January 12, 2006

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-06-01, UNIVERSITY OF TEXAS

Dear Dr. Landsberger:

During the week of December 12, 2005, 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 2.390 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/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 Phillip T. Young at 301-415-4094 or via Internet e-mail at pty@nrc.gov.

Sincerely,

/RA/

Brian E. Thomas, Branch Chief
Research and Test Reactors Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-602

Enclosures: 1. Initial Examination Report No. 50-602/OL-06-01
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

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Office of the Governor
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10100 Burnet Road
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Dr. William Vernetson
Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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DISTRIBUTION w/ encls.:
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ADAMS Package Accession No.: ML053320296
ADAMS Report Accession No.: ML053550298 **TEMPLATE #: NRR-074**

OFFICE	PRT:E/UI	E	IOLB:LA		PRT:SC	
NAME	PYoung		EBarnhill		BThomas	
DATE	01/05/2006		01/04/2006		01/06/2006	

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

REPORT NO.:	50-602/OL-06-01
FACILITY DOCKET NO.:	50-602
FACILITY LICENSE NO.:	R-129
FACILITY:	University of Texas
EXAMINATION DATES:	12/13/2005
EXAMINER:	Phillip T. Young, Chief Examiner

SUBMITTED BY:	**/RA/**	1/06/2006
	Phillip T. Young, Chief Examiner	Date

SUMMARY:

During the week of December 12, 2005, NRC administered Operator Licensing examinations to one Reactor Operator (RO). The one RO candidate passed the examinations.

REPORT DETAILS

1. Examiners:

   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	**1/0**	**0/0**	**1/0**
Overall	**1/0**	**0/0**	**1/0**

3. Exit Meeting:

   Personnel attending:

   Sean O'Kelly, Associate Director
   Michael G. Krause, Reactor Supervisor
   Phillip Young, NRC

   The examiner thanked the facility for their support in conducting the examinations.

Facility Comments Regarding NRC Exam Administered on December 12, 2005

NONE

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

FACILITY: University of Texas

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 12/13/2005

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
20.50	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

University of Texas - Austin

Written Examination and Answer Key

UNITED STATES NUCLEAR REGULATORY COMMISSION

OPERATOR LICENSING EXAMINATION

December 12, 2005

Enclosure 2

Question: A.001 [1.0 point, 0.25 each] (1.0)

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.001 a = 2; b = 4; c = 1; d = 3
Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1982, § 2.5, p. 2-36.

Question: A.002 [1.0 point] (2.0)

You enter the control room and note that all nuclear instrumentation show a steady neutron level, and no rods are in motion. Which one of the following conditions CANNOT be true?

a. The reactor is critical.

b. The reactor is subcritical.

c. The reactor is supercritical.

d. The neutron source has been removed from the core.

Answer: A.002 c
Reference: Standard NRC QUESTION

Question: A.003 [1.0 point] (3.0)

Which one of the following describes the MAJOR contributor to the production and depletion of Xenon respectively in a STEADY-STATE OPERATING reactor?

	Production	Depletion
a.	Radioactive decay of Iodine	Radioactive Decay
b.	Radioactive decay of Iodine	Neutron Absorption
c.	Directly from fission	Radioactive Decay
d.	Directly from fission	Neutron Absorption

Answer: A.003 b
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1988, §§ 8.1 —8.4, pp. 8-3 — 8-14.

Question: A.004 [1.0 point] (4.0)

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

Question: A.005 [1.0 point] (5.0)

Several processes occur that may increase or decrease the available number of neutrons. SELECT from the following the six-factor formula term that describes an INCREASE in the number of neutrons during the cycle.

a. Thermal utilization factor (f).

b. Resonance escape probability (p).

c. Thermal non-leakage probability ($\mathscr{L}_{th}$).

d. Reproduction factor (η).

Answer: A.005 d
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2, pp. 3-13 — 3-18.

Question: A.006 [1.0 point] (6.0)

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.006 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.007 [1.0 point] (7.0)

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.007 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.008 [1.0 point] (8.0)

Core excess reactivity changes with…

a. Fuel burnup

b. Control Rod Height

c. Neutron Level

d. Reactor Power Level

Answer: A.008 a.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 6.2 p. 6-1 — 6-4.

