December 21, 2001

Dr. B. Don Russell. Deputy Director
Texas Engineering Experiment Station
Texas A&M University
Nuclear Science Center, Bldg. 1095
College Station, TX 77843-3575

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-128/OL-02-01

Dear Dr. Russell:

During the week of November 12, 2001, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your Texas A&M University 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/

Eugene V. Imbro, Acting Chief
Operational Experience and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-128

Enclosures: 1. Initial Examination Report No. 50-128/OL-02-01
2. Examination and answer key (RO)

cc w/encls:
Please see next page

cc:

Texas A&M University System
ATTN: Dr. Warren D. Reece, Director
Nuclear Science Center
Texas Engineering Experiment Station
F.E. Box 89, M/S 3575
College Station, TX 77843

Texas State Department of Health
Radiation Control Program Director
Bureau of Radiation Control
1100 West 49th Street
Austin, TX 78756-3189

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

U.S. Customs Service
Safety Branch
ATTN: Mr. Rick Whitman
6026 Lakeside Boulevard
Indianapolis, IN 46278

U.S. Department of Transportation
Mr. Raymond Lamagdelaine, Special
Investigations Chief
Office of Hazardous Materials Enforcement
DHR-40
400 7th Street, S.W.
Washington, DC 20590

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

REPORT NO.: 50-128/OL-02-01

FACILITY DOCKET NO.: 50-128

FACILITY LICENSE NO.: R-129

FACILITY: Texas A&M University

EXAMINATION DATES: November 13 - 14, 2001

EXAMINER: Patrick Isaac, Chief Examiner

SUBMITTED BY: ***/RA/*** 11/29/2001
Patrick Isaac, Chief Examiner Date

SUMMARY:

During the week of November 12, 2001, NRC administered Operator Licensing Examinations to two Reactor Operator (RO) and one Senior Reactor Operator Upgrade (SROU) candidates. All the candidates passed the examinations.

REPORT DETAILS

1. Examiner: Patrick Isaac, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**2/0**	**N/A**	**2/0**
Operating Tests	**2/0**	**1/0**	**3/0**
Overall	**2/0**	**1/0**	**3/0**

3. Exit Meeting

An exit meeting was conducted on November 14, 2001, between the Chief Examiner and Mr. Bill Asher, Training Coordinator for the Texas A&M University Reactor, to discuss the preliminary results of the examinations. There were no generic concerns raised by the examiner.

ENCLOSURE 1

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

FACILITY: Texas A&M

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 2001/11/13

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	33.3	_____	____	A.	REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	33.3	_____	____	B.	NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.3	_____	____	C.	FACILITY AND RADIATION MONITORING SYSTEMS
60.00		_____ FINAL GRADE	____%		TOTALS

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

_____
Candidate's Signature

ENCLOSURE 2

A. RX THEORY, THERMO & FAC OP CHARS

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 ___

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/EMERG PROCEDURES & RAD CON

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 ___

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 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 ___

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 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 001 (1.00)
Inelastic Scattering is the process whereby a neutron collides with a nucleus and:

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

b. recoils with a lower kinetic energy, with the nucleus emitting a gamma ray.

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

d. recoils with a higher kinetic energy, with the nucleus emitting a gamma ray.

QUESTION 002 (1.00)
An example of a fissile isotope which occurs naturally is:

a. Pu-239

b. U-238

c. U-235

d. Th-232

QUESTION: 003 (1.00)

Given:	Shutdown margin	$4.50
	Control Rod 1	$2.00
	Control Rod 2	$2.00
	Control Rod 3	$1.00

What is the excess reactivity for this reactor?

a. $0.50

b. $1.50

c. $2.50

d. $5.00

QUESTION: 004 (1.00)
During the time when reactor power decreases, the delayed neutron fraction, β:

a. decreases because delayed neutron precursors are being produced at a slower rate.

b. decreases because prompt neutrons are being produced at a slower rate.

c. increases because delayed neutrons are being produced from precursors that were formed at the higher power level.

d. remains unchanged.

QUESTION: 005 (1.00)
When a reactor is prompt critical, the neutron multiplication rate is determined by:

a. the generation time of prompt neutrons only.

b. the value of β_{eff}.

c. the generation time of delayed neutrons only.

d. the half-life of the shortest-lived delayed neutron precursor.

