October 3, 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-03-02, UNIVERSITY OF TEXAS

Dear Mr. O'Kelly:

During the week of September 8, 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
New, Research and Test Reactors Program (RNRP)
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-602

Enclosures: 1. Initial Examination Report No. 50-602/OL-03-02
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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<u>DISTRIBUTION w/encls.</u>:
PUBLIC
AAdams, PM
Facility File (EBarnhill - O6-D17)

DISTRIBUTION w/o encls.:
RNRP\R&TR r/f
WEresian
PMadden

ADAMS EXAMINATION PACKAGE ACCESSION NO.: ML032671323
ADAMS INITIAL EXAMINATION REPORT ACCESSION NO.: ML032680616 **NRR-074**

OFFICE	RNRP:CE		IROB:LA		RNRP:SC	

NAME	WEresian:rdr	EBarnhill	PMadden
DATE	09/ 29 /2003	09/ 29 /2003	09/ 29 /2003

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

REPORT NO.:	50-602/OL-03-02
FACILITY DOCKET NO.:	50-602
FACILITY LICENSE NO.:	R-129
FACILITY:	University of Texas
EXAMINATION DATES:	September 11-12, 2003
EXAMINER:	Warren Eresian, Chief Examiner

SUBMITTED BY: ***/RA/*** 09/ 29 /2003
Warren Eresian, Chief Examiner Date

SUMMARY:

During the week of September 8, 2003, the NRC administered operator licensing examinations to two Reactor Operator candidates. 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	**2/0**	**N/A**	**2/0**
Operating Tests	**2/0**	**N/A**	**2/0**
Overall	**2/0**	**N/A**	**2/0**

3. Exit Meeting:

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

The NRC thanked the facility staff for their cooperation during the examination. No generic examination concerns were noted.

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

FACILITY: University of Texas

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 09/11/2003

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 -1.25×10^{-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 -7.0×10^{-5} Δ k/k/deg. F and the differential rod worth of the regulating rod is 8.87×10^{-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

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)

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

a. Maximum excess reactivity = 0.2% ΔK/K.

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

c. Pool water conductivity = 2 micromho/cm.

d. Reactivity of a moveable experiment = 1% ΔK/K.

QUESTION: 002 (1.00)

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.

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 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.

QUESTION: 006 (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.

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

QUESTION: 007 (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.

QUESTION: 008 (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.

QUESTION: 009 (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: 010 (1.00)

Following an abnormal shutdown, the reactor may be restarted only with the approval of:

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.

QUESTION: 011 (1.00)

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.

QUESTION: 012 (1.00)

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. 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.

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

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

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

QUESTION: 013 (1.00)

Which ONE of the following statements is applicable when moving experiments in the reactor pool?

a. Explosive materials in quantities greater than 25 milligrams shall be encapsulated in specially designed container.

b. The reactivity worth of any moveable experiment shall be less than $2.50.

c. The reactor must be subcritical by at least $0.25.

d. A licensed operator shall supervise all experiment movements in the reactor pool.

QUESTION: 014 (1.00)

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

a. Relocation of a $0.75 experiment.

b. Reactor Pool Power Calibration.

c. Pulsing the reactor.

d. Movements of fuel within the reactor bay.

QUESTION: 015 (1.00)

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 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.

b. 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.

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.

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

QUESTION: 016 (1.00)

Which ONE of the following is the Emergency Plan definition of Action Levels?

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

b. 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 emergency measures.

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

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

QUESTION: 017 (1.00)

The scram time for a scrammable control rod was last measured on July 31, 2001. Which ONE of the following dates is the latest time that maintenance may be performed again without exceeding the Technical Specification requirement?

a. February 14, 2002.

b. July 31, 2002.

c. October 31, 2002.

d. January 31, 2003.

QUESTION: 018 (1.00)

The CURIE content of a radioactive source is a measure of:

a. the number of radioactive atoms in the source.

b. the energy emitted per unit time by the source.

c. the amount of damage to body tissue per unit time.

d. the number of nuclear disintegrations per unit time.