Question: A.009 [1.0 point] (9.0)

INELASTIC SCATTERING is the process by which a neutron collides with a nucleus and …

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

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

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

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

Answer: A.009 b.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 2.4.5 p. 2-28.

Question: A.010 [1.0 point] (10.0)

The term *PROMPT JUMP* refers to …

a. an instantaneous change in power due to withdrawal of a control rod.

b. a reactor which has attained criticality on prompt neutrons alone.

c. a reactor which is critical on both prompt and delayed neutrons.

d. a negative reactivity insertion which is less than β_{eff}.

Answer: A.010 a.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 4.7, p. 4-21

Question: A.011 [1.0 point] (11.0)

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.011 b.
REFERENCE: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 2, pp. 24-27.

Question: A.012 [1.0 point] (12.0)

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.012 c.
REFERENCE: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 4, pg. 24.

Question: A.013 [1.0 point] (13.0)

For the same constant reactor period, which ONE of the following transients requires the SHORTEST time to occur? A power increase of:

a. 5% of rated power - going from 1% to 6% of rated power.

b. 15% of rated power - going from 10% to 25% of rated power.

c. 30% of rated power - going from 20% to 50% of rated power.

d. 50% of rated power - going from 50% to 100% of rated power.

Answer: A.013 d.
REFERENCE: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 4, pg.11.

Question: A.014 [1.0 point] (14.0)

The reactor is operating in the automatic mode at 50% power. A problem in the secondary cooling system causes the primary coolant temperature to increase by 5 degrees F. Given that the primary coolant temperature coefficient is $-7.0x10^{-5}$ Δ k/k/deg. F and the differential rod worth of the regulating rod is $8.87x10^{-5}$ Δk/k/inch, the change in the position of the regulating rod will be:

a. eight (8) inches in.

b. eight (8) inches out.

c. four (4) inches in.

d. four (4) inches out.

Answer: A.014 d.
REFERENCE: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 3, pg. 21.
Since coolant temperature increased, negative reactivity was added. Therefore, the rod must add positive reactivity, i.e. withdrawn out. $7x5x10^{-5}/8.75x10^{-5}$ = 4 inches.

Question: A.015 [1.0 point] (15.0)

During the minutes following a reactor scram, reactor power decreases on a negative 80 second period, corresponding to the half-life of the longest-lived delayed neutron precursors, which is approximately:

a. 20 seconds.

b. 40 seconds.

c. 55 seconds

d. 80 seconds.

Answer: A.015 c.
REFERENCE: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 4, pp. 17.

Question: A.016 [1.0 point] (16.0)

Which ONE of the following statements describes the difference between Differential (DRW) and Integral (IRW) rod worth curves?

a. DRW relates the worth of the rod per unit of travel to rod position. IRW relates the total reactivity added by the rod to the rod position.

b. DRW relates the time rate of reactivity change to rod position. IRW relates the total reactivity in the core to the time rate of reactivity change.

c. IRW relates the worth of the rod per unit of travel to rod position. DRW relates the total reactivity added by the rod to the rod position.

d. IRW is the slope of the DRW at a given rod position.

Answer: A.016 a.
Reference: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 3, pg. 51.

Question: A.017 [1.0 point] (17.0)

Delayed neutron precursors decay by beta decay. Which reaction below is an example of beta decay?

a. ${}_{35}Br^{87}$ -> ${}_{33}Kr^{83}$

b. ${}_{35}Br^{87}$ -> ${}_{35}Kr^{86}$

c. ${}_{35}Br^{87}$ -> ${}_{34}Kr^{86}$

d. ${}_{35}Br^{87}$ -> ${}_{36}Kr^{87}$

Answer: A.017 d.
REFERENCE: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 1, pg. 24.

Question: A.018 [1.0 point] (18.0)

Which ONE of the following describes the characteristics of a good moderator?

a. High scattering cross-section and low absorption cross-section.

b. Low scattering cross-section and high absorption cross-section.

c. Low scattering cross-section and low absorption cross-section.

d. High scattering cross-section and high absorption cross-section.

