



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 03, 2026

Ms. Amber Johnson, Director
Nuclear Reactor and Radiation Facilities
University of Maryland
Department of Materials Science
and Engineering
4418 Stadium Drive, Room 1104
College Park, MD 20742-2115

SUBJECT: EXAMINATION REPORT NO. 50-166/OL-26-02, UNIVERSITY OF MARYLAND

Dear Ms. Johnson:

During the week of August 24, 2026, the U.S. Nuclear Regulatory Commission (NRC) administered an operator licensing examination at your Maryland University Training 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 component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC website 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 Margaret Goodwin at (301) 415-1177, or via email at Margaret.Goodwin@nrc.gov.

Sincerely,

A handwritten signature in blue ink, appearing to read "Duane A. Hardesty", is located above the typed name.

Signed by Duane Hardesty on 09/03/26

Duane A. Hardesty, Chief
Non-Power Production and Utilization
Facilities Branch
Division of Licensing Projects II
Office of Nuclear Reactor Regulation

Docket No. 50-166

Enclosures:

1. Examination Report No. 50-166/OL-26-02
2. Written examination

cc: w/ enclosures to GovDelivery Subscribers

SUBJECT: EXAMINATION REPORT NO. 50-166/OL-26-02, UNIVERSITY OF MARYLAND
DATED: SEPTEMBER 3, 2026

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NRR-079

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

REPORT NO.: OL-26-02

FACILITY DOCKET NO.: 50-166

FACILITY LICENSE NO.: R-70

FACILITY: Maryland University Training Reactor

EXAMINATION DATE(S): Week of August 24, 2026

SUBMITTED BY: *Margaret Goodwin* September 1, 2026
Margaret N. Goodwin, Chief Date
Examiner

SUMMARY:

During the week of August 24, 2026, the NRC administered operator licensing examinations to one Reactor Operator (RO) retake candidate. All candidates passed all applicable portions of the examinations and tests.

REPORT DETAILS

1. Examiner: Margaret N. Goodwin, Chief Examiner, NRC

2. Results:

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

3. Exit Meeting:
Luke Gilde, Reactor Operations Manager, University of Maryland
Michael Hottinger, Senior Reactor Operator, University of Maryland
Margaret Goodwin, Chief Examiner, Nuclear Regulatory Commission

Prior to administration, adjustments to the written exam were accepted based on facility comments. These comments provided corrections and additional clarity to questions/answers and identified where changes were appropriate based on current facility conditions.

Upon completion of all operator licensing examinations, the NRC examiner met with facility staff representatives to discuss the results. At the conclusion of the meeting, the NRC examiner thanked the facility for their support in the administration of the examination.



University of Maryland

Operator Licensing Examination

Week of August 24, 2026

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

FACILITY: University of Maryland

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 08/28/2026

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 and a 70% overall are required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

<u>CATEGORY VALUE</u>	<u>% OF TOTAL</u>	<u>CANDIDATE'S SCORE</u>	<u>% OF CATEGORY VALUE</u>	<u>CATEGORY</u>
20.00	33.0	_____	_____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
20.00	33.0	_____	_____	B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.0	_____	_____	C. FACILITY AND RADIATION MONITORING SYSTEMS
20.00				
60.00		_____	_____ %	TOTALS
FINAL GRADE				

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. Answers written on the line will be taken as the final answer. **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 and a 70 percent overall.
12. There is a time limit of three (3) hours for completion of the examination.

Candidate Name: _____

Category B: Normal/Emergency Operating Procedures and Radiological Controls

ANSWER SHEET

Multiple Choice (Circle your choice, or write on the line)

If you change your answer, write your final selection on the line. Answers written on the line will be taken as the final answer.

