.

c. 35 to 45 hours.

d. 1 to 3 hours.

Answer: A.008 b.
Reference: RRF Training Manual

Question A.009 (1.0 point) {9.0}
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 (f).

b. Resonance escape probability (p).

c. Thermal non-leakage probability (L_{th}).

d. Reproduction factor (η).

Answer: A.009 d.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2, pp. 3-13 — 3-18.

Section A - Reactor Theory, Thermo & Facility Operating Characteristics

Question A.010 (1.0 point) {10.0}
INELASTIC SCATTERING is the process by which a neutron collides with a nucleus and …

a. is absorbed, with the nucleus emitting a gamma ray.

b. recoils with the same kinetic energy it had prior to the collision.

c. is absorbed, with the nucleus emitting a gamma ray and a neutron with a lower kinetic energy.

d. recoils with a higher kinetic energy than it had prior to the collision with the nucleus emitting a gamma ray.

Answer: A.010 c
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 2.4.5 p. 2-28.

Question A.011 (1.0 point) {11.0}
An initial count rate of 100 is doubled five times during a startup. Assuming an initial Keff of 0.950, which one of the following is the new Keff?

a. 0.957
b. 0.979
c. 0.985
d. 0.998

Answer: A.011 d.
Reference: CR1 (1-Keff1) = CR2 (1 - Keff2) or M1 (1-Keff1) = M2 (1 - Keff2)
CR2/CR1 = 32 CR1 (1-Keff1)/CR2 = 1 - Keff2)
100 (1-0.950)/3200 = 1 - Keff2 Keff2 = 1 - .0015625 = .998

Question A.012 (1.0 point) {12.0}
Consider two identical critical reactors, with the exception that one has a beta of 0.0072 and the other has a beta of 0.0060. Each reactor is operating a 10 watts. Which one of the following compares the response of the reactors to a +0.1% delta k/k reactivity insertion?

a. The resulting period will be shorter for the reactor with the 0.0072 beta fraction

b. The resulting period will be shorter for the reactor with the 0.0060 beta fraction

c. The resulting power level will be higher for the reactor with the 0.0072 beta fraction

d. The resulting power level will be higher for the reactor with the 0.0060 beta fraction

Answer: A.012 b.
Reference: Reed Reactor Facility Training Manual, Section 9.6.
Introduction to Nuclear Engineering, John R. Lamarsh, Section 12-2
Glasstone and Sesonske, edition copyrighted 1967, Section 5.27, equation 5.31

Question A.013 (1.0 point) {13.0}
Which one of the following is the PRIMARY reason that delayed neutrons are so effective at controlling reactor power?

a. Delayed neutrons are born at thermal energies.
b. Delayed neutrons are born at lower energies than prompt neutrons.
c. Delayed neutrons have a much longer mean lifetime than prompt neutrons.
d. Delayed neutrons make up a very large fraction of the fission neutrons in the core.

Answer: A.013 c.
Reference: Reed Reactor Facility Training Manual

Question A.014 (1.0 point) {14.0}
Which one of the following explains why the shim and safety control rods are worth more than the regulating rod?

a. The thermal neutron flux near the shim and safety rods is higher than the flux near the regulating rod.
b. The regulating rod is exposed to a higher fast neutron flux because it is located closer to the core reflector.
c. The regulating rod is exposed to a lower fast neutron flux because it is located closer to the core reflector.
d. The thermal neutron flux near the regulating rod is higher than the flux near the shim and safety rods.

Answer: A.014 a.
Reference: Reed Reactor Facility Training Manual

Question A.015 (1.0 point) {15.0}
The following data was obtained during a reactor fuel load.

No. of Elements	Detector A (cps)
0	20
8	28
16	30
24	32
32	42
40	80

Which one of the following represents the number of fuel elements predicted to reach criticality?

a. 44
b. 48
c. 52
d. 56

Answer: A.015 b.
Reference: Burn, R., Intro to Nuclear Reactor Operations, © 1982, § 5.5, pp. 5-18 — 5-25.

