April 16, 2001

Dr. Carl Beard
Director - NETL
University of Texas
10100 Burnet Road
Austin, TX 78758

Dear Dr. Beard:

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-602/OL-01-01

During the week of March 19, 2001, the NRC administered initial examinations to an employee 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 be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/indesx.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Patrick Isaac at (301)415-1019 or via Internet E-mail at pxi@nrc.gov.

Sincerely,

/RA/

Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-602

Enclosures: 1. Initial Examination Report No. 50-602/OL-01-01
2. Examination and answer key (RO)

cc w/encls:
Please see next page

cc:

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

Mr. Thomas Bauer
Nuclear Reactor Laboratory
University of Texas
Austin, TX 78712

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

Mr. R. Jacobi
7300 Grass Cove
Austin, TX 78759

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

April 16, 2001

Dr. Carl Beard
Director - NETL
University of Texas
10100 Burnet Road
Austin, TX 78758

Dear Dr. Beard:

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-602/OL-01-01

During the week of March 19, 2001, the NRC administered initial examinations to an employee 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 be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/indesx.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Patrick Isaac at (301)415-1019 or via Internet E-mail at pxi@nrc.gov.

Sincerely,

/RA/
Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-602

Enclosures: 1. Initial Examination Report No. 50-602/OL-01-01
2. Examination and answer key (RO)

cc w/encls:
Please see next page

DISTRIBUTION:

PUBLIC	REXB r/f	AAdams, PM	DMatthews
Facility File (EBarnhill O6-D17)		LTremper, LFDCB (T9-E10)	

ADAMS ACCESSION #: ML010960393 **TEMPLATE #: NRR-074**

To receive a copy of this document, indicate in the box: "**C**" = Copy without attachment/enclosure "**E**" = Copy with attachment/enclosure "**N**" = No copy

OFFICE	DIPM:IOLB		REXB:CE		REXB:BC	
NAME	EBarnhill		PIsaac		LMarsh	
DATE	04/ 10 /2001		04/ 09 /2001		04/ 16 /2001	

OFFICIAL RECORD COPY

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

REPORT NO.: 50-602/OL-10-01

FACILITY DOCKET NO.: 50-602

FACILITY LICENSE NO.: R-129

FACILITY: University of Texas

EXAMINATION DATES: March 21 - 22, 2001

EXAMINER: Patrick Isaac, Chief Examiner

SUBMITTED BY: ***/RA/*** 04/05/2001
Patrick Isaac, Chief Examiner Date

SUMMARY:

During the week of March 19, 2001, NRC administered Operator Licensing Examinations to one Reactor Operator (RO) candidate. The candidate passed the examinations.

REPORT DETAILS

1. Examiner: Patrick Isaac, Chief Examiner

2. Results:

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

3. Exit Meeting:

Mr. Patrick Isaac, NRC, Chief Examiner and Mr. Sean O'Kelley, University of Texas, Associate Director conducted a review of the written examination. Mr. O'Kelley requested and Mr. Isaac agreed to delete questions B.17 and C.8 from the written examination. The information provided for question B.17 was not currently correct and question C.8 does not apply to the University of Texas reactor.

ENCLOSURE 1

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

FACILITY: University of Texas

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 2001/03/21

CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:
Answers are to be written on the answer sheet provided. Attach all answer sheets to the examination. Point values 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 starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
20.00	**34.5**	_____	____	**A.**	**REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS**
19.00	**32.8**	_____	____	**B.**	**NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS**
19.00	**32.8**	_____	____	**C.**	**FACILITY AND RADIATION MONITORING SYSTEMS**
58.00		_____ **FINAL GRADE**	____**%**		**TOTALS**

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

_____
Candidate's Signature

A. RX THEORY, THERMO & FAC OP CHARS

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 ___

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

B. NORMAL/EMERG PROCEDURES & RAD CON

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 ___~~ ***DELETED***

018 a b c d ___

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

C. PLANT AND RAD MONITORING SYSTEMS

A N S W E R S H E E T

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 ___~~ ***DELETED***

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

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 neither received nor 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 and each answer sheet.

6. Mark your answers on the answer sheet provided. USE ONLY THE PAPER PROVIDED AND DO NOT WRITE ON THE BACK SIDE OF THE PAGE.

7. The point value for each question is indicated in [brackets] after the question.

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

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

10. Ensure all information you wish to have evaluated as part of your answer is on your answer sheet. Scrap paper will be disposed of immediately following the examination.

11. To pass the examination you must achieve a grade of 70 percent or greater in each category.

12. There is a time limit of three (3) hours for completion of the examination.

QUESTION A.1 [2.0 points, 0.5 each]
Match each term in column A with the correct definition in column B.

