February 17, 2009

Sean O'Kelly, Associate Director
Nuclear Engineering Teaching Lab
University of Texas at Austin
ETL-PRC Bldg. 159
10100 Burnet Rd
Austin, TX 78758

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-602/OL-09-01, UNIVERSITY OF TEXAS AT AUSTIN

Dear Mr. O'Kelly:

On January 22, 2009, I administered an NRC prepared operator licensing examination at your Nuclear Engineering Teaching Lab reactor. The examination was prepared and proctored according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report at the conclusion of the examination.

In accordance with Title 10 of the Code of Federal Regulations Section 2.390, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Phillip T. Young at (301) 415-4094 or e-mail at pty@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads Jr., Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-602
Enclosures: 1. Initial Examination Report No. 50-602/OL-09-01
2. Written examination with facility comments incorporated

cc without enclosures: See next page

February 17, 2009

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Docket No. 50-602

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DISTRIBUTION w/ encls.:
PUBLIC PRTB r/f RidsNRRDPRPRTA RidsNRRDPRPRTB Facility File (CRevelle) O-13 D-07

ADAMS ACCESSION #: ML090340133 **TEMPLATE #:NRR-074**

OFFICE	PRTB:CE		IOLB:LA	E	PRTB:SC	
NAME	PYoung pty		CRevelle car		JEads jhe	
DATE	2/6/09		2/6/09		2/17/09	

OFFICIAL RECORD COPY

cc:

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Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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

REPORT NO.: 50-602/OL-09-01

FACILITY DOCKET NO.: 50-602

FACILITY LICENSE NO.: R-129

FACILITY: UNIVERSITY of TEXAS at AUSTIN

EXAMINATION DATES: January 22, 2009

SUBMITTED BY: **/RA/** February 3, 2009
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of January 19,2009, the NRC administered an operator licensing examinations to one Senior Reactor Operator Instant candidate. The candidate passed all portions of the examination.

REPORT DETAILS

1. Examiners:
Phillip T. Young, Chief Examiner, NRC

2. Results:

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

3. Exit Meeting:
Phillip T. Young, NRC
Sean O'Kelly, Associate Director
Michael Krause, Reactor Manager

The NRC thanked the facility staff for their cooperation during the examination process. The facility indicated that they had a comment on one written examination question and would forward the comment via e-mail. The examiner indicated no generic weaknesses were noted during the operating examination.

ENCLOSURE 1

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

University of Texas – Austin

US NRC Licensed Operator Examination

Written Exam with Answer Key

January 9, 2009

Enclosure 2

Question A.001 [1.0 point] {1.0}
The term "Prompt Critical" refers to:

a. the instantaneous jump in power due to a rod withdrawal.
b. a reactor which is supercritical using only prompt neutrons.
c. a reactor which is critical using both prompt and delayed neutrons.
d. a reactivity insertion which is less than Beta-effective.

Answer: A.001 b.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 4), pg. 16.

Question A.002 [1.0 point] {2.0}
Reactor A increases power from 10% to 20% with a period of 50 seconds. Reactor B increases power from 20% to 30% with a period of also 50 seconds. Compared to Reactor A, the time required for the power increase of Reactor B is:

a. longer than A.
b. exactly the same as A.
c. approximately the same as A.
d. shorter than A.

Answer: A.002 d.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 4), pg. 11. Reactor A doubles in power while the power of reactor B only increases by a factor of 1.5. For the same period, this requires less time.

Question A.003 [1.0 point] {3.0}
Which ONE of the following parameter changes will require control rod INSERTION to maintain constant power level following the change?

a. Removal of an experiment containing cadmium.
b. Pool water temperature increase.
c. Buildup of samarium in the core.
d. Insertion of a void into the core.

Answer: A.003 a.
Reference: Insertion of a control rod inserts negative reactivity to balance the positive reactivity added when removing a neutron absorber.

