September 14, 2004

Dr. Sheldon Landsberger
Nuclear Engineering Teaching Laboratory
10100 Burnet Road
University of Texas at Austin
Austin, TX 78758

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-602/OL-04-02, UNIVERSITY OF TEXAS

Dear Dr. Landsberger:

During the week of August 23, 2004, the NRC administered operator licensing examinations at your Nuclear Engineering Teaching Laboratory. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/indesx.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 Phillip T. Young at 301-415-4094 or via Internet e-mail at pty@nrc.gov.

Sincerely,

/RA/

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

Docket No. 50-602

Enclosures: 1. Initial Examination Report No. NO. 50-602/OL-04-02
2. Facility comments with NRC resolution
3. Examination and answer key (RO/SRO)

cc w/encls.: Please see next page

cc:

Governor's Budget and
Planning Office
P.O. Box 13561
Austin, TX 78711

Bureau of Radiation Control
State of Texas
1100 West 49th Street
Austin, TX 78756

Mr. Roger Mulder
Office of the Governor
P.O. Box 12428
Austin, TX 78711

Dr. Sheldon Landsberger, Director
Nuclear Engineering Teaching
Laboratory
The University of Texas at Austin
10100 Burnet Road
Austin, TX 78758

Dr. William Vernetson
Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

September 14, 2004

Dr. Sheldon Landsberger
Nuclear Engineering Teaching Laboratory
10100 Burnet Road
University of Texas at Austin
Austin, TX 78758

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-602/OL-04-02, UNIVERSITY OF TEXAS

Dear Dr. Landsberger:

During the week of August 23, 2004, the NRC administered operator licensing examinations at your Nuclear Engineering Teaching Laboratory. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/indesx.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 Phillip T. Young at 301-415-4094 or via Internet e-mail at pty@nrc.gov.

Sincerely,

/RA/

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

Docket No. 50-602

Enclosures: 1. Initial Examination Report No. NO. 50-602/OL-04-02
2. Facility comments with NRC resolution
3. Examination and answer key (RO/SRO)

cc w/encls.: Please see next page

DISTRIBUTION:
PUBLIC RNRP\R&TR r/f PMadden AAdams Facility File (EBarnhill) O-6 F-2

Examination Package Accession No.: ML041660416
Examination Report Accession No.: ML042520465 **TEMPLATE #: NRR-079**

OFFICE	RNRP:E/UI	E	IROB:LA		RNRP:SC	
NAME	PYoung		EBarnhill		PMadden	
DATE	9/ 13 /2004		9/ 13 /2004		9/ 14 /2004	

C = COVER **E = COVER & ENCLOSURE** **N = NO COPY**
OFFICIAL RECORD COPY

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

REPORT NO.:	50-602/OL-04-02
FACILITY DOCKET NO.:	50-602
FACILITY LICENSE NO.:	R-129
FACILITY:	University of Texas
EXAMINATION DATES:	08/24/2004
EXAMINER:	Phillip T. Young, Chief Examiner

SUBMITTED BY: **/RA/** 9/13/04
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of August 24, 2004, NRC administered Operator Licensing examinations to one Reactor Operator (RO), and one Senior Reactor Operator upgrade. Both candidates passed the examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiners:

Phillip T. Young, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**1/0**	**N/A**	**1/0**
Operating Tests	**1/0**	**1/0**	**2/0**
Overall	**1/0**	**1/0**	**2/0**

3. Exit Meeting:

Personnel attending:

Michael G. Krause, Reactor Supervisor

Donna J. O'Kelly, Laboratory Manager and HP

Sean O'Kelly, Associate Director

Phillip Young, NRC, Chief Examiner

The examiner thanked the facility for their support in conducting the examinations. The examiner discussed his observation that both applicants displayed a general lack of knowledge of the facility air systems and their interaction with the facility ventilation and transient rod.

