June 2, 2010

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

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-288/OL-10-01, REED COLLEGE

Dear Mr. Frantz:

During the week of May 3, 2010, the Nuclear Regulatory Commission (NRC) administered operator licensing examinations at your Reed College reactor. The examinations were 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. John T. Nguyen at (301) 415-4007 or via internet e-mail John.Nguyen@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. Initial Examination Report No. 50-288/OL-10-01
2. Written examination with facility comments incorporated

cc w/o enclosures:
Please see next page

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OFFICE	PROB:CE		IOLB:LA	E	PROB:BC	
NAME	JNguyen		CRevelle		JEads	
DATE	05/19/2010		06/02/2010		06/02/2010	

C = COVER E = COVER & ENCLOSURE N = NO COPY

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Reed College Docket No. 50-288

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-10-01

FACILITY DOCKET NO.: 50-288

FACILITY LICENSE NO.: R-112

FACILITY: Reed College Reactor

EXAMINATION DATES: May 3 – 11, 2010

SUBMITTED BY: _____ _____
John T. Nguyen, Chief Examiner Date

SUMMARY:

During the week of May 3, 2010, the Nuclear Regulatory Commission (NRC) administered operator licensing examinations to fifteen Reactor Operator (RO) candidate's and eight Senior Operator Upgrade (SROU) candidate's. All candidates passed all portions of the examination.

REPORT DETAILS

1. Examiners: John T. Nguyen, Chief Examiner, NRC
Paul V. Doyle Jr., Examiner, NRC
Phillip T. Young, Examiner, NRC

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	15/0	0/0	15/0
Operating Tests	15/0	8/0	23/0
Overall	15/0	8/0	23/0

3. Exit Meeting:
John T. Nguyen, Chief Examiner, NRC
Mr. Steven G. Frantz, Director
Robin Bjorkquist, Associate Director

The NRC examiner thanked the facility staff for their cooperation during the examination. The examiner reported no generic weaknesses.

ENCLOSURE 1

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

License Operator Written Examination
With ANSWER KEY

OL-10-01

REED COLLEGE

MAY 3, 2010

ENCLOSURE 2

Facility Comments with NRC Resolution

Facility Comment Question B.03
We are required to perform a Same Day Startup per SOP 21 following a loss of AC power. We suggest answers “a” and “b” both be accepted

NRC response
Facility comment accepted. Answer key changed to either “a” or “b’, both answers will be accepted as correct. In the future, the question will be modified accordingly.

Facility Comment Question C.01
Part a: On a loss of AC power, the reactor would scram when the magnets lose their electrical power. The answer should be 4.
Part d: Reed college reactor only has two items we call interlocks, both required by Tech Specs. The answer to this should be 1.

NRC response
Facility comment accepted. Answer key changed from “2” to “4” for Part a and “3” to “1” for Part d. In the future, the question will be modified accordingly.

QUESTION A.01 [1.0 point]
During a reactor startup, criticality occurred at a **LOWER ROD HEIGHT** than the last startup. Which ONE of the following reasons could be the cause?

a. Xe^{135} increased.

b. Fuel temperature increased.

c. Pool temperature increased.

d. Moving an experiment with negative reactivity from the core.

QUESTION A.02 [1.0 point]
Which ONE of the following is the major source of energy (heat) generated after SHUTDOWN?

a. Prompt gamma ray.

b. Fission product decay.

c. Kinetic energy of the fission neutrons.

d. Kinetic energy of the fission fragments.

QUESTION A.03 [1 point]
Which ONE of the following best describes the beta decay (β_{-1}) of a nuclide?

a. The atomic mass number unchanged, and the number of protons increases by 1.

b. The atomic mass number unchanged, and the number of protons decreases by 1.

c. The atomic mass number increases by 1, and the number of protons decrease by 1.

d. The atomic mass number increases by 2, and the number of protons increase by 1.

QUESTION A.04 [1.0 point]
Which ONE of the following is the stable reactor period which will result in a power rise from 1% to 100% power in 60 seconds?

a. 6 seconds.

b. 13 seconds.

c. 28 seconds.

d. 80 seconds.