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

QUESTION A.2 [1.0 point]
You enter the control room and note that all nuclear instrumentation show a steady neutron level, and no rods are in motion. Which one of the following conditions **CANNOT** be true?

a. The reactor is critical.

b. The reactor is subcritical.

c. The reactor is supercritical.

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

QUESTION A.3 [1.0 point]
Which one of the following describes the **MAJOR** contributor to the production and depletion of Xenon respectively in a **STEADY-STATE OPERATING** reactor?

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

QUESTION A.4 [1.0 point]
Which factor of the Six Factor formula is most easily varied by the reactor operator?

a. Thermal Utilization Factor (f)

b. Reproduction Factor (η)

c. Fast Fission Factor (τ)

d. Fast Non-Leakage Factor (L_f)

QUESTION A.5 [1.0 point]
Which of the following does NOT affect the Effective Multiplication Factor (Keff)?

a. The moderator-to-fuel ratio.

b. The physical dimensions of the core.

c. The strength of installed neutron sources.

d. The current time in core life.

QUESTION A.6 [1.0 point]
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

QUESTION A.7 [1.0 point]
Several processes occur that may increase or decrease the available number of neutrons. SELECT from the following the six-factor formula term that describes an **INCREASE** in the number of neutrons during the cycle.

a. Thermal utilization factor (f).

b. Resonance escape probability (p).

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

d. Reproduction factor (η).

QUESTION A.8 [1.0 point]
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}

QUESTION A.9 [1.0 point]
K_{eff} for the reactor is 0.98. If you place an experiment worth **+$1.00** into the core, what will the new K_{eff} be?

a. 0.982

b. 0.987

c. 1.013

d. 1.018

QUESTION A.10 [1.0 point]
About two minutes following a reactor scram, period has stabilized, and is decreasing at a CONSTANT rate. If reactor power is 10^{-5} % full power what will the power be in three minutes.

a. 5×10^{-6} % full power

b. 2×10^{-6} % full power

c. 10^{-6} % full power

d. 5×10^{-7} % full power

QUESTION A.11 [1.0 point]
Core excess reactivity changes with…

d. Fuel burnup

e. Control Rod Height

f. Neutron Level

g. Reactor Power Level

QUESTION A.12 [1.0 point]
INELASTIC SCATTERING is the process by which a neutron collides with a nucleus and …

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

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

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

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

QUESTION A.13 [1.0 point]
For most materials the neutron microscopic cross-section for absorption τ_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

QUESTION A.14 [1.0 point]
Which one of the following is the definition of the FAST FISSION FACTOR?

a. The ratio of the number of neutrons produced by fast fission to the number produced by thermal fission

b. The ratio of the number of neutrons produced by thermal fission to the number produced by fast fission

c. The ratio of the number of neutrons produced by fast and thermal fission to the number produced by thermal fission

d. The ratio of the number of neutrons produced by fast fission to the number produced by fast and thermal fission

QUESTION A.15 [1.0 point]
Which one of the following is the **MAJOR** source of energy released during fission?

a. Kinetic energy of the fission neutrons.

b. Kinetic energy of the fission fragments.

c. Decay of the fission fragments.

d. Prompt gamma rays.

QUESTION A.16 [1.0 point]
As primary coolant temperature increases, rod worth:

a. increases due to higher reflector efficiency.

b. decreases due to higher neutron absorption in the moderator.

c. increases due to the increase in thermal diffusion length.

d. remains the same due to constant poison cross-section of the control rods.

QUESTION A.17 [1.0 point]
The term ***PROMPT JUMP*** refers to …

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

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

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

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

QUESTION A.18 [1.0 point]
Which one of the following factors has the **LEAST** effect on K_{eff}?

a. Fuel burnup.

b. Increase in moderator temperature.

c. Increase in fuel temperature.

d. Xenon and samarium fission products.

QUESTION A.19 [1.0 point]
Which one of the 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 are born at higher energies than prompt neutrons and therefore have a greater effect.

d. Delayed neutrons take longer to reach thermal equilibrium.

QUESTION B.1 [1.0 point]
Which one of the following statements define the Technical Specifications term "Channel Test?"

a. The adjustment of a channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures

b. The qualitative verification of acceptable performance by observation of channel behavior

c. The introduction of a signal into a channel for verification of the operability of the channel

d. The combination of sensors, electronic circuits and output devices connected to measure and display the value of a parameter

QUESTION B.2 [2.0 points, 0.5 each]
Match the type of radiation in column A with its associated Quality Factor (10CFR20) from column B.