QUESTION: 006 (1.00)
The core of reactor A is in the form of a sphere of radius R. The core of reactor B is in the form of a cube, with edge length R. The neutron leakage from reactor B, compared to reactor A, will be:

a. greater than A.

b. approximately the same as A.

c. exactly the same as A.

d. less than A.

QUESTION: 007 (1.00)
Which ONE of the following conditions would INCREASE the shutdown margin of a reactor?

a. Inserting an experiment which adds positive reactivity.

b. Lowering the moderator temperature, if the moderator temperature coefficient is negative.

c. Depletion of burnable poison.

d. Depletion of uranium fuel.

QUESTION: 008 (1.00)
When a reactor is scrammed, the xenon population starts to increase. This occurs primarily because:

a. delayed neutrons are continuing to be produced and cause fissions, resulting in xenon production.

b. the half-life for the decay of I-135 is shorter than the half-life for the decay of Xe-135.

c. Xe-135 is stable and does not decay.

d. the neutron population is so low that xenon burnout does not occur.

QUESTION: 009 (1.00)
A reactor is operating at criticality. Instantaneously, all of the delayed neutrons are suddenly removed from the reactor. The K_{eff} of the reactor in this state would be approximately:

a. 1.007

b. 1.000

c. 0.993

d. 0.000

QUESTION: 010 (1.00)
A reactor is critical at full rated power, with reactivity = zero. A control rod is inserted and the power decreases to a lower steady-state value. The reactivity of the reactor at the lower power level is zero because:

a. the positive reactivity due to the fuel temperature decrease balances the negative reactivity due to the control rod insertion.

b. the negative reactivity due to the fuel temperature decrease equals the negative reactivity due to the control rod insertion.

c. the positive reactivity due to the fuel temperature increase balances the negative reactivity due to the control rod insertion.

d. the negative reactivity due to the fuel temperature increase equals the negative reactivity due to the control rod insertion.

QUESTION: 011 (1.00)
Given the following neutron life cycle for a critical reactor:

100 fast neutrons are produced from the previous generation and start to slow down. 20 neutrons are captured in resonance peaks, and 10 leak out of the core after they have reached thermal energy. The remaining neutrons are absorbed in fuel and other materials. Each fission produces 2.5 neutrons, and 85% of the neutrons absorbed in fuel result in fissions. For this reactor, the thermal utilization factor is:

a. 0.47

b. 0.62

c. 0.67

d. 1.613

QUESTION: 012 (1.00)
Which ONE of the following elements will slow down fast neutrons most quickly, i.e. produces the greatest energy loss per collision?

a. Oxygen-16

b. Uranium-238

c. Hydrogen-1

d. Boron-10

QUESTION: 013 (1.00)
A hypothetical fuel produces 20% of its power from the fission of element X and 80% of its power from the fission of element Y. The beta fraction of element X is 0.006 and the beta fraction of element Y is 0.008. The beta fraction of the fuel as a whole is:

a. 0.0064

b. 0.0070

c. 0.0076

d. 0.0140

QUESTION: 014 (1.00)
An operating reactor generates 10^{15} fissions per second. The power of the reactor is approximately:

a. 16 kW

b. 32 kW

c. 48 kW

d. 64 kW

QUESTION: 015 (1.00)
The Inhour Equation relates reactivity insertion, ρ, to reactor period, T.
Reactivity insertion A is +0.001 delta k/k, and reactivity insertion B is -0.001 delta k/k. The absolute value of the period will be:

a. smaller for A.

b. larger for A.

c. smaller for B.

d. the same for A and B.

QUESTION: 016 (1.00)
A 1/M curve is being generated as fuel is loaded into the core. After some fuel elements have been loaded, the count rate existing at that time is taken to be the new initial count rate, C_o. Additional elements are then loaded and the inverse count rate ratio continues to decrease. As a result of changing the initial count rate:

a. criticality will occur earlier (i.e. with fewer elements loaded.)

b. criticality will occur later (i.e. with more elements loaded.)

c. criticality will occur with the same number of elements loaded.

d. criticality will be completely unpredictable.