Question A.004 [1.0 point] {4.0}
A reactor is operating at a steady-state power level of 1.000 kW. Power is increased to a new steady-state value of 1.004 kW. At the higher power level, K_{eff} is:

a. 1.004
b. 1.000
c. 0.004
d. 0.000

Answer: A.004 b.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 4), pg. 8.

Question A.005 [2.0 points, 0.5 each] {6.0}
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.005 a. = 7; b. = 2; c. = 6; d. = 5
Reference: Standard NRC Question

Question A.006 [1.0 point] {7.0}
Which factor of the Six Factor formula is most easily varied by the reactor operator?

a. Fast Fission Factor (ε)
b. Reproduction Factor (η)
c. Thermal Utilization Factor (f)
d. Fast Non-Leakage Factor (L_f)

Answer: A.006 c.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2, pp. 3-13 — 3-18.

Question A.007 [1.0 point] {8.0}
You perform two initial startups a week apart. Each of the startups has the same starting conditions, (core burnup, pool and fuel temperature, and count rate are the same). The only difference between the two startups is that during the SECOND one you stop for 10 minutes to answer the phone. For the second startup compare the critical rod height and count rate to the first startup.

	Rod Height	Count Rate
a.	Higher	Same
b.	Lower	Same
c.	Same	Lower
d.	Same	Higher

Answer: A.007 d.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 5.7, pp. 5-28 — 5-38.

Question A.008 [1.0 point] {9.0}
Which one of the following atoms will cause a neutron to lose the most energy in an elastic collision?

a. Uranium^{238}
b. Carbon^{12}
c. Hydrogen^{2}
d. Hydrogen^{1}

Answer: A.008 d.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 2.5.3 p. 2-45.

Question A.009 [1.0 point] {10.0}
For most materials the neutron microscopic cross-section for absorption σ_a generally …

a. increases as neutron energy increases
b. decreases as neutron energy increases
c. increases as target nucleus mass increases
d. decreases as target nucleus mass increases

Answer: A.009 b.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 2.5.1 p. 2-36.

Question A.010 [1.0 point] {11.0}
Which one of following is the correct reason that delayed neutrons enhance control of the reactor?

a. There are more delayed neutrons than prompt neutrons.
b. Delayed neutrons increase the average neutron generation time.
c. Delayed neutrons take longer to reach thermal equilibrium.
d. Delayed neutrons born at higher energies than prompt neutrons and therefore have a greater effect.

Answer: A.010 b.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2.4, p. 3-12.

Question A.011 [1.0 point] {12.0}
A 1/M curve is being generated as fuel is loaded into the core. After some fuel elements have been loaded, the count rate existing at that time is taken to be the new initial count rate, C_o. Additional elements are then loaded and the inverse count rate ratio continues to decrease. As a result of changing the initial count rate:

a. criticality will occur earlier (i.e., with fewer elements loaded.)
b. criticality will occur later (i.e., with more elements loaded.)
c. criticality will occur with the same number of elements loaded.
d. criticality will be completely unpredictable.

Answer: A.011 c.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 4), pg. 6.

Question A.012 [1.0 point] {13.0}
Which ONE of the following describes the response of the reactor to EQUAL amounts of reactivity insertion as the reactor approaches critical (K_{eff} =1.0)?

a. The change in neutron population per reactivity insertion is smaller, and it requires a longer time to reach a new equilibrium count rate.

b. The change in neutron population per reactivity insertion is larger, and it requires a longer time to reach a new equilibrium count rate.

c. The change in neutron population per reactivity insertion is larger, and it takes an equal amount of time to reach a new equilibrium count rate.

d. The change in neutron population per reactivity insertion is smaller, and it requires a shorter time to reach a new equilibrium count rate.

Answer: A.012 b.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 4), pg. 7.