Facility Comments Regarding NRC Exam Administered on August 24, 2004

Question A.017

Facility Comment: The Tech Spec Shutdown margin limit I thought the NRC was referring to was the shutdown margin with the most reactive rod out. The sketch refers to x axes says "rod" fully out, not "rods" implying this is a single rod worth curve, not the integral rod worth for all rods combined. Second, sketch shows the worth of the most reactive control rod as the area B-D, this is less than the rod being plotted if this is a single rod. The shutdown margin with the most reactive rod out is equal to the value (C-A) - (D-B). The NRC answer D-E is not correct as this area corresponds to the rod(s) being fully withdrawn and not fully inserted as shutdown margin requires.

NRC Resolution: Disagree with comment. The line at point "C" on the Integral Rod Worth Curve is labeled as corresponding to the Critical Rod Height, the distance between point D and point C is defined on the sketch as the Worth of Most Reactive Control Element, and E on the sketch is labeled ρ Max. Thus, shutdown margin with the most reactive rod fully withdrawn is the area D-E. The answer key is correct.

Question B.008

Facility Comment: Based on the list of answers, and the fact that we use $\beta = 0.007$, it appears answer D would be the best answer, since this results in the worth of a single secured experiment being worth 1.8%/0.7% = $2.57 which is greater than the TS limit of $2.50 for a single experiment. The answer listed in the key is not correct since the Conductivity limit is 5 µmho averaged over a month and no mention is made in the question about the time average.

NRC Resolution: Agree with comment. A typographical error occurred during question development and the key should have identified "D" as the correct answer. The answer key has been updated to correct the error.

Question C.005

Facility Comment: Actual Scram setpoints for the two NP(P) channels are at 600V with normal operating voltage at 750V, thus the scram for these is 20% decrease. The Scram for the NM Neutron channel is at 750V with the normal operating voltage at 800V, thus corresponding to a voltage decrease of 10%. Based on the wording of the question referring to a "neutron" detector which in our case would be the NM (since the NP(P) are ion chambers which see N and gamma) the correct answer should be a, - 10%. The correct answer should be a, 10%.

NRC Resolution: Agree with comment. A typographical error occurred during modification of the answer choices. The key should have identified "a." as the correct answer. The answer key has been updated to correct the error.

Question C.006

Facility Comment: The answer is not correct. The reflector plugs are Graphite, thus the correct answer is a.

NRC Resolution: Agree with comment. A typographical error occurred during modification of the answer choices. The key should have identified “a.” as the correct answer. The answer key has been updated to correct the error.

U. S. NUCLEAR REGULATORY COMMISSION
NON-POWER INITIAL REACTOR LICENSE EXAMINATION (Examination with Answer Key}

FACILITY: University of Texas

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 08/23/2004

CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:
Answers are to be written on the answer sheet provided. Attach the answer sheets to the examination. Points for each question are indicated in brackets for each question. A 70% in each section is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

Category Value	% of Total	% of Candidates Score	Category Value	Category
20.00	33.3	_____	____	A. Reactor Theory, Thermodynamics and Facility Operating Characteristics
20.00	33.3	_____	____	B. Normal and Emergency Operating Procedures and Radiological Controls
20.00	33.3	_____	____	C. Facility and Radiation Monitoring Systems
60.00		_____	____% FINAL GRADE	TOTALS

All work done on this examination is my own. I have neither given nor received aid.

_____
Candidate's Signature

QUESTION: A.001 [1.0 point] {1.0}

A core contains fuel with 20% U^{235} and 80% U^{238}. From the following data, what is the probability that fission will occur when the fuel absorbs a thermal neutron?

Isotope	σ_f	σ_c
U^{235}	582 barns	99 barns
U^{238}	0 barns	3 barns

a. 0.833

b. 0.840

c. 0.851

d. 0.855

Answer: A.001 b.

