

February 14, 2012

Dr. Gunter Kegel, Director  
Nuclear Radiation Laboratory  
University of Massachusetts — Lowell  
One University Avenue  
Lowell, MA 01854

SUBJECT: EXAMINATION REPORT NO. 50-223/OL-12-01,  
UNIVERSITY OF MASSACHUSETTS – LOWELL

Dear Dr. Kegel:

During the week of January 23, 2012, the U.S. Nuclear Regulatory Commission (NRC) administered operator licensing examinations at your University of Massachusetts – Lowell 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 at the conclusion of the examination with those members of your staff identified in the enclosed report.

In accordance with Title 10, Section 2.390 of the Code of Federal 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 <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room). The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. If you have any questions concerning this examination, please contact Phillip T. Young at 301-415-4094 or via internet e-mail [Phillip.young@nrc.gov](mailto: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. 50-223

Enclosures:

1. Examination Report No. 50-223/OL-12-01
2. Written examination

cc without enclosures: See next page

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DISTRIBUTION w/ encls.:

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PROB r/f

JEads

Facility File CRevelle (O07-F8)

ADAMS ACCESSION #: ML120340178

OFFICE	PROB:CE		IOLB:LA		PROB:BC	
NAME	PYoung		CRevelle		JEads	
DATE	2/07/2012		2/07/2012		2/14/2012	

OFFICIAL RECORD COPY

University of Massachusetts - Lowell

Docket No. 50-223

cc:

Mayor of Lowell  
City Hall  
Lowell, MA 01852

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Reactor Supervisor  
University of Massachusetts - Lowell  
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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.: 50-223/OL-12-01

FACILITY DOCKET NO.: 50-223

FACILITY LICENSE NO.: R-74

FACILITY: University of Massachusetts - Lowell

SUBMITTED BY:                     /RA/                     2/01/2012  
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of January 23, 2012, a written retake examination was administered to one Reactor Operator license applicant. The Reactor Operator applicant passed the retake examination.

**REPORT DETAILS**

1. Examiner: Phillip T. Young, Chief Examiner

2. Results:

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

3. Exit Meeting:  
Phillip T. Young, NRC, Chief Examiner  
Leo M. Bobek, Reactor Supervisor

The Facility administered the one section retake written examination. The Facility did not supply any comments on the written examination. An exit meeting was not conducted due to the nature of the examination.

ENCLOSURE 1

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

FACILITY: UNIVERSITY OF  
MASSACHUSETTS –  
LOWELL

REACTOR TYPE: POOL

DATE ADMINISTERED: 1/24/2012

CANDIDATE: \_\_\_\_\_

**INSTRUCTIONS TO CANDIDATE:**

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

<u>CATEGORY</u>	<u>% OF</u>	<u>CANDIDATE'S</u>	<u>% OF</u>	
<u>VALUE</u>	<u>TOTAL</u>	<u>SCORE</u>	<u>VALUE</u>	<u>CATEGORY</u>
<u>00.00</u>	<u>0</u>	<u>N/A</u>	<u>      </u>	A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
<u>20.00</u>	<u>100.0</u>	<u>      </u>	<u>      </u>	B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
<u>00.00</u>	<u>00.0</u>	<u>N/A</u>	<u>      </u>	C. FACILITY AND RADIATION MONITORING SYSTEMS
<u>20.00</u>		<u>      </u>	<u>      </u>	% TOTALS
		<u>FINAL GRADE</u>		

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 your 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.

N/A

Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.001 [1.00 point] (1.0)

Which ONE of the following is the 10 CFR 20 definition of TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)?

- a. The sum of the external deep dose and the organ dose.
- b. The dose that your whole body receives from sources outside the body.
- c. The sum of the deep dose equivalent and the committed effective dose equivalent.
- d. The dose to a specific organ or tissue resulting from an intake of radioactive material.

Answer: B.001 c.

Reference: 10 CFR 20.1003, Definitions

**Question:** B.002 [1.0 points, 0.25 each] (2.0)

Match the radiation reading from column A with its corresponding radiation area classification (per 10 CFR 20) listed in column B. (Assume gamma radiation)

COLUMN A

- a. 10 mRem/hr
- b. 150 mRem/hr
- c. 10 Rem/hr
- d. 550 Rem/hr

COLUMN B

- 1. Unrestricted Area
- 2. Radiation Area
- 3. High Radiation Area
- 4. Very High Radiation Area

Answer: B.002 a. = 2; b. = 3; c. = 3; d. = 4

Reference: 10 CFR 20.1003, Definitions

**Question:** B.003 [1.00 point] (3.0)

Which of the following types of radiation has the largest quality factor?