Question A.013 [1.0 point] {14.0}
Two critical reactors are identical except that Reactor 1 has a beta fraction of 0.0072 and Reactor 2 has a beta fraction of 0.0060. An equal amount of positive reactivity is inserted into both reactors. Which ONE of the following will be the response of Reactor 2 compared to Reactor 1?

a. The resulting power level will be lower.
b. The resulting power level will be higher.
c. The resulting period will be longer.
d. The resulting period will be shorter.

Answer: A.013 d.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 4), pg. 11.

Question A.014 [1.0 point] {15.0}
Which ONE of the following is the major source of energy released due to thermal fission of a U235 atom?

a. Kinetic energy of the fission fragments.
b. Kinetic energy of the fission neutrons.
c. Fission product decay.
d. Prompt gamma rays.

Answer: A.014 a.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 1), pg. 61.

Question A.015 [1.0 point] {16.0}
A reactor is subcritical with a Keff of 0.955. A positive reactivity of 3.5% delta k/k is inserted into the core. At this point, the reactor is:

a. supercritical.
b. exactly critical.
c. prompt critical.
d. subcritical.

Answer: A.015 d.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 3), pg.19.
For K = 0.955, reactivity = (K-1)/K = -0.045/0.955 = -4.71% ΔK/K; -4.71% + 3.50% = -1.21%, i.e. subcritical.

Question A.016 [1.0 point] {17.0}
The major contributor to the production of Xenon-135 in a reactor operating at full power is:

a. directly from the fission of Uranium-235.
b. directly from the fission of Uranium-238.
c. from the radioactive decay of Promethium.
d. from the radioactive decay of Iodine.

Answer: A.016 d.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 3), pg. 35.

Question A.017 [1.0 point] {18.0}
Which ONE of the reactions below is an example of a photoneutron source?

a. $_{1}H^{2} + \gamma \rightarrow {}_{1}H^{1} + n$
b. $_{92}U^{238} \rightarrow {}_{35}Br^{87} + {}_{57}La^{148} + 3n + \gamma$
c. $_{51}Sb^{123} + n \rightarrow {}_{51}Sb^{124} + \gamma$
d. $_{4}Be^{9} + \alpha \rightarrow {}_{6}C^{12} + n$

Answer: A.017 a.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 2), pg. 2.

Question A.018 [1.0 point] {19.0}
The effective neutron multiplication factor, Keff, is defined as:

a. production/(absorption + leakage)
b. (production + leakage)/absorption
c. (absorption + leakage)/production
d. absorption/(production + leakage)

Answer: A.018 a.
Reference: UT Trn Man, Vol. IV, Nuclear Physics & Rx Theory, (Mod 3), pg. 8.

Question A.019 [1.0 point] {20.0}
Question deleted during the administration of the examination. Examiner mistakenly left Answer & Reference attached to the question on the Applicant copy of the examination.
~~The reactor is to be pulsed. The projected pulse will add TWICE as much reactivity as the last pulse performed. In relation to the last pulse, for the projected pulse:~~
~~a. peak power will be four times larger and the energy released will be four times larger.~~
~~b. peak power will be two times larger and the energy released will be four times larger.~~
~~c. peak power will be four times larger and the energy released will be two times larger.~~
~~d. peak power will be two times larger and the energy released will be two times larger.~~
~~Answer: A.019 c.~~
~~Reference: UT TRIGA Training Manual, Vol. IV, Pulsed Reactors.~~

Question B.001 [1.0 point] {1.0}
Which ONE of the following requires the direct supervision (i.e., presence) of a Senior Reactor Operator?

a. Pulsing the reactor.
b. Reactor Pool Power Calibration.
c. Relocation of a $0.75 experiment.
d. Movements of fuel within the reactor bay.

