June 9, 2003

Mr. Sean O'Kelly, Associate Director
Nuclear Engineering Teaching Laboratory
University of Texas
10100 Burnet Road
Austin, TX 78758

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-602/OL-03-01, UNIVERSITY OF TEXAS

Dear Mr. O'Kelly:

During the week of May 5, 2003, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your University of Texas reactor. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1. At the conclusion of the examination, the examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will 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/index.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. Warren Eresian at 301-415-1833 or internet e-mail wje@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. 50-602/OL-03-01
2. Examination and answer key

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

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AAdams, PM
Facility File (EBarnhill) (6-D17)

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RORP/R&TR r/f
WEresian
PMadden

ADAMS PACKAGE ACCESSION NO.: ML031420672
ADAMS REPORT ACCESSION NO.: ML031420693 **TEMPLATE #: NRR-074**

OFFICE	RORP:CE		IEHB:LA		RORP:SC	
NAME	WEresian:rdr		EBarnhill		PMadden	
DATE	05/ 23 /2003		06/ 05 /2003		05/ 27 /2003	

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

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

REPORT NO.:	50-602/OL-03-01
FACILITY DOCKET NO.:	50-602
FACILITY LICENSE NO.:	R-129
FACILITY:	Texas A&M University
EXAMINATION DATES:	May 6-7, 2003
EXAMINER:	Warren Eresian, Chief Examiner

SUBMITTED BY: **/RA/** 05/ 22 /2003
Warren Eresian, Chief Examiner Date

SUMMARY:

During the week of May 5, 2003, the NRC administered operator licensing examinations to one Senior Reactor Operator (Upgrade) candidate and one Reactor Operator candidate. All candidates passed the examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiner: Warren Eresian, 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:

Mr. Sean O'Kelly, Associate Director
Mr. Michael Krause
Warren Eresian, NRC Chief Examiner

The NRC thanked the facility staff for their cooperation during the examination. There were no comments on the written examination. No generic concerns were noted.

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

FACILITY: University of Texas

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 05/06/2003

REGION: 4

CANDIDATE:___________________________

INSTRUCTIONS TO CANDIDATE:

Answers are to be written on the exam page itself, or the answer sheet provided. Write answers one side ONLY. Attach any answer sheets to the examination. Points for each question are indicated in parentheses for each question. A 70% in each category is required to pass the examination.

Examinations will be picked up three (3) hours after the examination begins.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20	33.3	_____	_____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
20	33.3	_____	_____	B. NORMAL/EMERGENCY PROCEDURES AND RADIOLOGICAL CONTROLS
20	33.3	_____	_____	C. FACILITY AND RADIATION MONITORING SYSTEMS
60				

CANDIDATE'S SCORE _____

FINAL GRADE % _____

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

____
Candidate's Signature

ENCLOSURE 2

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have not received or given assistance in completing the examination. This must be done after you complete the examination.

3. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

4. Use black ink or dark pencil only to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet.

6. Print your name in the upper right-hand corner of the answer sheets.

7. The point value for each question is indicated in parentheses after the question.

8. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK. NOTE: partial credit will NOT be given on multiple choice questions.

9. If the intent of a question is unclear, ask questions of the examiner only.

10. When turning in your examination, assemble the completed examination with examination questions, examination aids and answer sheets. In addition, turn in all scrap paper.

11. When you are done and have turned in your examination, leave the examination area as defined by the examiner. If you are found in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION: 001 (1.00)

Two different neutron sources were used during two reactor startups. The source used in the first startup emits ten times as many neutrons per second as the source used in the second startup. Assume all other factors are the same for the second startup. Which ONE of the following states the expected result at criticality?

a. Neutron flux will be higher for the first startup.

b. Neutron flux will be higher for the second startup.

c. The first startup will result in a higher rod position (rods further out of the core).

d. The second startup will result in a higher rod position (rods further out of the core).

QUESTION: 002 (1.00)

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.

QUESTION: 003 (1.00)

Which ONE of the following is the description of a thermal neutron?

a. A neutron possessing thermal rather than kinetic energy.

b. The primary source of thermal energy increase in the reactor coolant during reactor operation.

c. A neutron that has been produced in a significant time (on the order of seconds) after its initiating fission took place.

d. A neutron that experiences no net change in energy after several collisions with atoms of the diffusing media.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

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.