Question A.016 (1.0 point) {16.0}
The reactor is shutdown by 0.05 ΔK/K, this would correspond to Keff of:

a. 0.9995
b. 0.9524
c. 0.7750
d. 0.0500

Answer: A.016 b.
Reference: Burn, R., Intro to Nuclear Reactor Operations, © 1982, § 3.3.4, p. 3-21.
$p=(k-1)/k$; $p= -0.05$; $-0.05k = k-1$; $1 = k-(-0.05k) = k(1+0.05)$; $k=1/1.05$; $k=0.9524$

Question A.017 (1.0 point) {17.0}
The Reed Reactor is operating at 250 KW and the reactor scram is set for 110% of full power. What will be the power at the time of the scram if a nuclear excursion creates a 0.5 second period and the scram delay time is 1.0 second?

a. 275 KW
b. 670 KW
c. 1847 KW
d. 25000 KW

Answer: A.017 c.
Reference: $P_f = P_0\, e^{t/T}$ (=) P_f = 250 KW $e^{(1\ sec/0.5\ sec)}$ = 1847 KW

Question A.018 (1.0 point) {18.0}
Which of the following atoms will cause a neutron to lose the most energy during an elastic scattering reaction?

a. O^{16}
b. C^{12}
c. U^{235}
d. H^{1}

Answer: A.018 d.
Reference: Burn, R., *Introduction of Nuclear Reactor Operations*, © 1988, §

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.001 (1.0 point) {1.0}

Which one of the following is true about gammas when compared to alphas and betas?

a. Least penetrating

b. Highest ionization potential

c. Poses the greatest whole body concern

d. For the same curie content, poses the greatest hazard when taken internally

Answer: B.001 c.
Reference: Radiation Protection

Question B.002 (1.0 point) {2.0}

A 4 inch thickness of steel reduces a gamma radiation dose rate from 60 mrem/hr to 6 mrem/hr. What is the dose rate if an additional 1 inch thickness of steel is added?

a. 0.56 mrem/hr

b. 1.50 mrem/hr

c. 2.62 mrem/hr

d. 3.37 mrem/hr

Answer: B.002 d
Reference: 4 inches = 1/10 (6/60) shielding value layer. 1 inch = 10E (-0.25)
= .56 shielding value layer OR:
I/Io = e (-ux) Shielded dose = 6 mrem/hr X .56 = 3.37 mrem/hr

QUESTION B.003 Deleted during administration of the examination – no correct answer in the listed options

~~**Question** B.003 (1.0 point) {3.0}~~

~~Which one of the following requires the notification of "Unusual Event"?~~

~~a. A reactor operator received a localized dose of 27 rems to his feet.~~

~~b. A radical group of students is marching toward the Reactor Facility.~~

~~c. The reactor operator notices a pool level increase of greater than two inches in five minutes.~~

~~d. The reactor operator initiated a manual reactor scram when he felt a tremor that was caused by an unexpected earthquake.~~

~~Answer: B.003 c.~~
~~Reference: REED Emergency Plan Table I~~

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.004 (2.0 points, 0.5 each) {4.0}
Match the radiation reading from column A with its corresponding radiation area classification (per 10 CFR 20) listed in column B.

COLUMN A	COLUMN B
a. 10 mrem/hr	1. Unrestricted Area
b. 150 mrem/hr	2. Radiation Area
c. 10 Rem/hr	3. High Radiation Area
d. 550 Rem/hr	4. Very High Radiation Area

Answer: B.004 a. = 2; b. = 3; c. = 3; d. = 4
Reference: 10 CFR 20.1003, Definitions

Question B.005 (1.0 point) {5.0}
A small radioactive source is to be stored in the reactor building. The source is estimated to contain ½ 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. 28 feet
b. 22 feet
c. 17 feet
d. 2 feet

Answer: B.005 a.
Reference: $DR= 6CE/x^2 = 0.005 = 6(½)(1.33)/x^2$, $x^2 = 798$, $x = 28.25$ feet

Question B.006 (1.0 point) {6.0}
Which of the following does NOT require NRC approval for changes?

a. License
b. Emergency Plan
c. Requalification plan
d. Emergency Implementation Procedures

Answer: B.006 d.
Reference: Previous RRF RO Requal Exam

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.007 (1.0 point) {7.0}
As the reactor operator on duty for a first start up of the day, you determine that the Core Excess Reactivity Worth is $3.00. What actions should be taken?

a. No action required.
b. SCRAM the Reactor and notify the SRO of Record.
c. Shutdown the Reactor and notify the Operations Supervisor.
d. SCRAM the Reactor and re-perform the all the startup activities.