Answer: B.001 d.
Reference: FUEL-1

Question B.002 [1.0 point] {2.0}
Which ONE of the following statements is applicable when moving experiments in the reactor pool?

a. The reactor must be subcritical by at least $0.25.
b. The reactivity worth of any moveable experiment shall be less than $2.50.
c. A licensed operator shall supervise all experiment movements in the reactor pool.
d. Explosive materials in quantities greater than 25 milligrams shall be encapsulated in specially designed container.

Answer: B.002 c.
Reference: FUEL-2; T.S.3.4

Question B.003 [1.0 point] {3.0}
“The total worth of the transient rod shall be limited to 2.8% ΔK/K, and the total withdrawal time for the rod shall not exceed 15 seconds.” This is an example of a:

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

Answer: B.003 c.
Reference: UT-TRIGA Reactor Technical Specifications, Section 3.1.3.

Question B.004 [1.0 point] {4.0}
Half-way through a 6 hour reactor operation you discover that the normal ventilation exhaust damper has been blocked open by a student performing experiments. You cannot move the damper because it is damaged. Which one of the following actions should you take?

a. Immediately secure reactor operations and comply with the requirements for reportable events.

b. Immediately secure reactor. This event is not reportable if the damper is repaired within 48 hours.

c. Continue with reactor operations. Up to one week is allowed to repair the damper.

d. Continue with reactor operations. The CAM will offer adequate protection.

Answer: B.004 a.
Reference: Technical Specifications, Section 3.3.2.a

Question B.005 [1.0 point] {5.0}
In accordance with the Technical Specifications, which ONE condition below is NOT permissible when the reactor is operating?

a. Scram time = 1 second.
b. Shutdown Margin = 2.8% ΔK/K.
c. Pool water conductivity = 6.5 micromho/cm.
d. Reactivity worth of a single secured experiment = 1% ΔK/K.

Answer: B.005 c.
Reference: UT-TRIGA Reactor Technical Specifications, Section 3.3.1.c.

Question B.006 [1.0 point] {6.0}
A radiation survey of an area reveals a general radiation reading of 1 mrem/hr. However, there is a small section of pipe which reads 10 mrem/hr at one (1) meter. Assuming that the pipe is a point source, which ONE of the following defines the posting requirements for the area in accordance with 10CFR Part 20?

a. Restricted Area.
b. Radiation Area.
c. High Radiation Area.
d. Grave Danger, Very High Radiation Area.

Answer: B.006 c.
Reference: 10 mrem/hr at 1 meter (100 cm.) = 111.1 mrem/hr. at 30 cm.

Question B.007 [1.0 point] {7.0}
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.007 b
Reference: Technical Specification 3.4.1.a.

Question B.008 [1.0 point] {8.0}
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.008 c.
Reference: Technical Specifications 3.3.3.b 2nd ¶.

Question B.009 [1.0 point] {9.0}
The CURIE content of a radioactive source is a measure of

a. the amount of energy emitted per unit time by the source
b. the amount of damage to soft body tissue per unit time.
c. the number of nuclear disintegrations per unit time.
d. the number of radioactive atoms in the source.

Answer: B.009 c.
Reference: Standard Health Physics Definition.

Question B.010 [1.0 point] {10.0}
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] {11.0}
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.011 b.
Reference: Standard NRC Rad Con Question

Question B.012 [1.0 point] {12.0}
Which ONE of the listed radioisotopes produces the highest ionizing energy gamma?

a. H^3
b. N^{16}
c. Ar^{41}
d. U^{235}

Answer: B.012 b.
Reference: Chart of the Nuclides

Question B.013 [1.0 point] {13.0}
Which ONE of the following persons is allowed to operate the facility under YOUR direction as a licensed Reactor Operator (RO)?

a. School newspaper reporter, writing a story on the NETL nuclear reactor.
b. A student, as part of a curriculum for a Nuclear Physics class.
c. A student, in training to certify as a health physicist.
d. An NRC inspector, as part of his checking that Technical Specifications setpoints are being maintained.