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

QUESTION B.3 [2.0 points, 0.5 each]
Match the radiation reading from column A with its corresponding radiation area classification (per 10 CFR 20) listed in column B. (Assume gamma radiation)

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

QUESTION B.4 [1.0 point]
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

QUESTION B.5 [1.0 point]
A small radioactive source is to be stored in the reactor bay with no shielding. The source reads 2 R/hr at 1 foot. A "Radiation Area" barrier would have to be erected approximately ___ from the source.

a. 400 feet

b. 40 feet

c. 20 feet

d. 10 feet

QUESTION B.6 [1.0 point]
Which one of the following is the 10 CFR 20 definition of **TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)**?

a. The sum of the deep dose equivalent and the committed effective dose equivalent.

b. The dose that your whole body receives from sources outside the body.

c. The sum of the external deep dose and the organ dose.

d. The dose to a specific organ or tissue resulting from an intake of radioactive material.

QUESTION B.7 [1.0 point]
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 B.8 [1.0 point]
Your Reactor Operator license expires after _____ years.

a. 2

b. 4

c. 6

d. 8

QUESTION B.9 [1.0 point]
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.

QUESTION B.10 [1.0 point]
Which one of the following statements concerning the Fuel Temperature Limiting Safety System Setting is *FALSE*?

a. The trip level provides a margin of 400 °C for in any condition of operation.

b. The LSSS prevents the safety limit from being reached.

c. The LSSS is not applicable in the pulse mode because of the relatively long time constant of the fuel temperature channel.

d. Two redundant temperature thermocouple sensors monitor the fuel temperature LSSS.

QUESTION B.11 [1.0 point]
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 B.12 [1.0 point]
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 B.13 [1.0 point]
The Emergency Planning Zone (EPZ) for the UT TRIGA reactor is established at the ...

a. University Safety Office.

b. Operations boundary.

c. Brackenridge Hospital.

d. Health physics room.

QUESTION B.14 [1.0 point]
In accordance with the Technical Specifications, which one situation below is permissible when the reactor is operating?

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

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

c. The Transient Rod withdrawal time is 18 seconds.

d. One fuel temperature measuring channel is inoperable.

QUESTION B.15 [1.0 point]
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.

QUESTION B.16 [1.0 point]
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

QUESTION B.17 [1.0 point] DELETED

~~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 MANUAL mode if it is not already in MANUAL.~~

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

QUESTION B.18 [1.0 point]

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 C.1 [1.0 point]
Which one of the following devices is tested during the PRESTART checks?

e. Low water level

f. Magnet power key switch

g. Source level trip

h. External scram circuits

QUESTION C.2 [1.0 point]
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 C.3 [1.0 point]
Which one of the following statements describes the moderating properties of Zirconium Hydride?

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

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

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

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

QUESTION C.4 [1.0 point]
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 C.5 [1.0 point]
Which of the rings include the chromel-alumel thermocouples?

a. A and B

b. A and C

c. B and C

d. B and D

QUESTION C.6 [1.0 point]
Which one of the following completes the following statement?

The fuel in the UT TRIGA is a homogeneous mixture of uranium-_____ hydride alloy containing _____% by weight of uranium enriched to <_____%.

a. graphite, 20, 8.5

b. zirconium, 20, 8.5

c. graphite, 8.5 , 20

d. zirconium, 8.5, 20

QUESTION C.7 [1.0 point]
Which one of the following changes will have an effect on nuclear power indications when operating in the steady state mode?

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

b. The campbelling portion of the fission chamber signal processing circuitry provides no signal at 200 KW.

c. The Primary flow rate increases.

d. Loss of power to the water temperature transmitters.

QUESTION C.8 [1.0 point] DELETED

~~Compensating voltage for a Compensated Ion Chamber is lost while the reactor is operating at a power level low in the intermediate range. How will be the indicated power change compared to the actual power?~~

~~a. unchanged~~

~~b. higher than the actual power~~

~~c. lower than the actual power~~

~~d. higher or lower than the actual power dependent on the exact power level.~~

QUESTION C.9 [1.0 point]

Which one of the following is the primary purpose of the safety plate assembly?

a. Provide additional support to the reactor grid plate to accommodate the transient rod.

b. Ensure proper alignment of the shim-safety, regulating and transient rods.

c. Retain a shim-safety rod fuel follower if it becomes detached from its mounting.

d. Retain any debris resulting from an accident which has directly involved the fuel elements.

QUESTION C.10 [1.0 point]

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

QUESTION C.11 [1.0 point]

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 C.12 [1.0 point]
Which one of the 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 demin inlet temperature is 40°C.

QUESTION C.13 [1.0 point]
Which one of the following statements correctly describes the purpose of the potentiometer in the regulating 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 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 C.14 [1.0 point]
The control rods must drop in the core in less than 1 sec. How is damage to the rods prevented at the end of their travel?

a. A spring mechanism reduces bottom impact.