Answer: B.007 c.
Reference: SOP-01

Question B.008 (1.0 point) {8.0}
For training purposes, reactor power was increased from 400 watts to an equilibrium power 98% of the license limit in accordance with SOP 01, Reactor Operations. Which one of the following is correct for this power increase?

a. It violates SOP 01 and Tech. Specs.
b. It violates SOP 01, but not Tech. Specs.
c. The power increase is within all prescribed procedures and Tech. Specs.
d. The power increase is within all prescribed procedures and Tech. Specs. but violates good practice.

Answer: B.008 b.
Reference: Reed, SOP 01, Precaution 1.4.8

Question B.009 (1.0 point) {9.0}
In accordance with the Technical Specifications, the reactor will be considered shutdown with fixed experiments in place when sufficient control rods have been inserted to assure the reactor is subcritical by _____ in the cold, xenon-free condition.

a. 0.12% delta k/k
b. 0.4% delta k/k
c. 0.7% delta k/k
d. 2.25% delta k/k

Answer: B.009 c.
Reference: Tech Spec Definitions, Section A.1

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.010 (1.0 point) {10.0}
The Reed Reactor Facility Emergency Plan defines the term OFFSITE as the geographical area that is _____.

a. beyond the site boundary

b. beyond the Reed College campus

c. 250 feet beyond the operations boundary

d. 250 feet beyond the Reed College campus

Answer: B.010 a.
Reference: Emergency Plan, Section 2

Question B.011 (1.0 point) {11.0}
If the Radiation Area Monitor (RAM) failed and could be fixed within 2 hours, does Technical Specifications allow reactor operations to continue, and if so, what is the minimum requirement?

a. No.

b. Yes, as long as no increases in reactor power occur and no changes in reactor experiments occur.

c. Yes, for up to one week, while a detector capable of displaying gamma dose rate is utilized as a temporary substitute.

d. A continuous air monitor with readout and audible alarm shall be operable in the reactor room when the reactor is operating.

Answer: B.011 c.
Reference: T.S. Section G.

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.012 (1.0 point) {12.0}

The reactor is operating at 100% power when the pneumatic transfer system blower is turned on to irradiate an experiment sample. Seconds later, the Gaseous Stack Monitor (GSM) high radiation alarm is received for several seconds, then clears as the GSM meter reading steadily decreases. Which one of the following is the action that the operator is expected to take?

a. Continue operations and observe that GSM reading returns to normal.

b. Stop pneumatic transfer system operations and notify the SRO of Record.

c. SCRAM the reactor, verify isolation and ensure everyone leaves the reactor bay.

d. SCRAM the reactor, if an isolation occurs 1) ensure everyone leaves the reactor bay and 2) collect the CAM and APM filters to determine the release to the environment.

Answer: B.012 a.
Reference: SOP 13, Rabbits

Question B.013 (1.0 point) {13.0}

Which one of the following describes the control of the emergency grab-bag during an emergency evacuation of the reactor facility in accordance with the Emergency Implementation Plan?

a. It is taken by the on-duty Senior Operator who is acting as the Emergency Coordinator.

b. It is taken by the first Reactor Assistant to use the exit corridor and turned over to the Health Physicist.

c. It is taken by the on-duty Reactor Operator when leaving the Control Room and turned over to the Health Physicist.

d. It is taken by the first staff person using the exit corridor and turned over to the Emergency Coordinator.

Answer: B.013 d.
Reference: Emergency Implementing Plan

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.014 (1.0 point) {14.0}
The preferred hospital for dealing with radiological injuries is:

a. Providence Hospital
b. Kaiser Permanente
c. Mount Sinai Hospital
d. Legacy Good Samaritan Hospital

Answer: B.014 d.
Reference: E-Plan

Question B.015 (1.0 point) {15.0}
Which ONE of the following conditions is a violation of Technical Specifications, Reactor Pool ?

a. Conductivity of the pool water is 4 mhos per centimeter averaged over one month.
b. Bulk temperature of the coolant is 45 degrees C during reactor operation.
c. Radioactivity in the pool water is 0.2 micro Ci/ml.
d. Pool water ph is 5.7

Answer: B.015 a.
Reference: RRF Tech Spec

Question B.016 (2.0 points, ½ point each) {17.0}
10 CFR 55 contains requirements associated with your operator or senior operator license. Match each of the requirements listed in column A with it's appropriate time period in column B. (Note: Periods from column B may be used more than once or not at all.)