QUESTION A.05 [1.0 point]
Delayed neutrons are produced by:

a. decay of O-16.

b. Photoelectric Effect.

c. decay of fission fragments.

d. directly from the fission process.

QUESTION A.06 [1.0 point]
The FAST FISSION FACTOR is defined as a ratio of:

a. the number of fast neutrons produced by all fission over the number of fast neutrons produced by thermal fission.

b. the number of fast neutrons produced by fission in a generation over the number of total neutrons produced by fission in the previous generation.

c. the number of fast neutrons produced by U-238 over the number of thermal neutrons absorbed in fuel.

d. the number of neutrons that reach thermal energy over the number of fast neutrons that start to slow down.

QUESTION A.07 [1.0 point]
Which ONE of the following is the time period in which the MAXIMUM amount of Xe-135 will be present in the core?

a. 7 to 11 hours after a power increase from 0% to 50%.

b. 7 to 11 hours after a power increase from 50% to 100%.

c. 7 to 11 hours after a start up to 100%power.

d. 7 to 11 hours after a scram from 100% power.

QUESTION A.08 [1.0 point]
A reactor has a K_{eff} of 1.1. What are the values of Δk and ρ?

a. Δk = 0.10 and ρ = 0.09

b. Δk = 0.10 and ρ = 0.10

c. Δk = 0.90 and ρ = 0.10

d. Δk = 0.09 and ρ = 0.01

QUESTION A.09 [1.0 point]
The reactor is SHUTDOWN by 5% Δk/k with the count rate of 100 counts per second (cps). The Shim rods are withdrawn until the count rate is a steady 2000 cps. What is the value of K_{eff} at this point?

a. 0.952

b. 0.973

c. 0.998

d. 1.050

QUESTION A.10 [1.0 point]
Which ONE of the following is the reason that causes the reactor power to rapidly decrease in the TRIGA fuel due to a rapid power excursion (rapid reactivity change)?

a. By increasing of the reproduction factor.

b. By decreasing of Doppler broadening of U-238.

c. By increasing of the resonance escape probability.

d. By decreasing of the thermal non-leakage probability and fast non-leakage probability.

QUESTION A.11 [1.0 point]
The reactor has been stable at 5 W for about an hour. Removing the source from the core causes reactor power to:

a. increase due to an increase in the amount of moderator.

b. decrease since the reactor is under-moderated.

c. stay the same due to keff being constant.

d. decrease due to fast neutron leakage.

QUESTION A.12 [1.0 point]
Assume that the worths of the Safety, Shim, and Reg rods are, respectively, $4.00, $3.50, and $1.50. The reactor is critical at 5 W after WITHDRAWING the following control rod worths: Safety $3.00, Shim $2.00, and Reg $1.20. What is the core excess?

a. -$1.20

b. $2.20

c. $2.80

d. $9.00

QUESTION A.13 [1.0 point]
Which ONE of the following combinations of characteristics makes a good reflector?

	Scattering Cross Section	Absorption Cross Section
a.	High	High
b.	Low	High
c.	High	Low
d.	Low	Low

QUESTION A.14 [1.0 point]
The reactor is exactly critical with β_{eff} = 0.0075. Which ONE of the following is the MINIMUM reactivity that must be added to produce prompt criticality?

a. Reactivity when K_{eff} equals 1.0075.

b. Reactivity equals to the β_{eff}.

c. Reactivity when the stable reactor period equals 3 seconds.

d. Reactivity equals $1.50.

QUESTION A.15 [1.0 point]
Most text books list β for a U^{235} fueled reactor as 0.0065. However, your SAR lists β_{eff} as being 0.0075. Why is β_{eff} larger than β?

a. The fuel includes U^{238} which has a relatively large β for fast fission.

b. Some U^{238} in the core becomes Pu^{239} (by neutron absorption) which has a larger β for fission.

c. Delayed neutrons are born at lower energies than prompt neutrons resulting in less loss due to leakage for these neutrons.

d. Delayed neutrons are born at higher energies than prompt neutrons resulting in a greater worth for these neutrons.

QUESTION A.16 [1.0 point]
Which ONE of the following is the MOST affected factor in the six factor formula when a poison in the control rods is changed from BORON (B) to CADMIUM (Cd)?

a. Fast fission factor.

b. Reproduction factor.

c. Thermal utilization factor.

d. Fast non leakage probability.