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

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

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

QUESTION C.15 [1.0 point]
Which one of the following beam ports does NOT penetrate the graphite reflector?

a. 5

b. 4

c. 3

d. 1

QUESTION C.16 [1.0 point]
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 C.17 [1.0 point]
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 C.18 [1.0 point]
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 C.19 [1.0 point]
The pneumatic sample system has several design features including:

a. An override so the control room can return a sample from the reactor to its origin.

b. The use of dry compressed CO_2 to minimize production of Ar-41.

c. Control room permissive for each remote sample station.

d. Automatic return override if the samples get more exposure than expected.

QUESTION C.20 [1.0 point]
Which one of the following is NOT a condition that must exist for the system to enter the Pulse

mode?

a. System in Manual Mode.

b. Reactor period must be infinite.

c. Transient rod all the way down.

d. Reactor power less than 1 kW.

***** END OF EXAMINATION*****

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

A.2 c
REF: Standard NRC question

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

A.4 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2, pp. 3-13 — 3-18.

A.5 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.3.4, p. 3-21.

A.6 d
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 5.7, pp. 5-28 — 5-38.

A.7 d
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2, pp. 3-13 — 3-18.

A.8 d
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 2.5.3 p. 2-45.

A.9 b
REF: SDM = $(1-k_{eff})/k_{eff}$ = (1-0.98)/0.98 = 0.02/0.99 = 0.02041 or 0.02041/.0075 = \$2.72, or a reactivity worth (τ) of -\$2.72. Adding +\$1.00 reactivity will result in a SDM of \$2.72 - \$1.00 = \$1.72, or .0129081 τ K/K
K_{eff} = 1/(1+SDM) = 1/(1 + 0.0129081) = 0.987

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

A.11 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 6.2 p. 6-1 — 6-4.

A.12 b
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 2.4.5 p. 2-28.

A.13 b
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 2.5.1 p. 2-36.

A.14 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.3.1 p. 3-16.

A.15 b
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2.1, p. 3-4.

A.16 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.3.2, p. 3-18

A.17 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 4.7, p. 4-21

A.18 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.3.2, p. 3-18.

A.19 b
REF: Burn, R., *Introduction to Nuclear Reactor Operations*, © 1982, § 3.2.4, p. 3-12.

B.1 c
REF: Technical Specifications Section 1.0

B.2 a, 20; b, 1; c, 1; d, 10
REF: 10CFR20.100x

B.3 a, 2; b, 3; c, 3; d, 4
REF: 10 CFR 20.1003, Definitions

B.4 b
REF: 10CFR50.54(y)

B.5 c
REF: $\frac{DR_1}{X_2^2} = \frac{DR_2}{X_1^2} X_2^2 = \frac{DR_1}{DR_2} X$ $X_2^2 = \frac{2000}{5} \times 1^2 = 400 ft^2 X_2 = 20 f$

B.6
a
REF: 10 CFR 20.1003 *Definitions*

B.7 b
REF: Nuclear Power Plant Health Physics and Radiation Protection

B.8 c
REF: 10CFR55.55(a)

B.9 d
REF: SURV-2 “Reactor Pool Calibration”

B.10 c
REF: SOP II, *REACTOR OPERATIONS*, C.6, and 10 CFR 50.36

B.11 d
REF: FUEL-2; T.S.3.4

B.12 d
REF: FUEL-1

B.13 b
REF: Emergency Plan

B.14 b
REF: Technical Specifications, Section 3.2

B.15 b
REF: Technical Specifications 3.3.2 & 3.3.3

B.16 c
REF: 10 CFR 50.54 (q); 10 CFR 50.59; 10 CFR 55.59

B.17 a **DELETED**
REF: Control Console Operator’s Manual, page 3-1.

B.18 c
REF: HP-1, Radiation Monitoring - Personnel

C.1 c
REF: GA Control Console Operator's Manual pg. 2-5

C.2 d
REF SAR 5.2.1

C.3 d
REF GA - 3886 (Rev. A) TRIGA Mark III Reactor Hazards Analysis, Feb. 1965.

C.4 c
REF: GA Maintenance Manual

C.5 c
REF SURV-1

C.6 d
REF SAR Section 4.4.5.2

C.7 b
REF SAR 6.1.1

C.8 b **DELETED**
REF: BASIC PHYSICS FOR NUCLEAR POWER PLANT OPERATORS

C.9 c
REF SAR 4.4.4

C.10 c
REF SAR 4.1.2

C.11 a
REF Tech. Specs 3.3.2.a (Reportable - LCO violated)

C.12 b
REF: Rx Description Sect. 2.1.7

C.13 a
REF: SAR 4.4.8.2

C.14 d
REF: SAR 4.4.8.1

C.15 b
REF: Support Systems Sect. 3.4

C.16 d
REF SAR 4.4.6.3

C.17 d
REF: Support Systems 1.2

C.18 b
REF: Reactor Description 1.8.4

C.19 b

REF: Support Systems 3.2

C.20 b
REF: Control Console Operator’s Manual, Pulse Mode pg. 6-1