Column A (Requirements)	Column B (Years)
a. License Expires	1
b. Pass a Requalification Written Examination	2
c. Pass a Requalification Operating Test	4
d. Medical Examination Required	6

Answer: B.016 a. = 6; b. = 2; c. = 1; d. = 2
Reference: 10CFR55

Section C: - Plant and Rad Monitoring Systems

Question C.001 (1.0 point) {1.0}

During performance of a preliminary calibration at or below 150 kW (60% of full power) power calibration indicated power differed from calculated power by 15 Kwatts. 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 detectors height.

d. No adjustment necessary.

Answer: C.001 c.
Reference: RRR Routine Experiment 4 Reactor Power Measurement

Question C.002 (1.0 point) {2.0}

When air contamination greater than the setpoint has been detected in the Reactor Room. Which one of the following is the correct response by the ventilation system?

a. The supply system will automatically stop, dampers will direct air through filters purging the room at 150 cfm.

b. The supply system will shift to high speed, dampers will direct the exhaust to the ventilation stack at 150 cfm.

c. The exhaust system will shift to high speed, dampers will direct air through filters purging the room at 150 cfm.

d. The exhaust system will automatically stop, dampers will direct air through filters purging the room at 150 cfm.

Answer: C.002 a.
Reference: SOP-32 Ventilation

Section C: - Plant and Rad Monitoring Systems

Question C.003 (1.0 point) {3.0}

The return water from the primary coolant/purification system is ejected from an angled nozzle, which causes a swirling motion in the pool. Which one of the following is the primary purpose for this design …

a. Increase the heat transfer rate due to increase convective flow.

b. Increase the transport time for N^{16} to reach the surface of the pool.

c. Break up O^{16} bubbles in the pool thereby decreasing the formation of N^{16}.

d. Decrease the activation rate of O^{16} to N^{16} due to decrease time in the core.

Answer: C.003 b.
Reference: Examiner Notes from previous examinations

Question C.004 (1.0 point) {4.0}

Which one of the following statements describes the moderating properties of Zirconium Hydride?

a. The probability that a neutron will return to the fuel element before being captured elsewhere is a function of the temperature of the hydride.

b. The ratio of hydrogen atoms to zirconium atoms affects the moderating effectiveness for slow neutrons.

c. The hydride mixture is very effective in slowing down neutrons with energies below 0.025 eV.

d. Elevation of the hydride temperature increases the probability that a thermal neutron will escape the fuel-moderator element before being captured.

Answer: C.004 d.
Reference: SAR Appendix E GA - 3886 (Rev. A) TRIGA Mark III Reactor Hazards Analysis,

Section C: - Plant and Rad Monitoring Systems

Question C.005 (1.0 point) {5.0}
When inserting a SCRAM signal to shutdown the reactor the operator forgets and leaves the rod control system in automatic mode. What will be the condition of the rods after three minutes?

a. All 3 rods will be on the bottom. The rod drive for the Shim rod will be fully out.

b. The Safety and Regulating rods will be on the bottom. The Shim rod will be all the way out.

c. The Shim and Safety rods will be on the bottom. The Regulating rod will be all the way out.

d. All 3 rods will be on the bottom. The rod drive for the Regulating rod will be part of the way out.

Answer: C.005 d
Reference: Facility comment from NRC examination

Question C.006 (1.0 point) {6.0}
Which one of the following describes the operation of the rotary specimen rack?

a. Can be turned remotely from the reactor control console using a motor drive. Specimens are loaded using a grapple into WET racks.

b. Can be turned remotely from the reactor control console using a motor drive. Specimens are loaded through a water-tight tube into DRY racks.

c. Can be turned manually from the top of the reactor. Specimens are loaded through a water-tight tube into DRY racks.

d. Can be turned manually from the top of the reactor. Specimens are loaded using a grapple into WET racks.