Answer: A.018 a.
Reference: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 2, pg. 24.

Question: A.019 [1.0 point] (19.0)

Which ONE of the following is the time period during which the MAXIMUM amount of Xenon-135 will be present in the core?

a. 10 to 12 hours after a startup to 100% power.

b. 4 to 6 hours after a power increase from 50% to 100%.

c. 4 to 6 hours after a power decrease from 100% to 50%.

d. 10 to 12 hours after shutdown from 100% power.

Answer: A.019 d.
Reference: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 3, pg. 38.

Question: A.020 [1.0 point] (20.0)

During fuel loading, which ONE of the following will have NO effect on the shape of the 1/M plot?

a. The order of fuel placement.

b. The source strength.

c. The location of the source in the core.

d. The location of the detector (or detectors) in the core.

Answer: A.020 b.
Reference: UT-TRIGA Trn Man, Vol. IV, Nuclear Physics & Rx Theory, Module 4, pg. 5.

(*****END OF CATEGORY A *****)

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

Which ONE of the following would be an initiating condition for a Non-Reactor Specific Emergency?

a. Damage to building reactor systems or facility utilities.

b. > 20 mr/hr at operations boundary from unknown source.

c. Nearby, threatening, or impending natural disaster.

d. Discovery of forced entry or SNM theft.

Answer: B.001 c.
Reference: Procedure Plan-E, Emergency Classification.

Question: B.002 [1.00 point] (2.0)

A survey instrument with a window probe is used to measure the beta-gamma dose rate from an irradiated experiment. The dose rate is 100 mrem/hour with the window open and 60 mrem/hour with the window closed. The gamma dose rate is:

a. 100 mrem/hour.

b. 60 mrem/hour.

c. 40 mrem/hour.

d. 160 mrem/hour.

Answer: B.002 b.
Reference: Vol. IV, Radiation Detection the window stops the betas, and so the gamma dose rate is 60 mrem/hour.

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

The Safety System channels required to be operable in <u>all</u> modes of operation are:

a. manual scram and reactor high power scram (1.1 MW).

b. fuel element temperature scram (550°C) and manual scram.

c. fuel element temperature scram (550°C), reactor high power scram (1.1 MW), and manual scram.

d. reactor high power scram (1.1 MW), loss of high voltage scram, and fuel element temperature scram (550°C).

Answer: B.003 b.
Reference: UT-TRIGA Reactor Technical Specifications, Section 3.2.3.

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

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, > 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.004 a. = 4; b. = 2; c. = 2; d. = 1
Reference: 10 CFR 55

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

Which ONE statement below describes the basis for the Safety Limit applicable to fuel temperature?

a. Excessive gas pressure between the fuel-moderator and cladding may result in loss of fuel element cladding integrity.

b. High fuel temperature combined with lack of adequate cooling could result in fuel melt.

c. Excessive hydrogen produced as a result of the zirconium-water reaction is potentially explosive.

d. Pulsing the reactor at high fuel temperatures could result in loss of fuel element cladding integrity.

Answer: B.005 a.
Reference: SAR, Section 4-1.

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

“The reactivity of an experiment shall be measured before an experiment is considered functional.” This is an example of a:

a. safety limit.
b. limiting safety system setting.
c. limiting condition for operation.
d. surveillance requirement.

Answer: B.006 d.
Reference: UT-TRIGA Reactor Technical Specifications, Section 4.1.1.

Question: B.007 [2.00 point, 0.5 each] (8.0)

Match each of the following actions in Column A with the correct term from the Technical Specifications in Column B. Only one term from Column B may be used for each action in Column A.

Column A	Column B
a. Immersing a thermometer in an ice bath, then in boiling water and noting the readings.	1. Channel Check
b. Placing a source next to a radiation detector and observing meter movement.	2. Channel Test
c. Performing a determination of reactor power with a heat balance, then adjusting a power meter to correspond to the heat balance.	3. Channel Calibration
d. Observing the overlap between two different neutron detectors as power increases.	

Answer: B.007 a. = 2; b. = 2; c. = 3; d. = 1.
Reference: UT-TRIGA Reactor Technical Specifications, Definitions.