QUESTION: 005 (1.00)

The fuel temperature coefficient of reactivity is $-1.25x10^{-4}$ delta k/k/deg.C. When a control rod with an average rod worth of 0.1 % delta k/k/inch is withdrawn 10 inches, reactor power increases and becomes stable at a higher level. At this point, the fuel temperature has:

a. increased by 80 degrees C.

b. decreased by 80 degrees C.

c. increased by 8 degrees C.

d. decreased by 8 degrees C.

QUESTION: 006 (1.00)

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.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

Delayed neutron precursors decay by beta decay. Which ONE 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. $_{35}Br^{87}$ -> $_{36}Kr^{87}$

QUESTION: 008 (1.00)

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

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

b. 10% of rated power - going from 10% to 20% 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.

QUESTION: 009 (1.00)

Which ONE of the following is the principal source of energy (heat generation) in the reactor 15 minutes following a reactor shutdown from extended operation at full power?

a. Production of delayed neutrons.

b. Subcritical multiplication of neutrons.

c. Spontaneous fission of U-238.

d. Decay of fission products.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 010 (1.00)

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.

QUESTION: 011 (1.00)

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.

QUESTION: 012 (1.00)

A step insertion of positive reactivity in a critical reactor causes a momentary rapid increase in the neutron population, known as a *prompt jump*. Which ONE of the following describes the cause of this increase?

a. The positive reactivity insertion due to the rapid fuel temperature coefficient feedback.

b. An immediate increase in the prompt neutron population.

c. The step insertion produces a rate of reactivity addition which exceeds the delayed neutron fraction, β_{eff} .

d. A shortening of the delayed neutron generation when power increases.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

A reactor is subcritical with a K_{eff} of 0.984. and a count rate of 1500 cps on the startup instrumentation. Rods are withdrawn until the count rate is 6000 cps. At this point, the value of K_{eff} is:

a. 0.992

b. 0.994

c. 0.996

d. 0.998

QUESTION: 014 (1.00)

Which ONE of the following is the reason for operating with thermal neutrons rather than fast neutrons?

a. Probability of fission is increased since thermal neutrons are less likely to leak out of the core.

b. As neutron energy increases, neutron absorption in non-fuel materials increases exponentially.

c. The absorption cross-section of U-235 is much higher for thermal neutrons.

d. The fuel temperature coefficient becomes positive as neutron energy increases.

QUESTION: 015 (1.00)

Which ONE of the following parameter changes will require control rod INSERTION to maintain constant power level following the change?

a. Pool water temperature increase.

b. Insertion of a void into the core.

c. Removal of an experiment containing cadmium.

d. Buildup of samarium in the core.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 016 (1.00)

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.

QUESTION: 017 (1.00)

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.

QUESTION: 018 (1.00)

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

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 019 (1.00)

The equations which describe the operation of the installed neutron source at the UT reactor are:

a. Am-241 -> alpha + Np-237
Be-9 + alpha -> C-12 + neutron

b. Am-241 -> alpha + Np-237
B-10 + alpha -> N-13 + neutron

c. Am-241 -> beta + Cm-241
Be-9 + beta -> Li-8 + neutron

d. Am-241 -> beta + Cm-241
B-10 + beta -> Be-9 + neutron

QUESTION: 020 (1.00)

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.

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

QUESTION: 001 (1.00)

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.

QUESTION: 002 (1.00)

In accordance with the Technical Specifications, which ONE condition below is NOT permissible when the reactor is operating?

a. Maximum excess reactivity = 0.2% $\Delta K/K$.

b. Bulk pool water temperature = 48 deg. C.

c. Pool water conductivity = 2 micromho/cm.

d. Reactivity of a moveable experiment = 1% $\Delta K/K$.

QUESTION: 003 (1.00)

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.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

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.

QUESTION: 005 (1.00)

Which ONE of the following requires the direct supervision (i.e., presence) of a Senior Reactor Operator?

a. Control rod calibrations.

b. Fuel temperature calibrations.

c. Pulsing the reactor.

d. Performance of a Class A experiment.