********** End of Section A **********

QUESTION B.01 [1.0 point]
The radiation from an unshielded Co-60 source is 500 mrem/hr. What thickness of lead shielding will be needed to lower the radiation level to 5 mrem/hr? The HVL (half-value-layer) for lead is 6.5 mm.

a. 26 mm.

b. 33 mm.

c. 38 mm.

d. 44 mm.

QUESTION B.02 [1.0 point]
Why is algaecide added weekly to the secondary cooling loop?

a. Suppresses biological growth in the cooling tower.

b. Minimizes corrosion of the pipes.

c. Increases thermal conductivity of the water.

a. Prevents the water from freezing in cold temperatures.

QUESTION B.03 [1.0 point] **Answer key changed to "a" or "b" as the correct answers per facility comment**

Given that the following conditions occur during the reactor STARUP:

(1) The electrical transient causes the reactor scram while the reactor is still SUBCRITICAL.
(2) The electrical power comes on within 1 minute.

Which ONE of the following is the appropriate action when the electrical power comes on?

a. Continue to perform the startup and there is no need to log the scram on the purpose stamp.

b. Secure the reactor, immediately report the result to the supervisor and annotate the scram on the purpose stamp.

c. Secure the reactor, immediately report the result to the NRC and annotate the scram on the purpose stamp.

d Continue operation, create a new purpose stamp, and immediately report the result to the supervisor.

QUESTION B.04 [1.0 point]
A radioactive source reads 35 Rem/hr on contact. Five hours later, the same source reads 1.5 Rem/hr. What will the sample read in another five hours?

a. 55 mrem.

b. 65 mrem.

c. 75 mrem.

d. 750 mrem.

QUESTION B.5 [1.0 point]
Which ONE of the following is the definition of the site boundary for the Reed reactor facility?

a. The area inside the reactor bay.

b. 250 feet from the center of the reactor.

c. The physical boundary of Reed College.

d. Within the confines of the Psychology building.

QUESTION B.06 [1.0 point]
During a reactor startup, the reactor operator calculates that the maximum excess reactivity for reference core conditions is 2.35% Δk/k. For this excess reactivity, which ONE of the following is the best action?

a. Continue to operate because the excess reactivity is within TS limit.

b. Increase power to 100 W and verify the excess reactivity again.

c. Shutdown the reactor; immediately report the result to the supervisor due to excess being above TS limit.

d Continue operation, but immediately report the result to the supervisor since the excess reactivity is exceeding TS limit.

QUESTION B.07 [1.0 point]
An area in which radiation levels could result in an individual receiving a dose equivalent in excess of 20 mRem/hr can be considered as a:

a. Radiation area.

b. Vital Area.

c. High Radiation Area.

d. Very High Radiation Area.

QUESTION B.08 [1.0 point]
What are the MINIMUM staffing requirements for reactor operations?

a. 1 RO on console and 1 person in the facility.

b. 1 RO on console, 1 person in the facility, and 1 on-duty SRO on campus.

c. 2 RO on console and 1 person in the facility.

d. 1 SRO on console and the Reactor Director on campus.

QUESTION B.09 [1.0 point]
The Total Effective Dose Equivalent (TEDE) is defined as the sum of the deep-dose equivalent and the committed effective dose equivalent. The deep-dose equivalent is related to:

a. the dose to organs or tissues.

b. the external exposure to the skin or an extremity.

c. the external exposure to the lens of the eye.

d. the external whole-body exposure.

QUESTION B.10 [1.0 point]
Which ONE of the following radioisotopes will decay with the SHORTEST half-life?

a. Al^{28}

b. N^{16}

c. Ar^{41}

d. Xe^{135}

QUESTION B.11 [1.0 point]
What type of radiation detector is used for surveying contaminated areas?

a. Ionization chamber

b. Proportional counter

c. Geiger-Mueller tube

d. Scintillation detector

QUESTION B.12 [1.0 point]
The linear power level channel shall be calibrated at least _____ by thermal power calibration.

a. monthly

b. quarterly

c. semi-annually

d. annually

QUESTION B.13 [2.0 points, 0.5 each]
Identify whether each of the following logbook entries would be made in black ink (BLACK), green ink (GREEN), red ink (RED), black with red underline (BLACK R/U) or would be black with green underline (BLACK G/U).

a. Failure of primary water pump.

b. Removal of fuel element from core.

c. Reactor scram due to electrical transient.

d. Removal of neutron source from core.