Answer: C.006 c.
Reference: SAR Section 5.2.5

Section C: - Plant and Rad Monitoring Systems

Question C.007 (1.0 point) {7.0}

Which one of the following describes the purpose of the connecting rod piston and the vents in the rod drive barrel of the control rod drive system?

a. The piston and the small grated vents along the length of the rod barrel prevent excessive rod withdrawal speeds.

b. The piston and the small grated vents near the bottom of the rod barrel slow the rod speed before bottoming impact during scrams.

c. The piston weight holds the control rods fully inserted while the large slotted vents along the length of the rod barrel provide for unrestricted cooling water flow to the control rods.

d. The piston and the large slotted vents along the length of the rod barrel prevent excessive rod speeds during accidental rod drops while allowing unrestricted normal rod drive speeds.

Answer: C.007 b.
Reference: SAR, Section 5.2.8

Question C.008 (1.0 point) {8.0}

The reactor is at 240 Kwatts in "SERVO" control when gamma compensating voltage for the measuring NI channel is lost. What effect would this have on regulating rod position, and why?

a. Rod will drive in slightly, because indicated power will increase with demand remaining the same.

b. Rod will drive out slightly, because indicated power will decrease with demand remaining the same.

c. Rod will remain as is, because input to the control circuit is not affected.

d. Rod will scram, due to a large increase in indicated power.

Answer: C.008 a.
Reference: Reed Facility Training Manual

Section C: - Plant and Rad Monitoring Systems

Question C.009 (1.0 point) {9.0}
Which one of the following describes a control rod interlock?

a. The control servo cannot be placed in the automatic mode until the shim rod is partially withdrawn.

b. The shim rod cannot be driven in or out when the control servo is in the automatic mode.

c. The rod drive motors are prevented from operating immediately following a scram.

d. Two control rods cannot be withdrawn simultaneously when in the manual mode.

Answer: C.009 d.
Reference: SAR, Section 5.3.4

Question C.010 (1.0 point) {10.0}
What is the source of air for the pneumatic transfer system when inserting a sample into the reactor?

a. Outside air intake

b. Mechanical room

c. Loft free air space

d. Radiochemistry laboratory

Answer: C.010 b.
Reference: Reed Reactor Facility Training Manual

Question C.011 (1.0 point) {11.0}
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 Particulate Monitor

c. Bridge Area Monitor

d. Stack Gas Monitor

Answer: C.011 a.
Reference: Standard NRC Question

Section C: - Plant and Rad Monitoring Systems

Question C.012 (1.0 point) {12.0}
Which ONE of the following facility detectors does NOT have an input signal into the Multitrend?

a. CAM

b. Log-N Channel

c. Primary Conductivity

d. Bulk Water Temperature

Answer: C.012 c.
Reference: SOP-36, Multitrend

Question C.013 (2.0 points, 0.5 each) {14.0}
Match the facility radiation detector in column A with the type of radiological problem it detects in column B.

Column A		Column B
a.	RAM	1. Gases and Particulates
b.	CAM	2. Particulates Only
c.	APM	3. Radiation Level
d.	GSM	4. Gases Only

Answer: C.013 a. = 3; b. = 2; c. = 2; d, 4
Reference: SOP-41A, *RAM Calibration*; SOP-40C, *CAM Calibration*, SOP-40C, *APM Calibration* § 32.1; SOP-40D, *GSM Calibration* § 33.1

Question C.014 ([2.0 point, 0.5 each) {16.0}
Match the control rod drive mechanism part from column "A" with the correct function in column "B".

COLUMN A	COLUMN B
a. Piston	1. Provide rod bottom indication.
b. Potentiometer	2. Provide rod full withdrawn indication.
c. Pull Rod	3. Provide rod position indication when the electromagnet engages the armature.
d. Push Rod	4. Works with dash pot to slow rod near bottom of its travel.

Answer: C.014 a. = 4; b. = 3; c. = 1; d. = 2
Reference: Reed Reactor Facility SAR p. 5-10, also NRC previous examination