Question: B.008 [1.00 point] (9.0)

The area radiation monitor at the pool level has been out of service for one day. As a result:

a. the reactor cannot be operated.

b. the reactor can continue to operate.

c. the reactor can continue to operate only if the monitor is replaced by a locally-alarming unit of similar range.

d. the reactor can continue to operate only if the alarm setpoints of the remaining area radiation monitors are lowered.

Answer: B.008 a.
Reference: UT-TRIGA Reactor Technical Specifications, Section 3.3.3c.

Question: B.009 [1.00 point] (10.0)

With regard to visitors, which ONE of the following statements is TRUE?

a. Any licensed operator or senior operator may escort visitors into restricted areas.

b. Each member of a tour group must have a pocket dosimeter.

c. Authorization for visitor access to the reactor floor must be obtained from the Health Physicist.

d. Each visitor is responsible for adherence to radiological procedures and response to emergency signals.

Answer: B.009 c.
Reference: HP-1, Radiation Monitoring - Personnel

Question: B.010 [1.00 point] (11.0)

Two point sources have the same Curie strength. Source A's gammas have an energy of 1 Mev, while Source B's gammas have an energy of 2 Mev. You obtain a reading from the same GM tube 10 feet from each source. Concerning the two readings, which ONE of the following statements is true?

a. The reading from Source B is four times that of Source A.

b. The reading from Source B is twice that of Source A.

c. The reading from Source B is the same as Source A.

d. The reading from Source B. is half that of Source A.

Answer: B.010 c.
Reference: GM tubes cannot distinguish between energies.

Question: B.011 [1.00 point] (12.0)

Following an abnormal shutdown, what is the lowest level of authority that can authorize a reactor restart is:

a. a Senior Reactor Operator.

b. the Reactor Operator on duty at the time of the shutdown.

c. the Reactor Supervisor.

d. the NETL Director.

Answer: B.011 a.
Reference: OPER-2, Reactor Startup and Shutdown.

Question: B.012 [1.00 point] (13.0)

Prior to the movement of fuel out of the reactor, movement of any control rod drive is prevented by:

a. removing power from the drive motor.

b. de-energizing the magnets.

c. mechanically blocking the rod from moving.

d. removing the neutron source.

Answer: B.012 d.
Reference: FUEL-1, Movement of Fuel.

Question: B.013 [2.0 points, 0.5 each] (15.0)

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

Answer: B.013 a. = 2; b. = 3; c. = 3; d. = 4
Reference: 10 CFR 20.1003, Definitions

Question: B.014 [1.0 point] (16.0)

Two inches of shielding reduce the gamma exposure in a beam of radiation from 400 mR/hr to 200 mR/hr. If you add an **additional four** inches of shielding what will be the new radiation level? (Assume all reading are the same distance from the source.)

a. 25 mR/hr

b. 50 mR/hr

c. 75 mr/hr

d. 100 mr/hr

Answer: B.014 b.
Reference: Nuclear Power Plant Health Physics and Radiation Protection

Question: B.015 [1.0 point] (17.0)

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.015 b.
Reference: Emergency Plan

Question: B.016 [1.0 point] (18.0)

In accordance with the Technical Specifications, which one situation below is permissible when the reactor is operating?

a. One control rod inoperable but is in its fully withdrawn position.

b. The reactor power trip setpoint is set at 1.010 kW.

c. The Transient Rod withdrawal time is 18 seconds.

d. One fuel temperature measuring channel is inoperable.

Answer: B.016 b.
Reference: Technical Specifications, Section 3.2

Question: B.017 [1.00 point] (19.0)

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.017 a.
Reference: Procedure Plan-E, Emergency Response.

Question: B.018 [1.50 point, 0.5 each] (20.5)

Class C experiments require the direction of a(n)_______________, Class B experiments require the direction of a(n) ____________, and Class A experiments require the direction of a(n)_____________.

a. senior operator; reactor operator; experimenter.

b. experimenter; senior operator; reactor operator.

c. reactor operator, senior operator, experimenter.

d. experimenter; reactor operator; senior operator.