B01 a b c d ____

B02 a b c d ____

B03 a b c d ____

B04 a b c d ____

B05 a b c d ____

B06 a b c d ____

B07 a b c d ____

B08 a b c d ____

B09 a b c d ____

B10 a b c d ____

B11 a b c d ____

B12 a b c d ____

B13 a b c d ____

B14 a b c d ____

B15 a b c d ____

B16 a b c d ____

B17 a b c d ____

B18 a b c d ____

B19 a b c d ____

B20 a b c d ____

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

EQUATION SHEET

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

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

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

$$P = P_0 e^{\ell/T}$$

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

$$\ell^* = 1 \times 10^{-4} \text{ sec}$$

$$CR_1(1 - K_{\text{eff}_1}) = CR_2(1 - K_{\text{eff}_2})$$

$$CR_1(-\rho_1) = CR_2(-\rho_2)$$

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

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

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

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

$$M = \frac{1 - K_{\text{eff}_1}}{1 - K_{\text{eff}_2}}$$

$$SDM = \frac{1 - K_{\text{eff}}}{K_{\text{eff}}}$$

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

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

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

$$\Delta \rho = \frac{K_{\text{eff}_2} - K_{\text{eff}_1}}{K_{\text{eff}_1} K_{\text{eff}_2}}$$

$$\rho = \frac{K_{\text{eff}} - 1}{K_{\text{eff}}}$$

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

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

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

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

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

1 Curie = 3.7 x 10¹⁰ dis/sec

1 kg = 2.21 lb

1 Horsepower = 2.54 x 10³ BTU/hr

1 Mw = 3.41 x 10⁶ BTU/hr

1 BTU = 778 ft-lb

°F = 9/5 °C + 32

1 gal (H₂O) ≈ 8 lb

°C = 5/9 (°F - 32)

c_p = 1.0 BTU/hr/lb/°F

c_p = 1 cal/sec/gm/°C

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.01 [1.00 point]

Which ONE of the following changes would require a 50.59 screen?

- a. Amending the Emergency Plan to update the call list after hiring a new Reactor Supervisor.
- b. Amending the procedure for control rod reactivity measurements to include a new method to counteract the reactivity losses from burnup.
- c. Amending the control rod drive descriptions in the Safety Analysis Report to reflect that the motors were replaced following a 50.59 review of them.
- d. Amending the Technical Specifications to correct the spelling of "reactor" from "rector".

QUESTION B.02 [1.00 point]

In accordance with MP-305 "Reactor Makeup Water System Usage and Maintenance", if the pool level is currently at -13", how long would it take to fill to -9"?

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

QUESTION B.03 [1.00 point]

Assuming a 100% yield, which ONE of the following 15mCi sources would result in a radiation dose rate of 100 mR/hr when measured at 2 feet from the source?

- a. Cs-137 (E = 0.66 MeV)
- b. Co-60 (E = 1.33 MeV)
- c. C-12 (E = 4.44 MeV)
- d. N-16 (E = 6.13 MeV)

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.04 [1.00 point]

In accordance with the Technical Specifications, which ONE of the following conditions must be met prior to removing a fuel bundle from the core?

- a. All control rods must be physically decoupled from their control rod drive.
- b. The water in the reactor pool must be at its maximum fill line.
- c. The core must be subcritical by an amount equal to the most reactive fuel bundle plus \$0.50.
- d. All area radiation monitors must be verified, installed and operable.

QUESTION B.05 [1.00 point]

In accordance with the Technical Specifications, which ONE of the following scenarios would place the reactor in a SHUTDOWN condition?

- a. The console is off, the key has been removed and locked away, and an experiment worth \$0.35 is being placed in the reactor.
- b. The console is off, the key has been removed and locked away, and the conditions have been met that all staff can leave the facility.
- c. The key is in the console and the console is on. Control rods have been withdrawn such that the reactor is subcritical by approximately \$1.70.
- d. The key is in the console and the console is on. Control rods have been withdrawn to establish "cold clean" criticality.

QUESTION B.06 [1.000 point]

If the dose rate of a sample is 45 mrem/hr as measured at a distance of 15 cm. What dose rate would be read at a distance of 75 cm?