QUESTION: 006 (1.00)

The Safety System channels required to be operable in all modes of operation are:

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

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

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

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

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

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

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

QUESTION: 008 (1.00)

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

a. The reactivity worth of a single secured experiment = $3.00.

b. Pool water depth = 5.0 meters.

c. A fueled experiment containing 400 millicuries of I-133 and 400 millicuries of I-135.

d. Maximum reactivity insertion rate of a standard control rod = 0.12%ΔK/K.

QUESTION: 009 (1.00)

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.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 010 (1.00)

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

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

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

QUESTION: 011 (1.00)

You have entered the control room to begin your shift. The reactor is operating, and the outgoing operator has logged off the system. Which ONE of the following statements is TRUE?

a. The reactor will scram if you do not log onto the system within 2 minutes after the outgoing operator has logged off.

b. If you do not log in, control rods can only be inserted, and not withdrawn.

c. If you do not log in, the reactor will automatically switch to the AUTO mode if it is not already in AUTO.

d. If you do not log in within 5 minutes, a new Prestart Check must be performed.

QUESTION: 012 (1.00)

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.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

With regard to Radiation Work Permits (RWPs), which ONE of the following statements is NOT TRUE?

a. An RWP is issued for a specific time period, and may expire prior to the completion of work.

b. All personnel who work under an RWP must read and sign it.

c. If the potential for personnel exposure exceeds 100 mrem, the RWP must be approved by the ALARA committee.

d. The RWP is closed out by the person (or persons) who actually perform the work.

QUESTION: 014 (1.00)

In accordance with the Technical Specifications, which ONE condition below is NOT permissible when the reactor is operating?

a. Shutdown Margin = 2.8% ΔK/K.

b. Scram time = 1 second.

c. Pool water conductivity = 6.5 micromho/cm.

d. Reactivity worth of a single secured experiment = 1% ΔK/K.

QUESTION: 015 (1.00)

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.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 016 (1.00)

“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.

QUESTION: 017 (1.00)

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

a. One control rod inoperable but fully inserted in the core.

b. Pool water depth = 5.0 meters.

c. A fueled experiment containing 400 millicuries of I-133 and 400 millicuries of I-135.

d. Maximum reactivity insertion rate of a standard control rod = 0.12%ΔK/K.

QUESTION: 018 (1.00)

A person who is granted unescorted access to restricted areas only would be issued a:

a. white badge.

b. red badge.

c. green badge.

d. yellow badge.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 019 (1.00)

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

QUESTION: 020 (1.00)

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.	

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

QUESTION: 001 (1.00)

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.

QUESTION: 002 (1.00)

The fuel-moderator elements are:

a. 20% enriched uranium clad with zirconium.

b. 8.5% enriched uranium clad with stainless steel.

c. 20% enriched uranium clad with stainless steel.

d. 8.5% enriched uranium clad with zirconium.

QUESTION: 003 (1.00)

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.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

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.

QUESTION: 005 (1.00)

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.

QUESTION: 006 (1.00)

Which ONE of the following is a control rod interlock?

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

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

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

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

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

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.

QUESTION: 008 (1.00)

Carbon Dioxide is used in the pneumatic transfer system because:

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

b. it does not retain moisture.

c. it minimizes the production of Argon-41.

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

QUESTION: 009 (1.00)

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

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

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

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 010 (1.00)

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

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

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

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

QUESTION: 011 (1.00)

Which ONE of the following temperatures is measured by the thermocouples in the instrumented fuel element?

a. Surface of the fuel element cladding.

b. Outer surface of the fuel.

c. Interior of the fuel.

d. Center of the zirconium rod.

QUESTION: 012 (1.00)

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

a. an inner shield plug and an outer shield plug.

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

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

d. a removable cover plate.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

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

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

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

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

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

QUESTION: 014 (1.00)

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 into the MANUAL mode.

d. the reactor scrams.

QUESTION: 015 (1.00)

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.		

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 016 (1.00)

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. Reactor power must be steady (i.e. infinite period) in order to enter the Square-Wave mode.

c. The shim rods, regulating rod, and transient rod must all be above the down limit.

d. If the demand power is not reached within 10 seconds, system transfers back to Steady-State (Manual) mode.