Answer: B.013 b.
Reference:

Question B.014 [1.0 points, ¼ point each] {14.0}
Common radioisotopes associated with research reactors are N16, Ar4l, H3 and Na24. The half-life for each is seconds (sec), minutes (min) hours (hr) or years (yr).

a. N^{16} is 7 _____.
b. Ar^{41} is 1.9 _____.
c. H^3 is 12 _____.
d. Na^{24} is 15 _____.

Answer: B.014 a. = sec; b. = hr; c. = yr; d. = hr;
Reference: Standard NRC Question

Question B.015 [1.0 point] {15.0}
In accordance with 10 CFR 20, the "Annual Limit on Intake (ALI)" refers to:

a. the amount of radioactive material taken into the body by inhalation or ingestion in one (1) year which would result in a committed effective dose equivalent of five (5) rems.

b. the concentration of a given radionuclide in air which, if breathed for a working year of 2000 hours, would result in a committed effective dose equivalent of five (5) rems.

c. the dose equivalent to organs that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

d. limits on the release of effluents to an unrestricted environment.

Answer: B.015 a.
Reference: Vol. II, Radiological Safety

Question B.016 [1.0 point] {16.0}
Which ONE of the following is the Emergency Plan definition of Action Levels?

a. specific readings, or observations; radiological dose or dose rates; or specific contamination levels of airborne, waterborne, or surface-deposited radioactive materials used as thresholds for establishing emergency classes and initiating appropriate emergency methods.

b. conditions that call for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.

c. classes of accidents grouped by severity level for which predetermined emergency measures should be taken or considered.

d. allowable concentrations of radioactive effluents that may be released to the environment as specified by applicable regulations.

Answer: B.016 a.
Reference: Emergency Plan, § 1.1 Definitions

Question B.017 [1.0 point] {17.0}
Your Reactor Operator license expires after _____ years.

a. 2
b. 4
c. 6
d. 8

Answer: B.017 c.
Reference: 10CFR55.55(a)

Question B.018 [1.0 point] {18.0}
In order to comply with Tech. Specs, a power calibration is required on a regular interval. Which one of the below statements is correct for this condition?

a. The coolant pumps shall be on during the performance of the power calibration to assure proper mixing of pool water.

b. Adjustments to the power instrumentation cannot be performed under any circumstances, if the difference is greater than 5%.

c. Differences between indicated and measured power greater than 10% are suspect and will be verified by a follow-up calorimetric.

d. The pool constant is a function of the pool volume. A 10 centimeters change in pool volume is acceptable but requires the approval of the SRO.

Answer: B.018 c.
Reference: SURV-2 “Reactor Pool Calibration”

Question B.019 [1.0 point] {19.0}
While the reactor is operating and with experiments in Beam Port 3, which one of the following is a violation of Tech. Specs?

a. The HEPA filter of the auxiliary air purge system is out of service and a replacement cannot be found. The continuous air monitor (particulate) is operating.

b. The Ar-41 continuous air monitor has been out of service for the past seven (7) days for maintenance. The auxiliary air purge system is operating.

c. The particulate air monitor has been out of service for the past five (5) days for maintenance. The continuous air monitor (Ar-41) is in service.

d. The air confinement system exhaust fan is out of service. Exhaust of pool areas is via the auxiliary air purge system.

Answer: B.019 a.
Reference: Technical Specifications 3.3.2 & 3.3.3

Question B.020 [1.0 point] {20.0}
Which one of the following does NOT require NRC approval for changes?

a. Facility License

b. Requalification plan

c. Emergency Implementation Procedures

d. Emergency Plan

Answer: B.020 c.
Reference: 10 CFR 50.54 (q); 10 CFR 50.59; 10 CFR 55.59

Question C.001 [1.0 point] {1.0}
For the neutron monitoring system channels listed in Column I, select the appropriate detector type from Column II. Items in Column II may be used once, more than once, or not at all.