QUESTION: 017 (1.00)
A reactor power calibration is being performed by measuring the rate of temperature increase in the reactor pool. Which ONE of the following conditions would result in calculated power being LESS THAN actual power?

a. The measured final temperature is greater than the true temperature.

b. The measured final temperature is less than the true temperature.

c. The calculated volume of water in the pool is greater than the true volume.

d. The calculated rate of temperature increase is greater than the true rate.

QUESTION: 018 (1.00)
Delayed neutron precursors decay by beta decay. Which ONE reaction below is an example of beta decay?

a. $_{35}Br^{87} \rightarrow {}_{33}Kr^{83}$

b. $_{35}Br^{87} \rightarrow {}_{35}Kr^{86}$

c. $_{35}Br^{87} \rightarrow {}_{34}Kr^{86}$

d. $_{35}Br^{87} \rightarrow {}_{36}Kr^{87}$

QUESTION: 019 (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.

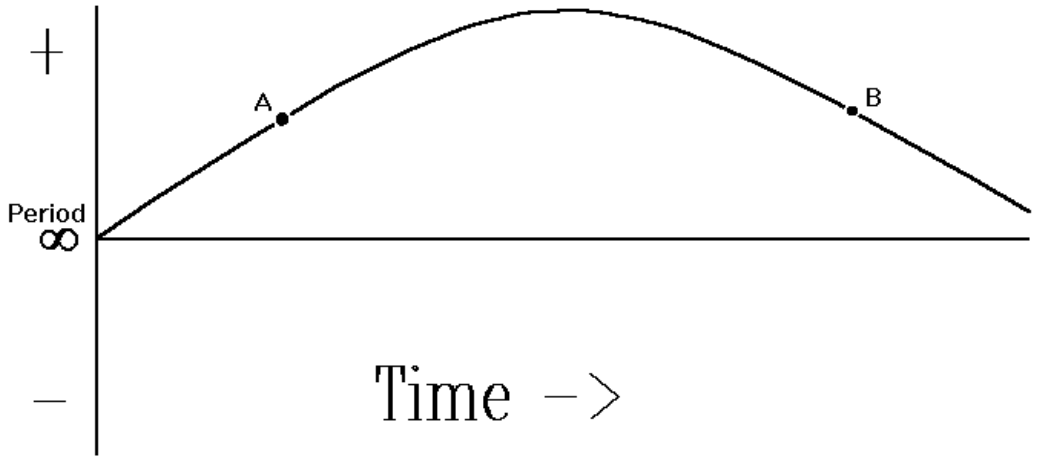
QUESTION: 020 (1.00)
Shown below is a trace of reactor period as a function of time. Between points A and B, reactor power is:

a. continually increasing.

b. increasing, then decreasing.

c. continually decreasing.

d. constant.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A
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QUESTION: 001 (1.00)
The SRO on duty has directed you to "secure the reactor." This is done by:

a. fully inserting all control rods and placing the rod control switches to NEUTRAL.

b. scramming the reactor.

c. removing all experiments.

d. removing the reactor key from the control console.

QUESTION: 002 (1.00)
You observe a loss of reactor pool water which can be controlled by adding makeup water. In accordance with the Emergency Plan, your first course of action is to:

a. assess the severity of the pool water loss by observing the leakage rate and reactor bridge area radiation monitor readings.

b. send a member of Reactor Operations to the west end of the pool and position the emergency cover over the 10-inch cooling exit line.

c. dispatch teams to take appropriate action to determine source of leakage and correct by valve manipulation if possible.

d. shutdown the reactor.

QUESTION: 003 (1.00)
In accordance with SOP "Personnel Dosimetry," an Expected High Dose Individual is a person who:

a. may receive a dose greater than the annual limit.

b. may receive a dose greater than 10% of the annual limit.

c. will not be expected to exceed 10% of the annual limit.

d. has received an unknown amount of radiation resulting from an accident.

QUESTION: 004 (1.00)
In accordance with the Emergency Classification Guide, all alarms from the Facility Air Monitor System are classified as Operational Events with the exception of:

a. Stack Particulate Monitor.

b. Building Gas Monitor.

c. Fission Gas Monitor.

d. Stack Gas Monitor.