Reference: UT-TRIGA Training Manual, Vol. IV, Interactions of Neutrons with Matter.
Probability = $\Sigma_f/(\Sigma_f + \Sigma_c)$ = (0.2x582)/(0.2x582 + 0.2x99 + 0.8x3) = 0.840

QUESTION: A.002 [1.0 point] {2.0}

Which ONE of the following elements will slow down fast neutrons least quickly, i.e. produces the smallest energy loss per collision?

a. Oxygen-16

b. Uranium-238

c. Hydrogen-1

d. Boron-10

Answer: A.002 b.

Reference: UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 2, pp. 24-27.

QUESTION: A.003 [1.0 point] {3.0}

Starting with a critical reactor at low power, a control rod is withdrawn from position X and reactor power starts to increase. Neglecting any temperature effects, in order to terminate the increase with the reactor again critical but at a higher power, the control rod must be:

a. inserted deeper than position X
b. inserted, but not as far as position X
c. inserted back to position X
d. inserted, but exact position depends on power level

Answer: A.003 c.

Reference: UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 24.

QUESTION: A.004 [1.0 point] {4.0}

Which ONE of the following conditions describes a critical reactor?

a. $K_{eff} = 1$; $\Delta k/k$ (ρ) = 1
b. $K_{eff} = 1$; $\Delta k/k$ (ρ) = 0
c. $K_{eff} = 0$; $\Delta k/k$ (ρ) = 1
d. $K_{eff} = 0$; $\Delta k/k$ (ρ) = 0

Answer: A.004 b.

Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1984, § 3.3.4, pp. 3-23.

QUESTION A.005 [2.0 points, 0.5 each] {6.0}

Match each term in column A with the correct definition in column B.

	Column A		Column B
a.	Prompt Neutron	1.	A neutron in equilibrium with its surroundings.
b.	Fast Neutron	2.	A neutron born directly from fission.
c.	Thermal Neutron	3.	A neutron born due to decay of a fission product.
d.	Delayed Neutron	4.	A neutron at an energy level greater than its surroundings.

Answer: A.005 a. = 2; b. = 4; c. = 1; d. = 3

Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, § 2.5, p. 2-36.

QUESTION A.006 [1.0 point] {7.0}

Which ONE of the following describes the difference between a moderator and reflector?

a. A reflector increases the fast non-leakage factor and a moderator increases the thermal utilization factor.

b. A reflector increases the neutron production factor and a moderator increases the fast fission factor.

c. A reflector decreases the thermal utilization factor and a moderator increases the fast fission factor.

d. A reflector decreases the neutron production factor and a moderator decreases the fast non-leakage factor.

Answer: A.006 a.

Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1985, § 2.8.9, pp. 2-63.

QUESTION A.007 [1.0 point] {8.0}

Which of the following does NOT affect the Effective Multiplication Factor (Keff)?

a. The moderator-to-fuel ratio.
b. The physical dimensions of the core.
c. The strength of installed neutron sources.
d. The current time in core life.

Answer: A.007 c.

Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.3.4, p. 3-21.

QUESTION A.008 [1.0 point] {9.0}

As a reactor continues to operate over a period of months, for a constant power level, the average neutron flux:

a. decreases, due to the increase in fission product poisons.
b. decreases, because fuel is being depleted.
c. increases, in order to compensate for fuel depletion.
d. remains the same.

Answer: A.008 c.

Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1984, § 3.4.8, pp. 3-36.

QUESTION A.009 [1.0 point] {10.0}

K_{eff} for the reactor is 0.98. If you place an experiment worth +$1.00 into the core, what will the new K_{eff} be?

a. 0.982

b. 0.987

c. 1.013

d. 1.018

Answer: A.009 b.

Reference: SDM = $(1-k_{eff})/k_{eff}$ = (1-0.98)/0.98 = 0.02/0.99 = 0.02041 or 0.02041/.0075 = $2.72, or a reactivity worth (ρ) of -$2.72. Adding +$1.00 reactivity will result in a SDM of $2.72 - $1.00 = $1.72, or .0129081 ΔK/K
K_{eff} = 1/(1+SDM) = 1/(1 + 0.0129081) = 0.987

QUESTION A.010 [1.0 point] {11.0}

About two minutes following a reactor scram, period has stabilized, and is decreasing at a CONSTANT rate. If reactor power is 10^{-5} % full power what will the power be in three minutes.

a. 5×10^{-6} % full power

b. 2×10^{-6} % full power

c. 10^{-6} % full power

d. 5×10^{-7} % full power

Answer: A.010 c.