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

QUESTION: 019 (1.00)

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

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

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

c. The transient rod withdrawal time is 18 seconds.

d. One fuel temperature measuring channel is inoperable.

QUESTION: 020 (1.00)

Identify the conditions in Column I with the Technical Specification definition in Column II. Column II items may be used once, more than once, or not at all.

<u>Column I</u>

a. The maximum transient reactivity insertion for the pulse operation of the reactor shall be 2.2% Δk/k in the PULSE mode.

b. Maximum excess reactivity shall be < 4.9% Δk/k.

c. The temperature of a fuel element shall not exceed 1150 degrees C for fuel element temperatures less than 500 degrees C.

d. During steady-state operation, a minimum of three reactor power level channels shall be operable.

<u>Column II</u>

1. Safety Limit (SL)
2. Limiting Safety System Setting (LSSS)
3. Limiting Condition for Operation (LCO)

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

QUESTION: 001 (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: 002 (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: 003 (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: 004 (1.00)

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 potential voltage as required for resetting the electromagnet current.

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

QUESTION: 005 (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: 006 (1.00)

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.

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

QUESTION: 007 (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: 008 (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: 009 (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: 010 (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: 011 (1.00)

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. the expansion of pool water at high temperatures does not reduce the moderating capability of the coolant.

c. demineralizer resins are not damaged.

d. activation of pool water impurities is limited.

QUESTION: 012 (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.

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

QUESTION: 013 (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: 014 (1.00)

There are small holes at various positions in the top grid plate. These holes are provided in order to:

a. ensure unimpeded coolant flow through the core.

b. ensure proper alignment of the top and bottom grid plates.

c. permit insertion of wires or foils into the core to obtain flux data.

d. allow thermocouple leads from instrumented fuel elements to pass out of the core.

QUESTION: 015 (1.00)

In order to prevent leakage of primary coolant into the secondary system, a positive pressure difference is maintained between the heat exchanger:

a. tube inlet and tube outlet.

b. shell inlet and shell outlet.

c. shell outlet and tube inlet.

d. shell inlet and tube outlet.

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

QUESTION: 016 (1.00)

During reactor operation, the HVAC system may be operated in the REACTOR OFF mode, provided that:

a. reactor power is less than 100 kW.

b. reactor operation is less than eight (8) hours duration.

c. the air particulate monitor is operable.

d. the argon purge system is operating.

QUESTION: 017 (1.00)

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.

QUESTION: 018 (1.00)

For each beam port in Column I, match its type from Column II.

	Column I		Column II
a.	Beam Port #1	1.	Tangential
b.	Beam Port #2	2.	Thru
c.	Beam Port #3	3.	Radial
d.	Beam Port #4		
e.	Beam Port #5		

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

QUESTION: 019 (1.00)

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

a. Low water level.

b. Magnet power key switch.

c. Source level trip.

d. External scram circuits.

QUESTION: 020 (1.00)

The reactor is operating at full power in the STEADY STATE mode. The operator depresses the PULSE mode switch on the console. As a result:

a. the reactor scrams.

b. the reactor enters the PULSE mode.

c. the reactor enters the PULSE mode and then scrams.

d. the reactor remains in the STEADY STATE mode.

(*****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. $7 \times 5 \times 10^{-5} / 8.75 \times 10^{-5} = 4$ 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)
D.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.4.1.

ANSWER: 002 (1.00)
A.
REFERENCE:
Procedure Plan-E, Emergency Response.

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)
A.
REFERENCE:
SAR, Section 4-1.

ANSWER: 006 (1.00)
D.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.2.1c.

ANSWER: 007 (1.00)
A.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Section 3.3.3c.

ANSWER: 008 (1.00)
C.
REFERENCE:
HP-1, Radiation Monitoring - Personnel

ANSWER: 009 (1.00)
C.
REFERENCE:
NETL Security Badge Policy.