QUESTION: 005 (1.00)
Which ONE of the following does not require the direct supervision (i.e., presence) of an SRO?

a. Movement of the reactor bridge.

b. Initiation of a pulse.

c. Removal of a control rod.

d. Performance of a power calibration of the Linear Power Channel.

QUESTION: 006 (1.00)
Which ONE of the following conditions is NOT permissible when the reactor is operating, or about to be operated?

a. The reactivity worth of a single experiment = $1.00.

b. A control rod scram = 1.5 seconds.

c. An excess reactivity = $2.20.

d. The Continuous Air Radiation Monitor is inoperable due to maintenance.

QUESTION: 007 (1.00)
Limiting Safety System Settings:

a. are limits on important process variables which are found to be necessary to reasonably protect the integrity of certain physical barriers which guard against the uncontrolled release of radioactivity.

b. are settings for automatic protective devices related to those variables having significant safety functions.

c. are combinations of sensors, interconnecting cables or lines, amplifiers, and output devices which are connected for the purpose of measuring the value of a variable.

d. are the lowest functional capability or performance levels of equipment required for safe operation of the facility.

QUESTION: 008 (1.00)
The Total Effective Dose Equivalent (TEDE) is defined as the sum of the deep-dose equivalent and the committed effective dose equivalent. The deep-dose equivalent is related to:

a. the dose to organs or tissues.

b. the external exposure to the skin or an extremity.

c. the external exposure to the lens of the eye.

d. the external whole-body exposure.

QUESTION: 009 (1.00)
An automatic scram signal which is NOT required by the Technical Specifications when operating in the steady state mode is:

a. short period.

b. high fuel temperature.

c. high power level.

d. loss of detector high voltage.

QUESTION: 010 (1.00)
In accordance with 10CFR55, a licensed operator must:

a. pass a comprehensive requalification written examination and an annual operating test during a 24-month period.

b. complete a minimum of six hours of shift functions each month.

c. have a medical examination during the six-year term of the license.

d. notify the NRC within 30 days following an arrest.

QUESTION: 011 (1.00)
Operation of the reactor in the steady state mode means that:

a. the mode switch is in the steady state position.

b. reactor power is constant.

c. reactor power is constant, with power controlled by the servo system.

d. the mode switch is in the steady state position with power at 1 MW.

QUESTION: 012 (1.00)
A "Red Tag" can only be initiated by:

a. the SRO on duty.

b. any SRO.

c. any NSC staff member.

d. the Manager of Reactor Operations.

QUESTION: 013 (1.00)
In accordance with 10CFR20, the "Derived Air Concentration (DAC) 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. limits on the release of effluents to an unrestricted environment.

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

QUESTION: 014 (1.00)
You are standing ten (10) feet from a point source of radiation. When a ¼ inch sheet of lead is placed between you and the source, your exposure rate is halved. How many sheets of lead are required to reduce your exposure rate to 1% of its original value?

a. 2

b. 6

c. 7

d. 10

QUESTION: 015 (1.00)
Information regarding the assembly and location of each fuel bundle is found in the:

a. fuel log.

b. operations log.

c. supervisor log.

d. reactor data log.

QUESTION: 016 (1.00)
"The temperature in a TRIGA-FLIP fuel element shall not exceed 2100°F (1150°C) under any conditions of operation." 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)
The Design Basis Accident for the TA&M reactor is:

a. an accidental pulse at full power.

b. a loss of coolant accident (reactor pool is accidentally drained of water).

c. the loss of integrity of one fuel element cladding and the simultaneous loss of pool water.

d. the accidental insertion of an experiment with a positive reactivity worth of $1.00 while the reactor is critical.

QUESTION: 018 (1.00)
An experiment with a reactivity worth of $0.40 is to be removed from the core. Prior to performing this operation:

a. reactor power must be less than 600 kW.

b. the reactor must be subcritical.

c. the reactor must be subcritical by at least $0.40.

d. the reactor must be shutdown.

QUESTION: 019 (2.00)
Match each of the following actions in Column I with the correct term from the Technical Specifications in Column II: Channel Check, Channel Test, or Channel Calibration. (Only one term per action).