Reference: $P = P_0 e^{-T/\tau} = 10^{-5} \times e^{(-180sec/80sec)} = 10^{-5} \times e^{-2.25} = 0.1054 \times 10^{-5} = 1.054 \times 10^{-6}$

QUESTION A.011 [1.0 point] {12.0}

Core excess reactivity changes with…

a. Fuel burnup
b. Neutron Level
c. Control Rod Height
4. Reactor Power Level

Answer: A.011 a.

Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 6.2 p. 6-1 — 6-4.

QUESTION: A.012 [1.0 point] {13.0}

In choosing a Fuel-Moderator material ZrH ratio of 1.6, the limiting effect or factor verses other ratios is the:

a. relative widely spaced cracks that occur, in higher ratios, due to the elevated temperatures produced by pulsing
b. large volume changes associated with the with the phase transformations that occur in higher ratios.
c. zirconium hydride chemical reactivity rate with water associated with lower ratios.
d. hydrogen gas over pressure at higher fuel temperatures.

Answer: A.012 d.

Reference: UT-TRIGA SAR 4.1 page 4-4

QUESTION A.013 [1.0 point] {14.0}

Which ONE of the following factors is the most significant in determining the differential worth of a control rod?

a. The rod speed.

b. Reactor power.

c. The flux shape.

d. The amount of fuel in the core.

Answer: A.013 c

Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, §

QUESTION A.014 [1.0 point] {15.0}

The reactor supervisor tells you the reactor is shutdown with a shutdown margin of 12%. An experimenter inserts an experiment in the core and nuclear instrumentation increases from 100 counts per minute to 200 counts per minute. What is the new K_{eff} of the reactor?

a. 0.920

b. 0.946

c. 0.973

d. 1.000

Answer: A.014 b

Reference: Standard NRC Question

$$K_{eff_1} = \frac{1}{1 + SDM} = \frac{1}{1 + 0.12} = 0.892857$$

$$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2});$$

$$1 - K_{eff_2} = \frac{100}{200}(1 - 0.892857) = (0.0535715)$$

$$K_{eff_2} = 0.9464285$$

QUESTION A.015 [1.0 point] {16.0}

The PRIMARY reason that a neutron source is installed in the reactor is to …

a. allow for testing and irradiation of experiments when the core is shutdown.
b. supply the neutrons required to start the chain reaction for reactor startups.
c. provide a neutron level high enough to be monitored for a controlled reactor startup.
d. increase the excess reactivity of the reactor which reduces the frequency for refueling.

Answer: A.015 c

Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, §

QUESTION A.016 [1.0 point] {17.0}

Which ONE of the following isotopes has the largest microscopic cross-section for absorption for thermal neutrons?

a. Sm^{149}
b. U^{235}
c. Xe^{135}
d. B^{10}

Answer: A.016 c

Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, §

QUESTION A.017 [2.0 points, 0.5 each] {19.0}

Using the drawing of the Integral Rod Worth Curve provided, identify each of the areas listed in Column I with the appropriate curve area listed in Column II.

Column I	Column II
a. Total Rod Worth	1. A — B
b. Actual Shutdown Margin	2. A — C
c. Tech. Spec. Shutdown Margin Limit	3. B — C
d. Excess Reactivity	4. C — D
	5. C — E
	6. D — E
	7. A — E

Answer: A.017 a. = 7; b. = 2; c. = 6; d. = 5

Reference: Standard NRC Question

QUESTION A.018 [1.0 point] {20.0}

Reactor Power increases from 15 watts to 65 watts in 30 seconds. The period of the reactor is:

a. 7 seconds
b. 14 seconds
c. 21 seconds
d. 28 seconds

Answer: A.018 c

Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, §
$P = P_0 e^{t/T}$, ln(65/15) = 30sec/τ τ = (30 sec)/(ln 4.3333) = 20.456

QUESTION B.001 [1.0 point] {1.0}

Which ONE of the following types of experiments is NOT required to be doubly encapsulated? Experiments which contain …

a. explosive materials.
b. solid fissionable materials
c. compounds highly reactive with water.
d. materials corrosive to reactor components.