QUESTION B.14 [1.0 point] **Answer key changed during the administrative of the examination. Corrected typographical error.**

What is the MINIMUM level of management who may approve a temporary procedure change if the change does not reduce the effectiveness of safety related equipments and does not alter the basic intent of the procedure?

a. The Reactor Operator.

b. The Senior Reactor Operator.

c. The Reactor Manager.

d. The Reactor Director.

QUESTION B.15 [1.0 point]
Which ONE of the following types of experiments shall **NOT** be irradiated at Reed College reactor?

a. The experiment contains 15 milligrams of explosive materials.

b. The movable experiment has a reactivity worth of – $0.80.

c. The experiment has an I-131 inventory of 1.3 curies.

d. The experiment contains a corrosive material.

********** End of Section B **********

QUESTION C.01 [2.0 points, 0.25 each] **Answer key changed during the administrative of the examination. "4" is a correct answer for Part a and "1" is for part d.**

Match the input signals listed in column A with their respective responses listed in column B. (Items in column B may be used more than once or not at all.)

Column A		Column B	
a.	Loss of AC power.	1.	Indication only.
b.	Raise two rods at once.	2.	Indication and rod rundown.
c.	No neutron source.	3.	Indication and interlock.
d.	Motor up limit switches.	4.	Indication and scram.
e.	Pool temperature = 49 °C.		
f.	Secondary pump is OFF.		
g.	Conductivity = 2 µS/cm.		
h.	Linear channel = 107% of the 250 kW scale.		

QUESTION C.02 [1.0 point]
When the Reed Reactor ventilation system is in the isolation mode, which one of the following describes the correct state of operation?
Damper 11 is the fresh supply inlet and Damper 14 is the HEPA inlet.

a. Damper 11 is OPEN and Damper 14 is OPEN.

b. Damper 11 is OPEN and Damper 14 is CLOSED.

c. Damper 11 is CLOSED and Damper 14 is OPEN.

d. Damper 11 is CLOSED and Damper 14 is CLOSED.

QUESTION C.03 [1.0 point]
How does the control rod position indicator measure rod height?

a. A potentiometer is attached to the control rod drive motor.

b. A sonar detector measures the amount of control rod still in the core.

c. An accelerometer determines the relative movement of the control rod.

d. A radio-frequency detector measures the height of the control rod extension tube above the piston.

QUESTION C.04 [1.0 point]
To minimize the power overshoot in automatic mode, the rod speed signal is modulated by…

a. the Log Channel's period signal.

b. the Linear Channel's period signal.

c. the Percent Power Channel's period signal.

d. the Linear Channel's power signal.

QUESTION C.05 [1.0 point] "YELLOW: (ON)" is added during the administrative of the examination.

Given the configuration of the lights associated with the safety rod: RED (UP): OFF
WHITE (DOWN): OFF, BLUE (CONT): ON, and YELLOW: ON, identify the condition of the safety rod.

a. Raising rod.

b. Rod dropping.

c. Rod hits bottom.

d. Scram is reset.

QUESTION C.06 [1.0 point] **Question and answer key changed during the administrative of the examination. The correct answer key is "c".**

The reactor is at 100 kW power in automatic mode. The Shim, Safe and Reg rods are balanced at same height and the Linear Channel is in the auto range. A sample worth of ~~- $0.15~~ -$0.40 is inserted to the core. The likely result with respect to reactor operation is:

a. The reactor remains in automatic and the linear channel will switch to the next higher range.

b. The reactor remains in automatic and the linear channel will switch to the next lower range.

c. The reactor will go out of automatic because the UP limit switch is actuated.

d. The reactor will scram because the DOWN limit switch is actuated.

QUESTION C.07 [2.0 points, 0.25 each]
Match each monitor and instrument (channel) listed in column A with a specific purpose in column B. Items in column B is to be used only once.