ANSWER: 010 (1.00)
A.
REFERENCE:
OPER-2, Reactor Startup and Shutdown.

ANSWER: 011 (1.00)
D.
REFERENCE:
FUEL-1, Movement of Fuel.

ANSWER: 012 (1.00)
D.
REFERENCE:
SURV-2 “Reactor Pool Calibration”

ANSWER: 013 (1.00)
D.
REFERENCE:
FUEL-2; T.S.3.4

ANSWER: 014 (1.00)
D.
REFERENCE:
FUEL-1

ANSWER: 015 (1.00)
B.
REFERENCE:
UT-TRIGA Reactor Technical Specifications 3.3.2 & 3.3.3

ANSWER: 016 (1.00)
B.
REFERENCE:
Emergency Plan, Section 1.1, Definitions.

ANSWER: 017 (1.00)
C.
REFERENCE:
Technical Specifications, Sections 4.2.1.b and 1.31.3 (15 months)

ANSWER: 018 (1.00)
D.
REFERENCE:
10 CFR 20

ANSWER: 019 (1.00)
B.
REFERENCE:
Technical Specifications, Section 3.2.

ANSWER: 020 (1.00)
A,2; B,3; C,1; D,3.
REFERENCE:
Technical Specifications, Sections 2.1, 2.2.3, 3.1.1, 3.2.4 (table).

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER: 001 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 26.

ANSWER: 002 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 34.

ANSWER: 003 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. V, ICS System Surveillance Interlock and SCRAM Features.

ANSWER: 004 (1.00)
A.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Description of TRIGA Mark II Reactor, page 20.

ANSWER: 005 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Description of TRIGA Mark II Reactor, page 16.

ANSWER: 006 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 36.

ANSWER: 007 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. V, Air Confinement System Surveillance.

ANSWER: 008 (1.00)
B.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Control Console Operator's Manual, page 5-3.

ANSWER: 009 (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: 010 (1.00)
D.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Control Console Operator's Manual, pages 5-3, 5-4.

ANSWER: 011 (1.00)
C.
REFERENCE:
UT-TRIGA Reactor Technical Specifications, Appendix A.3.3.3.1.

ANSWER: 012 (1.00)
D.
REFERENCE:
SAR 5.2.1

ANSWER: 013 (1.00)
C.
REFERENCE:
UT-TRIGA Training Manual, Vol. II, Reactor Instrumentation and Control Systems, page 34.

ANSWER: 014 (1.00)
C.
REFERENCE:
SAR 4.4.3.

ANSWER: 015 (1.00)
C.
REFERENCE:
SAR 5.2.1.

ANSWER: 016 (1.00)
D.
REFERENCE:
OPER-5.

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

ANSWER: 018 (1.00)
A, 2; B,1; C,3; D,3; E,2.
REFERENCE:
Operation Support Systems, Section 3.4.

ANSWER: 019 (1.00)
C.
REFERENCE:
Control Console Operator's Manual, page 2-4.

ANSWER: 020 (1.00)
D.
REFERENCE:
Control Console Operator's Manual, page 6-1.

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______e______

019 a b c d ______

020 a b c d ______

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

EQUATION SHEET

$Q = m\ c_p\ \Delta T$	$CR_1\ (1\text{-}Keff)_1 = CR_2\ (1\text{-}Keff)_2$
$P = P_0\ e^{(t/\tau)}$	$\tau = (\ell^*/\rho) + [(\beta-\rho)/\lambda_{eff}\rho]$
λ_{eff} = 0.1 seconds^{-1}	$DR_1 D_1^2 = DR_2 D_2^2$
$DR = DR_o e^{-\lambda t}$	$DR = 6CiE/D^2$
$\rho = (Keff-1)/Keff$	1 ft^3 (water) = 7.48 gallons
1 kW = 3413 Btu/hour	1 gallon (water) = 8.34 pounds
$^\circ F = 9/5^\circ C + 32$	$^\circ C = 5/9\ (^\circ F - 32)$