Answer: B.018 d.
Reference: ADMN-6, Authorization of Experiments.

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

Question: C.001 [1.00 point] (1.0)

A three-way solenoid valve controls the air supplied to the pneumatic cylinder of the transient rod. De-energizing the solenoid causes the valve to shift to:

a. open, admitting air to the cylinder.

b. close, admitting air to the cylinder.

c. open, removing air from the cylinder.

d. close, removing air from the cylinder.

Answer: C.001 d.
Reference: University of Texas SAR, page 4-69. SAR 4.4.6.3

Question: C.002 [1.00 point] (2.0)

A diffuser nozzle is located a short distance above the top grid plate and directs water downward over the core. The purpose of this diffuser is to:

a. enhance heat transfer across all fuel elements in the core.

b. ensure consistent water chemistry in the core.

c. better distribute heat throughout the pool.

d. reduce the dose rate at the pool surface from N-16.

Answer: C.002 d.
Reference: Vol. II, Operation Support Systems, page 6.

Question: C.003 [1.00 point] (3.0)

Carbon Dioxide is used in the pneumatic transfer system because:

a. it does not retain moisture.

b. it minimizes the production of Argon-41.

c. it is more compressible than compressed air, which minimizes the pressure required to move samples.

d. it is a better neutron absorber than compressed air, thus inserting negative reactivity in the event of a leak.

Answer: C.003 b.
Reference: Vol. II, Operation Support Systems, page 21.

Question: C.004 [1.00 point] (4.0)

Which ONE of the following is the purpose of the ½-inch aluminum safety plate suspended beneath the lower grid plate?

a. Prevents the control rods from dropping out of the core if the mechanical connections fail.

b. Provides a catch plate for small tools and hardware dropped while working on the core.

c. Provides structural support for the lower grid plate and the suspended core.

d. Prevents fuel rods from dropping out of the core.

Answer: C.004 a.
Reference: Vol. II, Description of TRIGA Mark II Reactor, page 14.

Question: C. 005 [1.00 point] (5.0)

With reference to the heat exchanger in the coolant system, differential pressure is measured between the cooling system inlet and secondary outlet. The purpose of this measurement is:

a. provide an alarm if the secondary system pump discharge pressure exceeds the cooling system pump suction pressure.

b. alarm when the cooling system inlet pressure exceeds the secondary outlet pressure.

c. alarm when the secondary outlet pressure exceeds the cooling system inlet pressure.

d. to measure the difference in flow rate of the primary and secondary loops.

Answer: C.005 b.
Reference: Vol. II, Reactor Instrumentation and Control Systems, page 36.

Question: C.006 [1.00 point] (6.0)

Which ONE of the following statements correctly describes the purpose of the potentiometer in the control rod drive assembly?

a. Provides rod position indication when the electromagnet engages the connecting rod armature.

b. Provides a variable voltage to the rod drive motor for regulating control rod speed.

c. Provides the potential voltage to relatch the connecting rod to the electromagnet.

d. Provides potential voltage as required for resetting the electromagnet current.

Answer: C.006 a.
Reference: Vol. II, Description of TRIGA Mark II Reactor, page 20.

Question: C.007 [1.00 point] (7.0)

In order to prevent radiation streaming through a beam port, each beam port contains:

a. a step (or steps) to provide for divergence of the radiation beam.

b. an inner shield plug and an outer shield plug.

c. a lead-filled shutter and a lead-lined door.

d. a removable cover plate.

Answer: C.007 a.
Reference: Vol. II, Operation Support Systems, page 24.

Question: C.008 [1.00 point] (8.0)

How does the ventilation system respond to a high radiation alarm from the air particulate monitor?

a. If the ventilation system was not running prior to the high radiation alarm, it automatically starts. If running, continues to operate.

b. The supply fan continues to operate, while the return fan stops. Supply and return dampers remain open.

c. Both the supply and return fans stop, and supply and return dampers close.

d. The return fan continues to operate, while the supply fan stops.

Answer: C.008 c.
Reference: Vol. V, Air Confinement System Surveillance.