Column I	Column II
a. NM-1000.	1. Fission chamber
b. NP-1000	2. Compensated ion chamber
c. NPP-1000	3. Uncompensated ion chamber
d. Pulse channel.	

Answer: C.001 a. = 1; b. = 3; c. = 3; d. = 3.
Reference: UT-TRIGA Training Manual, Vol.II,
Reactor Instrumentation and Control Systems, page 15.

Question C.002 [1.0 point] {2.0}
When the PULSE mode is selected on the control panel:

a. all scrams are bypassed.
b. the NPP-1000 is disabled.
c. the gain of the NM-1000 is changed to 2000 MW full scale.
d. the NM-1000 and NP-1000 scrams are bypassed.

Answer: C.002 d.
Reference: UT-TRIGA Training Manual, Vol.II,
Reactor Instrumentation and Control Systems, page 31.

Question C.003 [1.0 point] {3.0}
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.003 c.
Reference: UT TRIGA - Operation Support Systems, 4.1.4, Pool Stirrer page 28 and
SURV-2, Reactor Pool Power Calibration

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 - ℝ Description, Reactor Instrumentation and Controls § 2.1.3.3, page 19.

Question C.005 [1.0 point] {5.0}
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.005 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.006 [1.0 point] {6.0}
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.006 a.
Reference: SAR 6.1.1

Question C.007 [1.0 point] {7.0}
For a standard control rod, the rod color is MAGENTA and the magnet box is BLACK. This indicates that:

a. the drive is completely UP, and the rod is DOWN.

b. the drive is completely UP, and the rod is UP.

c. the drive is between limits, and the rod is DOWN.

d. both the rod and the drive are between limits.

Answer: C.007 a.
Reference: Vol. II, Rx Instrumentation & Control Systems, page 26.

Question C.008 [1.0 point] {8.0}
The purpose of the differential pressure sensor in the secondary system is to …

a. maintain secondary coolant (chill water) pressure 1 psi higher than primary pressure to prevent primary coolant leaking into the secondary.

b. maintain secondary coolant (chill water) pressure 1 psi lower than primary pressure to prevent chill water leaking into the primary.

c. maintain secondary coolant (chill water) temperature less than 90ºF to protect the chill water system.

d. maintain primary temperature less than 120ºF, to protect the purification system.

Answer: C.008 a.
Reference: SAR § 5.2.1, 3rd ¶.

Question C.009 [2.0 points, 0.4 each] {10.0}
Classify the five beam ports. Each Beam Port has only one answer.

a. Beam Port 1 **Tang**ential
b. Beam Port 2 **Thru**
c. Beam Port 3 **Rad**ial
d. Beam Port 4
e. Beam Port 5

Answer: C.009 a. = Thru; b. = Tang; c. = Rad; d, = Radial; e. = Thru
Reference: Operation Support Systems §§ 3.4.1 – 3.4.3.

Question C.010 [1.0 point] {11.0}
WHICH ONE of the following detectors is used primarily to measure N16 release to the environment?

a. NONE, N16 has too short a half-life to require environmental monitoring.
b. Stack Particulate Monitor
c. Bridge Area Monitor
d. Stack Gas Monitor

Answer: C.010 a.
Reference: Standard NRC Question

Question C.011 [1.0 point] {12.0}
According to Technical Specification 3.3.3, the Air Particulate Detector (APD) normally provides the automatic signal to isolate the ventilation system. If the APD is not available, the output from the …

a. Pool Level Area Radiation Monitor will provide an automatic signal to isolate the ventilation system.

b. Pool Level Area Radiation Monitor will be used to manually isolate the ventilation system.

c. Ar41 monitor will provide an automatic signal to isolate the ventilation system.

d. Ar41 monitor will be used to manually isolate the ventilation system.

Answer: C.011 d.
Reference: Technical Specification 3.3.3.