- a. 1.8 mrem/hr
- b. 2.4 mrem/hr
- c. 3.6 mrem/hr
- d. 4.8 mrem/hr

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.07 [1.00 point]

In accordance with the Technical Specifications, all of the following are required for reactor operations EXCEPT:

- a. At least one operable exhaust fan.
- b. At least one operable radiation monitoring device on the reactor bridge.
- c. At least one operable fuel temperature measuring device.
- d. At least one reactor power measuring channel attached to a recording device to record operating histories.

QUESTION B.08 [1.00 point]

In accordance with the Emergency Plan, which ONE of the following best describes the Reactor Boundary?

- a. The reactor bay or reactor room.
- b. The Chemical and Nuclear Engineering Building.
- c. The area within the confines of Reactor Building and the fenced area of the north side of the building.
- d. The building in which the reactor is physically located and all area within a 500 ft. radius of the building.

QUESTION B.09 [1.00 point]

In accordance with SP-202 "Reactor Power Calibration" which ONE of the following conditions shall be met during the calibration?

- a. The ambient temperature of the reactor bay must not exceed 25°C.
- b. All temperature detectors associated with the reactor water system must be verified operable.
- c. The reactor pool temperature must be kept between 22°C and 30°C during the entirety of the calibration.
- d. Reactor power must not exceed 100 kW at any point during the calibration.

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.10 [1.00 point]

In accordance with OP-102 "Reactor Shutdown Checklist", which ONE of the following must be done if there is a rabbit in the core or receiver?

- a. It must be removed prior to leaving the facility.
- b. The rabbit system must be tagged out.
- c. The air to the rabbit system must be turned off.
- d. The operator leaving must verbally notify the operator who starts the next day.

QUESTION B.11 [1.00 point]

In accordance with the Technical Specifications, which ONE of the following would result in an automatic reactor scram?

- a. A reactor period of 10 seconds.
- b. A reactor pool water temperature of 75°C.
- c. An exhaust radiation alarm at 10 mR/hr.
- d. A water conductivity of 8×10^{-4} mhos/cm.

QUESTION B.12 [1.00 point]

In accordance with the Technical Specifications, all of the following experiments would be permissible EXCEPT:

- a. A singly encapsulated tube of a sodium-mercury compound for in-core irradiation.
- b. A fueled experiment containing 0.2 mCi of Iodine-131.
- c. A set of 4 experiments each worth \$0.60.
- d. An experiment containing approximately 12mg of explosive TNT.

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.13 [1.00 point]

In accordance with the Emergency Plan, which ONE of the following locations is the primary evacuation point?

- a. The area directly outside the main entrance of the Chemical and Nuclear Engineering Building.
- b. The area directly outside the main door to the reactor room.
- c. Room 2309D of the Chemical and Nuclear Engineering Building.
- d. The office of the Reactor Operations Manager.

QUESTION B.14 [1.00 point]

In accordance with OP-104 "Operating Procedures", which ONE of the following must be completed prior to becoming the Operator of Record?

- a. Do a visual inspection of the reactor room.
- b. Review the previous log entries from the last month.
- c. Check in with the Senior Reactor Operator and make sure they know about the change in personnel.
- d. Verify that you are current in Requal.

QUESTION B.15 [1.00 point]

In accordance with SP-204 "Control Rod Calibration", which ONE of the following is the preferred method for determining control rod reactivity worths?

- a. The Rod Drop Method
- b. The Positive Period Method
- c. The Bernoulli Method
- d. The Calorimetric Method

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.16 [1.00 point]

In accordance with the Technical Specifications, which ONE of the following statements best describes the basis of the Safety Limit?

- a. To prevent the boiling of the reactor pool water and the release of fission products.
- b. To ensure that the negative temperature coefficient of reactivity stays within acceptable margins.
- c. To ensure that the recorded reactor power is always an accurate representation of the actual power.
- d. To prevent the buildup of excessive pressure between the fuel-moderator and the cladding.

QUESTION B.17 [1.00 point]

In accordance with the Technical Specifications, which ONE of the following actions must be supervised by a Senior Reactor Operator?