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

QUESTION: 001 (1.00)
Which ONE of the following provides a reactor scram in any mode of operation?

a. High fuel temperature.

b. Low pool level.

c. High power level.

d. Loss of supply voltage to high power level detector.

QUESTION: 002 (1.00)
When the reactor is being controlled by the servo controller:

a. the period scram is bypassed.

b. the regulating rod moves in response to the linear channel signal.

c. the regulating rod moves in response to the log power channel signal.

d. the regulating rod moves out following a scram to try to maintain constant power.

QUESTION: 003 (1.00)
The reactor is in the "PULSE" mode when the TR fire button is depressed. As a result, the solenoid valve is:

a. energized, admitting air to the cylinder.

b. de-energized, admitting air to the cylinder.

c. de-energized, removing air from the cylinder.

d. energized, removing air from the cylinder.

QUESTION: 004 (1.00)
A safety plate assembly is installed beneath the reactor grid plate. Its purpose is to:

a. stop a standard fuel element from dropping more than 2 inches out of the core if it should become detached from its mounting.

b. stop a FLIP fuel element from dropping more than 2 inches out of the core if it should become detached from its mounting.

c. stop a control rod follower from dropping more than 2 inches out of the core if it should become detached from its mounting.

d. provide a stop for the grid plate if it should become detached from the suspension frame.

QUESTION: 005 (2.00)
Which ONE of the following statements correctly describes system response for a pool level drop to less than 90%?

a. Two float switches actuate. One stopping the pool water recirculation pump and one energizing an alarm at the University Communications Room.

b. Two float switches actuate. Each stopping the pool water recirculation pump and energizing an alarm at the University Communications Room.

c. One float switch actuates. This switch both stops the pool water recirculation pump and energizes an alarm at the University Communications Room.

d. One float switch actuates. This switch energizes an alarm at the University Communications Room. The pool water recirculation pump continues to operate.

QUESTION: 006 (1.00)
For a control rod, the "CARR UP" light is OFF, the "CARR DOWN" light is OFF, and the "ENGAGED" light is ON. This indicates that:

a. the rod and drive are in contact, and are both full in.

b. the rod and drive are in contact, and are both full out.

c. the rod and drive are not in contact, and the rod and drive are somewhere between full in and full out.

d. the rod and drive are in contact, and are somewhere between full in and full out.

QUESTION: 007 (1.00)
Under emergency conditions, the master control panel located in the reception room may be used to:

a. scram the reactor.

b. operate the air handling systems.

c. operate the emergency pool fill system.

d. operate the emergency lighting system.

QUESTION: 008 (1.00)
The FLIP fuel elements:

a. are about 20% enriched uranium with stainless steel clad and no burnable poison.

b. are about 70% enriched uranium with stainless steel clad and erbium burnable poison.

c. are about 20% enriched uranium with aluminum clad and erbium burnable poison.

d. are about 70% enriched uranium with aluminum clad and no burnable poison.

QUESTION: 009 (1.00)
Which ONE of the following controls the amount of reactivity that is inserted by the transient rod during pulse operations?

a. The preset pulse timer setting that vents the pneumatic piston.

b. The pressure of the air applied to the pneumatic piston.

c. The position of the cylinder.

d. The reactivity of the reactor prior to firing the pulse.

QUESTION: 010 (1.00)
The purpose of the diffuser above the core during operation is to:

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

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

c. better distribute heat throughout the pool.

d. ensure consistent water chemistry in the core.

QUESTION: 011 (1.00)
When the stack particulate activity alarm sounds, which ONE of the following occurs?

a. The reactor scrams.

b. The evacuation alarm sounds.

c. The air handling system shuts down.

d. There are no automatic actions.

QUESTION: 012 (2.00)
Match the neutron measuring channel in Column A with the type of detector in Column B.

Column A	Column B
a. Log Power Channel	1. Compensated Ion Chamber
b. Linear Power Channel	2. Uncompensated Ion Chamber
c. Safety Power Channel	3. Fission Chamber
d. Pulse Power Channel	4. G-M Tube

QUESTION: 013 (1.00)
More than 95% of the facility's Ar-41 is produced:

a. in the beam ports.

b. in the pneumatic system.

c. in the reactor building atmosphere.

d. in the reactor pool.