QUESTION: 017 (1.00)

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.

QUESTION: 018 (1.00)

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.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 019 (1.00)

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

a. Deenergizing the rod magnet initiates the rod down motion of the draw tube.

b. Actuation of the MAGNET DOWN limit switch initiates the rod down motion of the draw tube.

c. Actuation of the ROD DOWN limit switch initiates the rod down motion if the rod drive is withdrawn.

d. Resetting the scram signal initiates the rod down motion of the draw tube.

QUESTION: 020 (1.00)

Which ONE of the following conditions will prevent rod withdrawal?

a. Compensating voltage is 20% lower than normal.

b. The reactor operator selects pulse mode and attempts to withdraw the shim rod.

c. Rods are being pulled for a reactor startup. Source count 1.4 cps.

d. The demineralizer inlet temperature is 40°C.

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

ANSWER: 001 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 2.

ANSWER: 002 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 16.

ANSWER: 003 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 2, pg. 23.

ANSWER: 004 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 11.
Reactor A doubles in power, but the power of reactor B only increases by a factor of 1.5. For the same period, this requires less time.

ANSWER: 005 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 3, pg. 21.
Positive reactivity added by control rod = (0.001 ΔK/K/inch)(10 inches) = +0.01 ΔK/K. This balances the
negative reactivity of the fuel temperature change: (-0.01 ΔK/K)/(-1.25x10^{-4} ΔK/K/deg.C) = +80 deg. C.

ANSWER: 006 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 3, pg. 51.

ANSWER: 007 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 1, pg. 24.

ANSWER: 008 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg.11.

ANSWER: 009 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory,, Module 4, pg. 33.

ANSWER: 010 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 2, pg. 24.

ANSWER: 011 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pp. 17.

ANSWER: 012 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 14.

ANSWER: 013 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 6.
CR1/CR2 = (1 - K2)/(1 - K1) ; 1500/6000 = (1 - K2)/(1 - 0.984) ; K2 = 0.996

ANSWER: 014 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 2, pg. 9.

ANSWER: 015 (1.00)
C.
REFERENCE:
Insertion of a control rod inserts negative reactivity to balance the positive reactivity added when removing a neutron absorber.

ANSWER: 016 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 3, pg. 38.

ANSWER: 017 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 3, pg. 21.
Since the 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.

ANSWER: 018 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 3, pg. 8.

ANSWER: 019 (1.00)

A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Description of TRIGA Mark II Reactor, pg. 16.

ANSWER: 020 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Nuclear Physics and Reactor Theory, Module 4, pg. 5.

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

ANSWER: 001 (1.00)
C.
REFERENCE:
Procedure Plan-E, Emergency Response.

ANSWER: 002 (1.00)
D.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.4.1.

ANSWER: 003 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Radiological Safety

ANSWER: 004 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. IV, Radiation Detection
The window stops the betas, and so the gamma dose rate is 60 mrem/hour.

ANSWER: 005 (1.00)
D.
REFERENCE:
ADMN-6, Authorization of Experiments.

ANSWER: 006 (1.00)
B.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.2.3.

ANSWER: 007 (1.00)
A,4; B,2; C,2; D,1
REFERENCE:
10 CFR 55

ANSWER: 008 (1.00)
D.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.2.1c.

ANSWER: 009 (1.00)
A.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.3.3c.

ANSWER: 010 (1.00)
A.
REFERENCE:
Technical Specifications, Section 3.3.2.a

ANSWER: 011 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Control Console Operator's Manual, page 3-1.

ANSWER: 012 (1.00)
C.
REFERENCE:
HP-1, Radiation Monitoring - Personnel

ANSWER: 013 (1.00)
D.
REFERENCE:
HP-7, Radiation Work Permits.

ANSWER: 014 (1.00)
C.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.3.1.c.

ANSWER: 015 (1.00)
C.
REFERENCE:
10 mrem/hr at 1 meter (100 cm.) = 111.1 mrem/hr. at 30 cm.

ANSWER: 016 (1.00)
D.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 4.1.1.

ANSWER: 017 (1.00)
D.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.2.1c.