- a. Neutron
- b. X-ray
- c. Gamma
- d. Alpha

Answer: B.003 d.

Reference: 10CFR20.104(b)



Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.004 [1.00 point] (4.0)

An irradiated sample having a half-life of 30 minutes provides a dose rate of 200 mr/hr at 3 ft. Approximately how far from the sample must a Radiation Area sign be posted?

- a. 5 ft.
- b. 8 ft.
- c. 20 ft.
- d. 50 ft.

Answer: B.004 c.

Reference: 10CFR20 Radiation area > 5 mrem/hour

**Question:** B.005 [1.00 point] (5.0)

Operator "A" works a standard forty (40) hour work week. His duties require him to work in a radiation area for (4) hours a day. The dose rate in the area is 10 mR/hour. Which one of the following is the MAXIMUM number of days Operator "A" may perform his duties without exceeding 10CFR20 limits?

- a. 12 days
- b. 31 days
- c. 90 days
- d. 125 days

Answer: B.005 d.

Reference: 10CFR20.1201(a)(1)  $5000 \text{ mr} \times \underline{1 \text{ hr}} \times \underline{\text{day}} = 125 \text{ days} \quad \{ 10 \text{ mr} \quad 4 \text{ hr} \}$

**Question:** B.006 [1.00 point] (6.0)

The dose rate from a mixed beta-gamma point source is 100 mrem/hour at a distance of one (1) foot, and is 0.1 mrem/hour at a distance of twenty (20) feet. What percentage of the source consists of beta radiation?

- a. 20%
- b. 40%
- c. 60%
- d. 80%

Answer: B.006 c.

Reference: 10CFR20.

At 20 feet, there is no beta radiation. Gamma at 20 feet = 0.1 mrem/hour, gamma at 1 foot = 40 mrem/hour. Therefore beta at 1 foot = 60 mrem/hour = 60%.

Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.007 [1.0 point] (7.0)

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

- a. In any emergency.
- b. In an emergency declared by the Emergency Director.
- c. In an emergency, when the action is needed to protect health and safety and no other action is immediately apparent.
- <sup>3.</sup> d. In an emergency declared by the Emergency Director along with the approval of the Senior Reactor Operator on site.

Answer: B.007 c.

Reference: 10CFR50.54 (x)

**Question:** B.008 [1.00 point, 0.25 each] (8.0)

Match 10 CFR 55 requirements listed in Column A for an actively licensed operator with correct time period from Column B. Column B answers may be used once, more than once, or not at all.

Column A

Column B

- |  |            |
|--|------------|
| a. License Expiration                  | 1. 1 year  |
| b. Medical Examination                 | 2. 2 years |
| c. Requalification Written Examination | 3. 3 years |
| d. Requalification Operating Test      | 4. 6 years |

Answer: B.008 a. = 4; b. = 2; c. = 2; d. = 1

Reference: 10 CFR 55

**Question:** B.009 [1.00 point, 0.25 each] (9.0)

Identify each of the following as either a Safety Limit (SL) a Limiting Safety System Setting (LSSS) or a Limiting Condition for Operation (LCO).

- a. The minimum coolant flow rate shall be 1170 GPM (Forced Convection Mode).
- b. Maximum excess reactivity shall be 4.7%  $\Delta k/k$ .
- c. The True value of pool water level shall not be less than 24.25 feet above the centerline of the core. (Forced Convection Mode).
- d. During steady-state operation a minimum of two Reactor Power Level (Linear N) Channels shall be operable.

Answer: B.009 a. = LSSS; b. = LCO; c. = SL; d. = LCO

Reference: Technical Specifications §§ 2.1, 2.2.3, 3.1.1 and 3.2.4 (table).

Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.010 [1.0 point] (10.0)

Which ONE of the following situations would illustrate a time when the reactor is shutdown but NOT secured?

- a. One of the shim rod drives is removed for inspection; the rod is decoupled and is fully inserted into the core, all other shim rods are fully inserted and the console key is in the 'off' position and removed.
- b. All shim rods are fully inserted; the console key is in the 'off' position and removed, while fuel is being rearranged in the fuel storage racks.
- c. The shim rods are withdrawn to a subcritical position, the core is subcritical by \$1.20.
- d. An experiment having a reactivity of 50¢ is installed in the central thimble with all shim rods fully inserted and the key removed.

Answer: B.010 c.

Reference: Tech Spec's § 1 Definitions 1.18 Reactor Secured & 1.19 Reactor Shutdown.