Column A		Column B	
a.	Log Channel Channel.	1.	Monitor radiation level in the reactor top.
b.	Percent Power Channel.	2.	Detect radioisotopes released due to fuel failure.
c.	Automatic Rod Control.	3.	Protect the demineralizer resins.
d.	Portable Monitor.	4.	Survey of laboratory.
e.	Linear Channel.	5.	Provide a wide range of power on a linear meter.
f.	Area Radiation Monitor.	6.	Provide a reactor period.
g.	Core Inlet Temperature.	7.	Provide a full power scram.
h.	Air Particulate Monitor.	8.	Control the regulating rod in automatic mode.

QUESTION C.08 [1.0 point]
The reactor operator is measuring the reactivity worth of the Shim rod. Before withdrawing the Shim rod to the new height, the reactor operator needs to stabilize the reactor power at:

a. 5 W for delayed neutrons to reach equilibrium.

b. 5 W for thermal neutron to reach equilibrium.

c. 100 W for delayed neutrons to reach equilibrium.

d. 100 W for thermal neutrons to reach equilibrium.

QUESTION C.09 [1.0 point]
The reactor operator conducts a loss of high voltage (HV) Percent Power Channel scram by momentarily pressing and release the test button on its module. The reactor operator notices the indications as follows:

(1) The Percent Power Channel red “Percent Power” light goes on.

(2) The Percent Power Scram annunciator goes on.

(3) All three yellow magnet power ON lights go off.

Which additional actions and/or indications will occur?

a. The raised control rod drops and its motor stops.

b. The raised control rod drops and its motor drives DOWN.

c. The blue CONT light for the raised rod continuously blinks after the scram.

d. The regulating rod starts driving down and the reactor operation changes from Manual Mode to Automatic Mode.

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 purification system?

a. A valve upstream of the primary pump will shut automatically.

b. A valve downstream of the primary pump will shut automatically.

c. The Emergency Fill system will automatically maintain pool level.

d. “Vacuum breaks” are located in the system which prevents draining the pool 40 inches below the surface of water.

QUESTION C.11 [1.0 point]
Which ONE of the following best describes the design of fuel element used at Reed College reactor?

a. The fuel is a mixture of U-Zr-H alloy containing 8.5% weight of uranium enriched to 20% U^{235}.

b. The fuel is a mixture of U-Zr-H alloy containing 8.5% weight of uranium enriched to 30% U^{235}.

c. The fuel is a mixture of U-Zr-H alloy containing 20% weight of uranium enriched to 8.5% U^{235}.

d. The fuel is a mixture of U-Zr-H alloy containing 20% weight of uranium enriched to 20% U^{235}.

QUESTION C.12 [1.0 point]
Which one of the following correctly describes the operation of a Thermocouple?

a. A bi-metallic strip which winds/unwinds due to different thermal expansion constants for the two metals, one end is fixed and the other moves a lever proportional to the temperature change.

b. a junction of two dissimilar metals, generating a potential (voltage) proportional to temperature changes.

c. a precision wound resistor, placed in a Wheatstone bridge, the resistance of the resistor varies proportionally to temperature changes.

d. a liquid filled container which expands and contracts proportional to temperature changes, one part of which is connected to a lever.

QUESTION C.13 [1.0 point]
At Reed College reactor, the output of the fission chamber provides the signal to:

a. Linear Amplifier.

b. Log-n Amplifier.

c. Rod Control Servo.

d. Percent Power Amplifier.

QUESTION C.14 [1.0 point]
During a startup, the reactor operator performs the Percent Power scram to verify whether the scram channel is operable. This action is considered to be:

a. a channel test.

b. a channel check.

c. a channel calibration.

d. a channel verification.

********** End of Section C **********

A.01 d
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 8.4, page 8-9.

A.02 b
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 3.3.2, page 3-19.

A.03 a
REF: Chart of the Nuclides

A.04 b
REF: $P = P_0 e^{t/T}$ —> $T = t/Ln(P/P_0)$
$t = 60/Ln(100)$; $t = 13$ sec.

A.05 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 3.2.

A.06 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 3.3.1, page 3-16.

A.07 d
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 8.4, page 8-9.