Answer: B.001 b

Reference: Technical Specification 3.4.2.a

QUESTION B.002 [2.0 points, 0.5 each] {3.0}

Match the type of radiation in column A with its associated Quality Factor (10CFR20) from column B.

Column A	Column B
a. alpha	1
b. beta	2
c. gamma	5
d. neutron (unknown energy)	10
	20

Answer: B.002 a, 20; b, 1; c, 1; d, 10

Reference: 10CFR20.100x

QUESTION B.003 [1.0 point] {4.0}

According to Technical Specification 3.4.1.a “A moveable experiment shall have a reactivity worth less than …

a. $0.50
b. $1.00
c. $2.50
d. $3.00

Answer: B.003 b

Reference: Technical Specification 3.4.1.a.

QUESTION B.004 [1.0 point] {5.0}

Per Technical Specifications regarding the Ar41 Radiation Monitor: If the Ar41 monitor is not operable, operating the reactor with the auxiliary air purge system shall be limited to a period of

a. two hours
b. seven days
c. ten days
d. indefinitely if corrective action is being taken

Answer: B.004 c

Reference: Technical Specifications 3.3.3.b 2nd ¶.

QUESTION B.005 [1.0 point] {6.0}

Which ONE of the following is NOT a condition for the Technical Specification limit on Shutdown Margin?

a. All experiments in most reactive state.

b. Core at maximum Xenon concentration.

c. Most reactive rod in fully out position.

d. Core at ambient temperature.

Answer: B.005 b

Reference: Technical Specifications § 1.20 Definition of Reference Core and § 3.1.4 Shutdown Margin.

QUESTION B.006 [1.0 point, 0.25 each] {7.0}

Identify the PRIMARY source (irradiation of **air**, irradiation of **water**, or **fission** product) of EACH of the radioisotopes listed.

a. $_{1}H^{3}$

b. $_{18}Ar^{41}$

c. $7N^{16}$

d. $_{54}Xe^{135}$

Answer: B.006 a. = Water; b. = Air; c. = Water; d. = Fission

Reference: Standard NRC QUESTION.

QUESTION B.007 [1.0 point] {8.0}

The reactor has been shutdown following operations which achieved 1200 kW. WHO may authorize restart of the Reactor?

a. The Reactor Supervisor
b. The Facility Director
c. The Reactor Operations Committee
d. The Nuclear Regulatory Commission

Answer: B.007 d

Reference: Tech. Specs, § 6.5.1.a Action to be taken in the Event a Safety Limit is Exceeded. p. 32.

QUESTION B.008 [1.0 point] {9.0}

The reactor is operating at full power with experiments in progress. Given the parameters listed {a. through d.} and the fact no corrective actions are to be taken, which ONE condition below is NOT permissible when the reactor is operating?

a. Shutdown Margin is calculated at 2.8% $\triangle$k/k.
b. Shim rod #1 has a scram time of 1 second.
c. The pool water conductivity measures 5.5 μmho/cm.
d. the reactivity worth of the only secured experiment is 1.8% $\triangle$k/k.

Answer: B.008 ~~c.~~ d. per facility comment to correct typographical error.

Reference: UT-TRIGA Reactor TS, Section 3.3.1.c.

QUESTION B.009 [1.0 point] {10.0}

In the event of an area evacuation, personnel should proceed to the emergency assembly area, located in:

a. the health physics room.

b. the reception office.

c. the control room.

d. the library/conference room.

Answer: B.009 a.

Reference: Procedure Plan-E, Emergency Response.