ANSWER: 018 (1.00)
C.
REFERENCE:
NETL Security Badge Policy.

ANSWER: 019 (1.00)
B.
REFERENCE:
Nuclear Power Plant Health Physics and Radiation Protection

ANSWER: 020 (1.00)
A,2; B,2; C,3; D,1.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Definitions.

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER: 001 (1.00)
D.
REFERENCE:
University of Texas SAR, page 4-69.

ANSWER: 002 (1.00)
C.
REFERENCE:
University of Texas SAR, page 4-59.

ANSWER: 003 (1.00)
B.
REFERENCE:
University of Texas SAR, page 5-8.

ANSWER: 004 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 26.

ANSWER: 005 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 34.

ANSWER: 006 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. V, ICS System Surveillance Interlock and SCRAM Features.

ANSWER: 007 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Operation Support Systems, page 6.

ANSWER: 008 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Operation Support Systems, page 21.

ANSWER: 009 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Description of TRIGA Mark II Reactor, page 14.

ANSWER: 010 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 36.

ANSWER: 011 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Description of TRIGA Mark II Reactor, page 16.

ANSWER: 012 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Operation Support Systems, page 24.

ANSWER: 013 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. V, Air Confinement System Surveillance.

ANSWER: 014 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Control Console Operator's Manual, page 5-3.

ANSWER: 015 (1.00)
A,1; B,3; C,2; D,1.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, figure 2-1.

ANSWER: 016 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Control Console Operator's Manual, pages 5-3, 5-4.

ANSWER: 017 (1.00)
D.
REFERENCE:
SAR 5.2.1

ANSWER: 018 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 34.

ANSWER: 019 (1.00)
C.
REFERENCE:
GA Maintenance Manual

ANSWER: 020 (1.00)
B.
REFERENCE:
Reactor Description,. Section 2.1.7

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)
If you change your answer, write your selection in the blank.

001 a b c d _____

002 a b c d _____

003 a b c d _____

004 a b c d _____

005 a b c d _____

006 a b c d _____

007 a b c d _____

008 a b c d _____

009 a b c d _____

010 a b c d _____

011 a b c d _____

012 a b c d _____

013 a b c d _____

014 a b c d _____

015 a b c d _____

016 a b c d _____

017 a b c d _____

018 a b c d _____

019 a b c d _____

020 a b c d _____

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

B. NORMAL/EMERGENCY PROCEDURES AND RADIOLOGICAL CONTROLS

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)
If you change your answer, write your selection in the blank.

001 a b c d _____

002 a b c d _____

003 a b c d _____

004 a b c d _____

005 a b c d _____

006 a b c d _____

007 a_____ b_____ c_____ d _____

008 a b c d _____

009 a b c d _____

010 a b c d _____

011 a b c d _____

012 a b c d _____

013 a b c d _____

014 a b c d _____

015 a b c d _____

016 a b c d _____

017 a b c d _____

018 a b c d _____

019 a b c d _____

020 a_____ b_____ c_____ d _____

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)
If you change your answer, write your selection in the blank.

001 a b c d _____

002 a b c d _____

003 a b c d _____

004 a b c d _____

005 a b c d _____

006 a b c d _____

007 a b c d _____

008 a b c d _____

009 a b c d _____

010 a b c d _____

011 a b c d _____

012 a b c d _____

013 a b c d _____

014 a b c d _____

015 a_____b_____c_____d _____

016 a b c d _____

017 a b c d _____

018 a b c d_____

019 a b c d _____

020 a b c d _____

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

EQUATION SHEET

$Q = m\, c_p\, \Delta T$

$P = P_0\, e^{(t/\tau)}$

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

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

$\rho = (Keff-1)/Keff$

1 kW = 3413 Btu/hour

$°F = 9/5°C + 32$

$CR_1\, (1-Keff)_1 = CR_2\, (1-Keff)_2$

$\tau = (\ell^*/\rho) + [(\beta-\rho)/\lambda_{eff}\rho]$

$DR_1 D_1^2 = DR_2 D_2^2$

$DR = 6CiE/D^2$

1 ft^3 (water) = 7.48 gallons

1 gallon (water) = 8.34 pounds

$°C = 5/9\,(°F - 32)$