**Question:** B.011 [1.0 points, 0.25 each] (11.0)

Identify the **modes** {Forced Convection (above 0.1 Mw) (**FC**), Natural Convection (**NC**), Cross-Pool flow pattern (**CP**) or Down-Comer flow pattern (**DC**), or all modes (**ALL**)} for which each of the following scrams is required to be operational. (**Modes** may be used more than once or not at all.)

- a. Pool level 2'3" above centerline of core.
- b. Either Coolant Riser Gate or Downcomer Gate opens
- c. Coolant Inlet Temperature 108°F
- d. Manual Scram button

Answer: B.011 a. = NC; b. = DC; c. = FC; d. = ALL

Reference: T.S. § 3.3, table

**Question:** B.012 [1.0 point] (12.0)

Which ONE of the following conditions regarding experiments is **not** allowed under ANY condition? The experiment ...

- a. contains cryogenic liquids.
- b. contains 2.1 milligrams of explosive material
- c. causes a reduction in the reading for the startup channel.
- d. causes the outside temperature of a submerged material to reach 90°C (176°F)

Answer: B.012 c.

Reference: T.S. § 3.6, specifications 3, 5, 7 and 8.

Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.013 [1.0 point] (13.0)

When taking logs readings, you must inform the Chief Reactor Operator when you notice a discrepancy between power channels greater than ...

- a. 2%
- b. 3%
- c. 4%
- d. 5%

Answer: B.013 b.

Reference: Standing Order #4, Sequence of Operations during Startup and at Rated Power.

**Question:** B.014 [1.0 point] (14.0)

The containment ventilation system is not operating. The reactor may continue to operate if

- a. Each ventilation valve is in its Technical Specification required position and the RSO approves.
- b. Each ventilation valve is closed or has failed in the closed position.
- c. The ventilation system is not required due to weather conditions.
- d. No experiments are in progress.

Answer: B.014 a.

Reference: R0-5, 8.0 Actions for Ventilation Shutdown

**Question:** B.015 [1.0 point] (15.0)

Following work in a drained pool, whose permission (minimum) is required to use the primary system for refill?

- a. None, this is the normal method for refill.
- b. The Chief Reactor Operator.
- c. The Reactor Supervisor.
- d. The Reactor Director.

Answer: B.015 c.

Reference: AP-0, GENERAL AUTHORITY, #4

Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.016 [1.0 point] (16.0)

During an emergency responsibility for authorizing re-entry into the reactor building or portions thereof belongs to the ...

- a. Console Operator
- b. Senior Reactor Operator
- c. Emergency Director
- d. Radiation Safety Officer

Answer: B.016 c.

Reference: Emergency Plan § 3.4

**Question:** B.017 [1.0 point] (17.0)

The Co<sup>60</sup> source is in use. RO-13, Radiation Monitoring Equipment Checkout, states that you shall not perform checks on channel Q (Gamma Cave) and channel ...

- a. F (Facilities Filter)
- b. G (Rabbit Filter)
- c. H (Hot Cell)
- d. O (Stairwell)

Answer: B.017 a.

Reference: RO-13, § 13.1.b.2.

**Question:** B.018 [1.0 point] (18.0)

An Emergency Action Level is:

- a. a condition which calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.
- b. a class of accidents for which predetermined emergency measures should be taken or considered.
- c. a procedure that details the implementation actions and methods required to achieve the objectives of the Emergency Plan.
- d. a specific instrument reading or observation which may be used as a threshold for initiating appropriate emergency measures.

Answer: B.018 d.

Reference: E-Plan Definitions

Section B- Normal, Emergency and Radiological Control Procedures

**Question:** B.019 [1.0 point] (19.0)

According to Technical Specifications an individual meets the definition of "ON CALL" if ...

- a. is within the confines of the Pinanski building while the reactor is in operation.
- b. keeps the operator posted of his/her whereabouts and telephone number.
- c. is capable of arriving at the reactor facility within 30 minutes.
- d. calls in to the operator at the controls every half hour.

Answer: B.019 a.

Reference: AP-0, REACTOR OPERATIONS AUTHORITY #2 and Tech Spec 6.1.5

**Question:** B.020 [1.0 point] (20.0)

You are the console operator during insertion of a sample into and later removal of a sample from the core. Which ONE of the following items are you NOT required to log in the console operator's log?

- a. Exposure
- b. Time In/Out
- c. Sample Number
- d. Reactivity worth of sample

Answer: B.020 a.

Reference: U. Mass.-Lowell, RO-4 § 2.1.9

Section C Facility and Radiation Monitoring Systems

N/A