QUESTION B.010 [1.0 point] {11.0}

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

a. any Reactor Operator licensed at facility

b. any Senior Reactor Operator licensed at facility

c. Facility Manager (or equivalent at facility).

d. NRC Project Manager

Answer: B.010 b.

Reference: 10CFR50.54(y)

QUESTION B.011 [1.0 point] {12.0}

The Emergency Planning Zone (EPZ) for the UT TRIGA reactor is established at the ...

a. University Safety Office.

b. Operations boundary.

c. Brackenridge Hospital.

d. Health physics room.

Answer: B.011 b

Reference: Emergency Plan

QUESTION B.012 [1.0 point] {13.0}

The radiological design goal for the accessible areas of the pool water system and shield structure is _____ .

a. 0.5mrem/hour
b. 1.0mrem/hour
c. <2.5mrem/hour
d. ≤5.0mrem/hour at the hottest spot

Answer: B.012 b.

Reference: SAR 7.2.1 page 7-2

QUESTION B.013 [1.0 point] {14.0}

During work in a Restricted Area the pocket dosimeter is required to be checked periodically and re-zeroed when it reads _____ of scale.

a. 65%
b. 75%
c. 85%
d. 95%

Answer: B.013 b.

Reference: HP00-1 Radiation Monitoring - Personnel

QUESTION B.014 [1.0 point] {15.0}

For a radiation worker at NETL to exceed the facility individual dose limits, written permission is required from the _____ .

a. Health Physicst
b. Radiation Safety Officer
c. Facility Director
d. Reactor Supervisor and Nuclear Reactor Committee

Answer: B.014 c.

Reference: HP00-3 NETL ALARA Program

QUESTION B.015 [1.0 point] {16.0}

You drop a sample on the floor and it breaks open. The sample contained irradiated power which is radioactive. What type of detector is best suited for determining whether you are contaminated or not?

a. Ion Chamber
b. Geiger Müller
c. Scintillation
d. GeLi

Answer: B.015 B.

Reference: Standard NRC Rad Con Question

QUESTION B.016 [1.0 points, ¼ point each] {17.0}

Match the Federal Regulation number in column A with the appropriate topic in column B.

a.	10 CFR 20	1.	Operator Licenses
b.	10 CFR 50	2.	Facility Licenses
c.	10 CFR 55	3.	Radiation Protection
d.	10 CFR 73	4.	Special Nuclear Material

Answer: B.016 a. = 3; b. = 2; c. = 1; d. = 4.

Reference: Title 10 to the Code of Federal Regulations.

QUESTION B.017 [2.0 points, ½ each] {19.0}

Match type of radiation (a thru d) with the proper penetrating power (1 thru 4)

a. Gamma	1. Stopped by thin sheet of paper
b. Beta	2. Stopped by thin sheet of metal
c. Alpha	3. Best shielded by light material
d. Neutron	4. Best shielded by dense material

Answer: B.017 a. = 4; b. = 2; c. = 1 d. = 3

Reference: Standard NRC Question

QUESTION B.018 [1.0 point] {20.0}

An experiment is removed from the reactor with a radiation level of 10R/hr at 1 foot. The radioisotope has a half-life of 120 seconds. Approximately how long must you let the experiment decay before the radiation level has decreased by a factor of 1000?

a. 600 seconds (ten minutes)

b. 1200 seconds (twenty minutes)

c. 6000 seconds (1hour 40 minutes)

d. 12000 seconds (3 hours 20 minutes)

Answer: B.018 b.

Reference: Standard NRC question $1/1000 \approx ½^{10}$

QUESTION C.001 [1.0 point] {1.0}

Which ONE of the following detectors is used to detect the amount Ar^{41} released to the environment?

a. NONE, Ar^{41} has too short a half-life to require environmental monitoring.
b. Stack Gas Monitor
c. Stack Particulate Monitor
d. Bridge Area Monitor

Answer: C.001 b

Reference: Standard NRC Exam Question

QUESTION C.002 [1.0 point] {2.0}

WHICH ONE of the following is the purpose of the pool stirrer?

a. Increase transport time for N16 to reach surface of pool.
b. Break up of O16 bubbles in pool, thereby decreasing production of N16.
c. Increase mixing within the core, for a more accurate reading of bulk pool temperature.
d. Increase mixing within the core, for a more accurate reading of pool water conductivity.