- a. Placing a sample worth \$0.15 in the rabbit system.
- b. Recovery from a planned reactor scram for training purposes.
- c. Increasing power after having to lower from 180kW to 15 kW due to an increase in reactor pool temperature.
- d. Replacing the resin in the demineralizer system.

QUESTION B.18 [1.00 point]

In accordance with the Technical Specifications, which ONE of the following surveillances is performed on an annual basis?

- a. Determination of the core excess.
- b. Gamma spectrometry of the reactor coolant.
- c. Inspection and maintenance of the confinement system fans.
- d. Replacement of the various environmental radiation monitors around the facility.

Category B: Normal/Emergency Operating Procedures and Radiological Controls

QUESTION B.19 [1.00 point]

An experiment is removed from the core emitting a dose rate of 340 mrem/hr at 30 cm. If the half-life of the sample is 1.2 hours, what radiation posting will it need after 24 hours?

- a. No posting required
- b. Radiation Area
- c. High Radiation Area
- d. Very High Radiation Area

QUESTION B.20 [1.00 point]

In accordance with the Emergency Plan, which ONE of the following incidents would be classified as an Alert?

- a. A large hurricane that causes some damage to the reactor building.
- b. A bomb is found in the reactor bay within the vicinity of the reactor pool.
- c. An experimenter using the rabbit system accidentally breaks a sample resulting in a personal dose of 200 mrem.
- d. An incident during fuel handling that results in multiple fuel clusters becoming damaged.

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

Category B: Normal/Emergency Operating Procedures and Radiological Controls

B.01

Answer: b

Reference: UMD OP-100, Control and Maintenance of Reactor Documents, p.3

B.02

Answer: b

Reference: UMD MP-305, Reactor Water Makeup System Usage and Maintenance, p.1

B.03

Answer: c

Reference: $DR = \frac{6 \cdot Ci \cdot E(n)}{R^2}$
 $E(n) = \frac{DR \cdot R^2}{6 \cdot Ci}$
 $E(n) = \frac{0.1 \cdot 2^2}{6 \cdot 0.015}$
 $E(n) = 4.44 \text{ MeV}$

B.04

Answer: c

Reference: UMD Technical Specifications 3.1

B.05

Answer: c

Reference: UMD Technical Specifications 1.3

B.06

Answer: a

Reference: $DR_1 d_1^2 = DR_2 d_2^2$
 $DR_2 = \frac{DR_1 d_1^2}{d_2^2}$
 $DR_2 = \frac{45 \cdot 15^2}{75^2} = 1.8 \text{ mrem/hr}$

B.07

Answer: a

Reference: UMD Technical Specifications 3.4

B.08

Answer: c

Reference: UMD Emergency Plan 2

B.09

Answer: c

Reference: UMD SP-202, Reactor Power Calibration, p.1

B.10

Answer: b

Reference: UMD OP-102, Reactor Shutdown Checklist, p.2

Category B: Normal/Emergency Operating Procedures and Radiological Controls

B.11

Answer: c

Reference: Technical Specifications 3.2

B.12

Answer: a

Reference: Technical Specifications 3.6

B.13

Answer: c

Reference: UMD Emergency Plan Figure 7.2

B.14

Answer: d

Reference: UMD OP-104, Operating Procedures, p.4

B.15

Answer: b

Reference: UMD SP-204, Control Rod Calibration, p.1

B.16

Answer: d

Reference: UMD Technical Specifications 2.1

B.17

Answer: c

Reference: UMD Technical Specifications 6.1.3

B.18

Answer: a

Reference: UMD Technical Specifications 4.1

B.19

Answer: a

Reference: $DR = DR_0 e^{-\lambda t}$ where $\lambda = \left(\frac{0.693}{T_{1/2}} \right)$

$$DR = 340 * e^{0.5775 * 24}$$

$$DR = 0$$

B.20

Answer: d

Reference: UMD Emergency Plan 4.3

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