A.08 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 3.3.4.

A.09 c
REF: $K_{eff1} = 1/1 - \rho_1$
$K_{eff1} = 1/(1-(-.05))$ —>$K_{eff1} = 0.952$,
$Count_1*(1-K_{eff1}) = Count_{2*}(1-K_{eff2})$ $Count_1*(1-0.952) = Count_{2*}(1-K_{eff2})$
$100*(1-0.952) = 2000(1- K_{eff2})$; $K_{eff2} = 0.998$

A.10 d
REF: Reed Training Manual, Chapter 10.6, Moderator Temperature Effects

A.11 a
REF: NRC Standard question.

A.12 c
REF: Total worth=\$4+\$3.5+\$1.5=\$9; Reactivity at 5 W= \$3.0 + \$2.0 + \$1.2 = \$6.2
Core excess = Total worth – Reactivity at 5 W
\$9.0-\$6.2 = \$2.8

A.13 c
REF: Standard NRC Question
A.14 b
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 4.2.

A.15 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, § Section 3.3, page 3-14

A.16 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, Sec 4.5.

B.01 d
REF: $DR = DR_{\circ} * e^{-\mu X}$
HVL (=6.5 mm) means the original intensity will reduce by half when a lead sheet of 6.5 mm is inserted. Find μ if the HVL is given as follows: $1 = 2 * e^{-\mu * 6.5}$; μ = 0.10664
Find X: 5 mrem/hr = 500 mrem/hr* $e^{-0.10664 * X}$; X= 43.2 mm

B.02 a
REF: Reed Reactor Facility Training Manual

B.03 **a or b Answer key changed to "a" or "b" as the correct answers per facility comment**
REF: Procedure 2, Section 2.5.7

B.04 b
REF $DR = DR_{\circ} * e^{-\lambda t}$
1.5 rem/hr =35 rem/hr* $e^{-\lambda(5hr)}$
Ln(1.5/35) = -λ*5 --> λ=0.623; solve for another 5 hour later, DR DR=1.5 Rem* $e^{-0.623*(5)}$
DR=6.6*10^{-2} Rem or ~65 mrem

B.05 b
REF: EP, Section 2, Definition

B.06 c
REF: TS, Section E, Reactor Core

B.07 a
REF: 10 CFR 20

B.08 b
REF: Procedure 20, Section 20.8

B.09 d.
REF: 10 CFR 20.1201

B.10 b.
REF: Chart of the Nuclides

B.11 c
REF: NRC Standard question.

B.12 d
REF: TS. F.10, Control and Safety Systems

B.13 a (BLACK G/U) b (RED) c (GREEN) d (BLACK R/U)
REF: Procedure 60, Section 60.17, Ink Color

B.14 ~~b~~ **d Corrected typographical error**
REF: Procedure 61, Section 61.9, Temporary Procedure Changes

B.15 a
REF: TS, Section J

C.01 ~~a(2)~~ a(4) b(3) c(3) ~~d(3)~~ d(1) e(1) f(1) g(1) h(4)
Answer key changed during the administrative of the examination. "4" is a correct answer for Part a and "1" for part d per facility comment.
REF: Reed TS and Procedure 20

C.02 c
REF: Reed Training Manual, September 2008, page 194

C.03 a
REF: Reed Reactor Facility Mech Manual 3.8

C.04 a.
REF: SOP 01, Section 1.11

C.05 a
REF: Reed Training Manual, September 2008, page 178

C.06 ~~b~~ c **Question and answer key changed during the administrative of the examination. The correct answer key is "c".**
REF: SOP 1, Section 1.11

C.07 a(6) b(7) c(8) d(4) e(5) f(1) g(3) h(2)
REF: Reed Training Manual, Section 11.8 and 11.9

C.08 a
REF: SOP 34, Section 34.7.3.9

C.09 b
REF SOP 20, Section 20.8.14

C.10 d
REF: Reed Training Manual, Section 11.6

C.11 a
REF: SAR, Section 5.2.2, Fuel-Moderator Elements

C.12 b
REF: NRC Standard Question

C.13 b
REF: Reed Manual, Figure 11.10

C.14 a
REF: NRC Standard Question