Answer: C.002 c.

Reference: UT TRIGA - Operation Support Systems, 4.1.4, Pool Stirrer page 28 and SURV-2, Reactor Pool Power Calibration

QUESTION C.003 [1.0 point] {3.0}

In order to minimize release of Ar41 from the pneumatic tube (rabbit) system, the …

a. piping is a recirculating loop with an N2 purge.
b. piping is a recirculating loop with a CO2 purge.
c. exhaust of the system is located in the facility exhaust stack.
d. exhaust of the system is connected to the Ar41 purge system.

Answer: C.003 b.

Reference: UT TRIGA - Operation Support Systems, 3.2, Pneumatic Transfer System page 21

QUESTION C.004 [1.0 point] {4.0}

Which ONE of the following methods is used to monitor reactor power during a pulse? Placing the mode switch in the Pulse position …

a. changes NPP-1000 channel input to a photo tube with output proportional to power (detection of Cherenkov radiation).
b. modifies the gain setting for the NPP-1000 channel, with input from the fission chamber in campbelling mode.
c. modifies the gain setting for the NPP-1000 channel, with input from the ion chamber.
d. changes NPP-1000 channel input to a Geiger-Müller tube with no amplification.

Answer: C.004 c

Reference: UT TRIGA - Rx Description, Reactor Instrumentation and Controls § 2.1.3.3, page 19.

QUESTION C.005 [1.0 point] {5.0}

The reactor protection system will generate a scram signal if neutron detector high voltage drops by …

a. 10%
b. 20%
c. 80%
d. 90%

Answer: C.005 ~~b.~~ d. per facility comment to correct typographical error.

Reference: UT TRIGA - ~~R~~x Description, Reactor Instrumentation and Controls § 2.1.6.2.2 on page 29. (Note: hand written change from 20% to 10%.)

QUESTION C.006 [1.0 point] {6.0}

Each fuel element contains a top and bottom reflector plugs which are made of …

a. graphite
b. zirconium
c. Stainless Steel
d. zirconium hydride

Answer: C.006 ~~c.~~ a. per facility comment to correct typographical error.

Reference: SAR § 4.4.5 2nd ¶.

QUESTION C.007 [2.0 points, 0.5 each] {8.0}

Match the purification system functions in column A with the purification component listed in column B. (Note items from column B may be used more than once, or not at all.)

Column A	Column B
a. remove floating dust, bug larvae, etc.	1. Demineralizer (Ion Exchanger)
b. remove dissolved impurities	2. Skimmer
c. remove suspended solids	3. Filter
d. maintain pH	

Answer: C.007 a. = 2; b. = 1; c. = 3; d. = 1

Reference: SAR § 5.2.2., also UT TRIGA - Operational Support Systems, § 1.1 Reactor Water Systems page 4

QUESTION C.008 [1.0 point] {9.0}

WHICH ONE of the following experimental facilities can be modified to supply a highly collimated beam of neutron and gamma radiation?

a. Pneumatic Transfer system

b. Hollow Element Assembly

c. Central Thimble

d. Lazy Susan

Answer: C.008 c.

Reference: UT TRIGA - Operational Support Systems, § 3.3, p. 21.

QUESTION C.009 [1.0 point] {10.0}

Which ONE of the following is the neutron absorbing medium in the control rods?

a. Boron carbide

b. Samarium

c. Halfnium

d. Xenon

Answer: C.009 a.

Reference: UT TRIGA - R Description, § 3.7, 1st and 3rd paragraphs page 18

QUESTION C.010 [1.0 point] {11.0}

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

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

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

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

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

Answer: C.010 d.