Question C.012 [1.0 point] {13.0}
Which ONE of the following methods is used to determine control rod position? As the rod goes out...

a. a magnet on the rod assembly closes limit switches located along the length of the rod movement producing a signal of rod position.

b. a motor electrically coupled to a set of contacts in the rod out circuit, generates a signal proportional to rod position.

c. a lead screw moves into a coil, the change in impedance is used as an input signal to determine rod position.

d. a potentiometer mechanically coupled to the rod drive motor generates a signal proportional to rod position.

Answer: C.012 d.
Reference: R Description, § 3.7.1, p. 20.

Question C.013 [1.0 point] {14.0}
Which ONE of the following design features prevents water from being siphoned out of the reactor pool and uncovering the core in the event of a primary coolant pipe rupture?

a. The capacity of the primary water makeup system.

b. All primary coolant pipes and components are located above core height.

c. The suction and discharge lines penetrate the reactor tank approximately 8 feet below pool surface.

d. The small holes that are drilled in the suction and return lines approximately ½ meter below pool surface.

Answer: C.013 d.
Reference: SAR 5.2.1

Question C.014 [1.0 point] {15.0}
Which ONE of the following is a control rod interlock?

a. Control rods cannot be withdrawn unless the count rate is greater than 1.2 CPS in the SQUARE WAVE mode.

b. Two control rods cannot be withdrawn at the same time above 1 kW in the MANUAL mode.

c. Above reactor power of 1 kW, the transient rod cannot be operated in the PULSE mode.

d. Only one standard rod at a time can be withdrawn in the PULSE mode.

Answer: C.014 c.
Reference: UT-TRIGA Training Manual, Vol. V,
ICS System Surveillance Interlock and SCRAM Features.

Question C.015 [1.0 point] {16.0}
Pool water conductivity is measured at the:

a. outlet of the coolant system heat exchanger.

b. outlet of the purification system filter.

c. discharge of the purification system pump.

d. discharge of the coolant system pump.

Answer: C.015 b.
Reference: SAR, page 5-8.

Question C.016 [1.0 point] {17.0}
When the reactor is in the AUTOMATIC mode, the controlling signal is:

a. reactor power as measured by the ion chamber in the NPP-1000 system.

b. reactor period as measured by the ion chamber in the NM-1000 system.

c. reactor power as measured by the fission chamber in the NM-1000 system.

d. reactor power as measured by the fission chamber in the NP-1000 system.

Answer: C.016 c.
Reference: UT-TRIGA Trn Manual, Vol. II, Rx Inst & Control Systems, page 34.

Question C.017 [1.0 point] {18.0}
Which ONE of the following types of detector is used in the Area Radiation Monitor system?

a. Proportional Counter.
b. Scintillation Detector.
c. Ionization Chamber.
d. Geiger-Mueller Tube.

Answer: C.017 d.
Reference: UT-TRIGA Training Manual, Vol. II,
Rx Instrumentation & Control Systems, page 36.

Question C.018 [1.0 point] {19.0}
Which ONE of the following statements is TRUE regarding the Square-Wave mode?

a. Reactor power can be increased from 50 kW to 500 kW.
b. The shim rods, regulating rod, and transient rod must all be above the down limit.
c. Reactor power must be steady (i.e. infinite period) in order to enter the Square-Wave mode.
d. If the demand power is not reached within 10 seconds, system transfers back to Steady-State (Manual) mode.

Answer: C.018 d.
Reference: UT-TRIGA Training Manual, Vol. II, Control Console Operator's Manual, pages 5-3, 5-4.

Question C.019 [1.0 point] {20.0}
Which one of the following physical characteristics of the TRIGA fuel design accounts for the majority of the negative temperature feedback?

a. Doppler broadening
b. Thermal Expansion of the moderator
c. Uranium-Zirconium Hydride disadvantage factor
d. Geometric Buckling

Answer: C.019 c.
Reference: SAR 4.1.2

Figure for question A.005