Question: C.009 [1.00 point] (9.0)

The reactor is in the AUTOMATIC mode at a power level of 500 kW. The neutron detector from which the control system receives its input signal fails low (signal suddenly goes to zero). As a result:

a. the control system inserts the regulating rod to reduce power, to try to match the power of the failed detector.

b. the control system withdraws the regulating rod to increase power.

c. the control system drops out of the AUTOMATIC mode.

d. the reactor scrams.

Answer: C.009 b.
Reference: Vol. II, Control Console Operator’s Manual, page 5-3.

Question: C.010 [2.00 points, 0.5 each] (11.0)

For the measurements listed in Column I, select the appropriate neutron monitoring system from Column II. Items in Column II may be used once, more than once, or not at all.

	Column I		Column II
a.	Reactor period.	1.	NM-1000
b.	Pulse energy.	2.	NP-1000
c.	Safety Channel #2.	3.	NPP-1000
d.	Log power.		

Answer: C.010 a. =1; b. = 3; c. = 2; d. = 1.
Reference: Vol. II, Reactor Instrumentation and Control Systems, figure 2-1.

Question: C.011 [1.00 point] (12.0)

Bulk pool water temperature is limited to 48 degrees C in order to ensure that:

a. nucleate boiling does not occur on fuel element surfaces.
b. activation of pool water impurities is limited.
c. demineralizer resins are not damaged.
d. the expansion of pool water at high temperatures does not reduce the moderating capability of the coolant.

Answer: C.011 c.
Reference: UT-TRIGA Reactor Technical Specifications, Appendix A.3.3.3.1.

Question: C.012 [1.00 point] (13.0)

Which describes the action of the rod control system to drive the magnet draw tube down after a dropped rod?

a. Resetting the scram signal initiates the rod down motion of the draw tube.
b. De-energizing the rod magnet initiates the rod down motion of the draw tube.
c. Actuation of the MAGNET DOWN limit switch initiates the rod down motion of the draw tube.
d. Actuation of the ROD DOWN limit switch initiates the rod down motion if the rod drive is withdrawn.

Answer: C.012 d.
Reference:GA Maintenance Manual

Question: C.013 [1.0 point] (14.0)

Which one of the following devices is tested during the PRESTART checks?

a. Magnet power key switch

b. External scram circuits

c. Source level trip

d. Low water level

Answer: C.013 c.
Reference: GA Control Console Operator's Manual pg. 2-5

Question: C.014 [1.0 point] (15.0)

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

Answer: C.014 d.
Reference: GA - 3886 (Rev. A) TRIGA Mark III Reactor Hazards Analysis, Feb. 1965.

Question: C.015 [1.0 point] (16.0)

The control rods must drop in the core in less than 1 second. 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.015 d.
Reference: SAR 4.4.8.1

Question: C.016 [1.0 point] (17.0)

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

a. 5

b. 4

c. 3

d. 1

Answer: C.016 b.
Reference: Support Systems Sect. 3.4

Question: C.017 [1.0 point] (18.0)

Which is NOT a condition that must exist for the system to enter the Pulse mode?

a. System in Manual Mode.

b. Reactor period must be infinite.

c. Transient rod all the way down.

d. Reactor power less than 1 kW.

Answer: C.017 b.
Reference: Control Console Operator's Manual, Pulse Mode pg. 6-1

Question: C.018 [1.00 point] (19.0)

The temperature of the water in the secondary side of the heat exchanger is controlled by:

a. a temperature controller which allows some of the cooling water to bypass the heat exchanger.

b. varying the speed of the secondary coolant (chill water) pump.

c. a flow control valve at the outlet of the secondary pump.

d. a flow control valve at the outlet of the heat exchanger.

Answer: C.018 a.
Reference: SAR 5.2.1.

Question: C.019 [1.00 point] (20.0)

The Argon Purge System receives inputs from two air suction points. They are:

a. the reactor bay and beam port manifold.

b. the pool surface and reactor bay.

c. the pool surface and beam port manifold.

d. the reactor bay and control room.

Answer: C.019 c.
Reference: Vol. II, Operation Support Systems, page 13.

(*****END OF CATEGORY C *****)

(*****END OF WRITTEN EXAMINATION*****)