QUESTION: 014 (1.00)
The reactor is operating at 800 kW, with power being controlled by the servo control system. An experiment is inadvertently inserted into the core, causing reactor power to drop to 600 kW. As a result:

a. the regulating rod moves out of the core in an effort to restore power to 800 kW.

b. the reactor scrams.

c. regulating rod control shifts back to manual.

d. the regulating rod moves into the core to maintain power at 600 kW.

QUESTION: 015 (1.00)
The chemical feed system controls the chemical characteristics of the:

a. secondary cooling loop.

b. pool water cooling system.

c. purification system.

d. pool water transfer system.

QUESTION: 016 (1.00)
Which ONE of the following is NOT selected using the fuel element temperature selector switch?

a. Instrumented Fuel Element Temperature

b. Pool Temperature

c. Irradiation Cell Temperature

d. Instrumented Fuel Peak Temperature

QUESTION: 017 (1.00)
Thermocouples in the instrumented fuel element measure temperature at the:

a. interior surface of the cladding.

b. center of the zirconium rod.

c. outer surface of the fuel.

d. interior of the fuel.

QUESTION: 018 (1.00)
When a compensated ion chamber is used for neutron detection at low power levels, how is the gamma flux accounted for?

a. The gamma flux is cancelled by creating an equal and opposite gamma current.

b. The gamma flux is proportional to neutron flux and is counted with the neutrons.

c. Pulse height discrimination is used to eliminate the gamma flux.

d. The gamma flux passes through the detector with no interaction because of detector design.

QUESTION: 019 (1.00)
Which ONE of the following is the method used for to generate the signal for the control rod position digital read outs on the control console?

a. A series of reed switches open/close as the rod moves generating a signal proportional to rod position.

b. A lead screw on the control rod varies the impedance between the two windings of a transformer generating a signal proportional to rod position.

c. A syncro transmitter within the control rod drive sends a signal to a servo receiver in the console, which generates the signal proportional to rod position.

d. A two channel encoder/decoder system produces 100 pulses per revolution.

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

ANSWER: 001 (1.00)
B.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 2-28.

ANSWER: 002 (1.00)
C.
REFERENCE:
Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, pg. 104.

ANSWER: 003 (1.00)
A.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 6-3.

ANSWER: 004 (1.00)
C.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 4-8.

ANSWER: 005 (1.00)
A.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 4-3.

ANSWER: 006 (1.00)
A.
REFERENCE:
Glasstone, Sesonske, Nuclear Reactor Engineering, 3rd. Edition, pg. 154.
The volume of the sphere is larger than the volume of the cube, and its ratio of surface area to volume is smaller.

ANSWER: 007 (1.00)
D.
REFERENCE:
Anything which adds negative reactivity increases the shutdown margin.

ANSWER: 008 (1.00)
B.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 8-10.

ANSWER: 009 (1.00)
C.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 4-1.

ANSWER: 010 (1.00)
A.
REFERENCE:
Since the fuel temperature must drop, positive reactivity is added.

ANSWER: 011 (1.00)
C.

REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 3-15.
A total of 70 thermal neutrons (100-20-10) are absorbed in fuel plus other materials. Since the reactor is critical, there were 40 fissions (40x2.5 = 100). Since 85% of absorptions result in fission, there were 40/0.85 = 47 neutrons absorbed in fuel. The thermal utilization = 47/70 = 0.67.

ANSWER: 012 (1.00)
C.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 2-45.

ANSWER: 013 (1.00)
C.
REFERENCE:
The beta fraction for the fuel is the power weighted average of the beta fractions for each component.
Beta = (0.2)(0.006) + (0.8)(0.008) = 0.0076

ANSWER: 014 (1.00)
B.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 2-51.
$(10^{15}$ fissions/sec)x(200 Mev/fission)x($1.6x10^{-19}$ watt-sec/ev) = 32 kW.

ANSWER: 015 (1.00)
A.
REFERENCE:
Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, pg. 285.

ANSWER: 016 (1.00)
C.
REFERENCE:
R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 5-18.

ANSWER: 017 (1.00)
B.
REFERENCE:
SOP Power Calibration.

ANSWER: 018 (1.00)
D.
REFERENCE:
Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, pg. 19.