Reference: GA - 3886 (Rev. A) TRIGA Mark III Reactor Hazards Analysis, Feb. 1965.

QUESTION C.011 [1.0 point] {12.0}

Which of the rings include the chromel-alumel thermocouples?

a. A and B

b. A and C

c. B and C

d. B and D

Answer: C.011 c.

Reference: SURV-1

QUESTION C.012 [1.0 point] {13.0}

Which one of the following changes will have an effect on nuclear power indications when operating in the steady state mode?

a. Campbelling portion of the fission chamber signal processing circuitry provides no signal at 200 KW.

b. NVT circuit failed and is indicating 50 MWS on the bargraph.

c. Loss of power to the water temperature transmitters.

d. Primary flow rate increases.

Answer: C.012 a.

Reference: SAR 6.1.1

QUESTION C.013 [1.0 point] {14.0}

The control rods must drop in the core in less than 1 sec. How is damage to the rods prevented at the end of their travel?

a. A spring mechanism reduces bottom impact.

b. The small gap between the rod and adjacent fuel elements acts as a brake.

c. Large slotted openings in the upper portion of the barrel restrain rod motion by a dashpot action.

d. Small vent holes in the lower end of the barrel in conjunction with the piston act to slow down the rod down motion.

Answer: C.013 d.

Reference: SAR 4.4.8.1

QUESTION C.014 [1.0 point] {15.0}

Which one of the following beam ports does NOT penetrate the graphite reflector?

a. 5

b. 4

c. 3

d. 1

Answer: C.014 b.

Reference: UT TRIGA - Support Systems Sect. 3.4.3, Radial beam Ports page 24

QUESTION: C.015 [1.0 point] {16.0}

You are the reactor operator and the reactor is in the AUTOMATIC mode at a power level of 900 kW. You observe that shim rod number one rod color is MAGENTA and the magnet box is BLACK. Which one of the following results would you expect to see as a result of these indications?

a. the control system drops out of the AUTOMATIC mode into the MANUAL mode.

b. the control system withdraws the regulating rod.

c. the control system inserts the regulating rod.

d. the reactor scrams.

Answer: C.015 a.

Reference: UT-TRIGA Trn Man, Vol. II, Control Console Operator's Manual, page 5-3 and UT-TRIGA Trn Man, Vol. II, Rx I & C Systems, page 26.

QUESTION: C.016 [1.0 point] {17.0}

The pool level indications are provided by ___ dowels (rods) positioned by ___ floats.

a. 2 dowels and 5 floats

b. 2 dowels and 4 floats

c. 3 dowels and 3 floats

d. 5 dowels and 5 floats

Answer: C.016 a.

Reference: SURV-4, Reactor Water Systems Surveillance step B.1.f and MAIN-3, Support System Features step B.1 - B.4

QUESTION: C.017 [1.0 point] {18.0}

Which ONE of the following temperature measuring devices utilizes the presence of a temperature difference that can be seen by the voltage generated between two dissimilar metals?

a. Resistance temperature detector
b. Bimetallic thermometer
c. Thermocouple
d. Thermistor

Answer: C.017 c.

Reference: SURV-4, Reactor Water Systems Surveillance step B.1.f and MAIN-3, Support System Features step B.1 - B.4

QUESTION C.018 [1.0 point] {19.0}

Which ONE of the following parameters is NOT measured in the Purification System?

a. Pressure
b. Flow Rate
c. Conductivity
d. pH

Answer: C.18 d

Reference: SURV-4, Reactor Water Systems Surveillance step B.2.a. and b.

QUESTION C.019 [1.0 point] {20.0}

Which ONE of the following neutron flux detectors provides a signal indicating the Log N period of the reactor?

a. Fission chamber
b. Gamma ion chamber
c. Compensated ion chamber
d. Uncompensated ion chamber

Answer: C.019 a.

Reference: UT-TRIGA Trn Man, Vol.II, Reactor I and C Systems, page 15.