ANSWER: 019 (1.00)
D.
REFERENCE:
The power for reactor A increases by a factor of 2, while the power for reactor B increases by a factor of 1.5. Since the periods are the same, power increase B takes a shorter time.

ANSWER: 020 (1.00)
A.
REFERENCE:
Since the period is always positive, power must be increasing.

ANSWER: 001 (1.00)
D.
REFERENCE:
SOP Reactor Shutdown.

ANSWER: 002 (1.00)
D.
REFERENCE:
SOP Implementing Procedure For A Pool Level Alarm.

ANSWER: 003 (1.00)
B.
REFERENCE:
SOP Personnel Dosimetry.

ANSWER: 004 (1.00)
C.
REFERENCE:
Emergency Classification Guide, pg. 2.

ANSWER: 005 (1.00)
D.
REFERENCE:
SOP Power Calibration.

ANSWER: 006 (1.00)
B.
REFERENCE:
TA&M Technical Specifications, Section 3.2.3.

ANSWER: 007 (1.00)
B.
REFERENCE:
TA&M Technical Specifications, Section 1.13.

ANSWER: 008 (1.00)
D.
REFERENCE:
10CFR20.

ANSWER: 009 (1.00)
A.
REFERENCE:
TA&M Technical Specifications, Table 1.

ANSWER: 010 (1.00)
A.
REFERENCE:
TA&M Requalification Program.

ANSWER: 011 (1.00)
A.
REFERENCE:
TA&M Technical Specifications, Section 1.41.

ANSWER: 012 (1.00)
C.

REFERENCE:
SOP Red Tag Procedures.

ANSWER: 013 (1.00)
D.
REFERENCE:
20CFR20.

ANSWER: 014 (1.00)
C.
REFERENCE:
Each sheet of lead reduces the exposure rate by half. First sheet - 50%; second sheet - 25%; third sheet - 12.5%, etc.

ANSWER: 015 (1.00)
A.
REFERENCE:
SOP Operations Records.

ANSWER: 016 (1.00)
A.
REFERENCE:
TA&M Technical Specifications, Section 2.1.

ANSWER: 017 (1.00)
C.
REFERENCE:
SAR Chapter XI.

ANSWER: 018 (1.00)
D.
REFERENCE:
SOP Steady State Operation.

ANSWER: 019 (2.00)
A,2; B,2; C,3; D,1
REFERENCE:
TA&M Technical Specifications, Section 1.0

ANSWER: 001 (1.00)
A.
REFERENCE:
SAR, page 100.

ANSWER: 002 (1.00)
B.
REFERENCE:
SAR, page 93.

ANSWER: 003 (1.00)
A.
REFERENCE:
SAR, page 38.

ANSWER: 004 (1.00)
C.
REFERENCE:
SAR, page 14.

ANSWER: 005 (1.00)
C.
REFERENCE:
SAR, VIII-G.1

ANSWER: 006 (1.00)
D.
REFERENCE:
SAR, page 26.

ANSWER: 007 (1.00)
B.
REFERENCE:
SAR, page 76.

ANSWER: 008 (1.00)
B.
REFERENCE:
SAR, page 18.

ANSWER: 009 (1.00)
C.
REFERENCE:
SOP Pulsing Operation.

ANSWER: 010 (1.00)
A.
REFERENCE:
SAR, page 68.

ANSWER: 011 (1.00)
C.
REFERENCE:
SAR, page 119.

ANSWER: 012 (2.00)

A,3; B,1; C,2; D,2
REFERENCE:
SAR, pages 91-96.

ANSWER: 013 (1.00)
D.
REFERENCE:
SAR, page 116.

ANSWER: 014 (1.00)
C.
REFERENCE:
SAR, page 93.

ANSWER: 015 (1.00)
A.
REFERENCE:
SAR, page 65.

ANSWER: 016 (1.00)
D.
REFERENCE:
SAR, VII.B.2 Figures 7-4 and 7-5

ANSWER: 017 (1.00)
D.
REFERENCE:
SAR, page 18.

ANSWER: 018 (1.00)
A.
REFERENCE:
SOP Linear Power Measuring Channel Maintenance Surveillance.

ANSWER: 019 (1.00)
D.
REFERENCE:
Modification Authorization M-46

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