ENCLOSURE 1

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

REPORT NO.: 50-407/OL-92-02

FACILITY DOCKET NO.: 50-407

FACILITY LICENSE NO.: R-126

FACILITY: University of Utah

EXAMINATION DATE: June 30, 1992

EXAMINER: Paul V. Doyle, Jr., Chief Examiner

SUBMITTED BY: for James L. Caldwell 7/22/92
Paul V. Doyle, Jr., Chief Examiner Date

APPROVED BY: James L. Caldwell 7/22/92
James L. Caldwell, Chief Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation, NRR

SUMMARY:

The NRC administered written and operating examinations to four Reactor Operators (RO) and one Senior Reactor Operator instant (SROI) on December 9, 1991. All five candidates passed the operating portion of the examination, but due to candidate performance and questions regarding the validity of the written examination, the NRC decided to disregard the results of the written examination (see Interim Initial Examination Report No. 50-407/OL-91-01). A new written examination was administered to three RO and one SROI on June 30, 1992. All four candidates passed the written examination. One individual who had previously taken and passed the operating portion of the examination during the December 9, 1991, examination decided to withdraw from the examination process and not take the written examination administered on June 30, 1992. This decision to withdraw from the written examination after having completed the operating examination will constitute an examination failure in accordance with NUREG-1021, Examiners Standards, Revision 6. The applicant may reapply in accordance with 10 CFR 55.35.

Encl

Resolution of facility comments:

A.19: A short reactor period is of greater concern when reactor pow
is:

a. close to 100%
b. above the point of adding heat
c. below the point of adding heat
d. near the source counts

Recommendation: Accept both c and d as correct. The answer
the response c. Near the source counts is considered belo
adding heat.

Resolution: comment accepted the answer key has been mod

C.17 The ventilation system for the UU Nuclear Engi
designed to provide the following flow rate:

a. a mean flow rate of 148 cfm
b. at least four air exchanges per hour
c. at least two air exchanges per hour
d. at least six air exchanges per hour

Recommendation: Accept b. as the correct answer

Resolution: Comment accepted. " b. at least f
the correct answer. This was changed during
answer key has been modified.
of the examination
results listed in the letter
ich dated June 12, 1992

, University of Utah
versity of Utah

operation in the administration of

NRC Official Use Only

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Key

Nuclear Regulatory Commission
Operator Licensing
Examination

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Official Use Only category on
date of examination.

REPORT DETAILS

1. Examiners:

   Paul Doyle, Chief Examiner, NRC
   Brian Hughes, NRC

2. Results:

	RO (Pass/Fail)	SRO (Pass/Fail)	Total (Pass/Fail)
NRC Grading:	3/1	1/0	4/1

3. Written Examination:

   All four candidates who took the written examination administered June 30, 1992 passed the written examination. One candidate did not take the written examination. Because he did not take the written examination the candidate will receive a denial letter in accordance with NUREG 1021 "Examiner Standards," Revision 6, due to examination withdrawal.

4. Operating Examinations:

   All five candidates passed the operating portion of the examination administered on December 9, 1991. See the results listed in the letter from Robert M. Gallo to Dr. Dietrich K. Gehmlich dated June 12, 1992 (Interim Examination Report No. 50-407/OL-91-01).

5. Exit Meeting:

   Participants: Dr. Gary Sandquist, Director, University of Utah
   Dr. John M. Slaughter, University of Utah
   Mr. Brian Hughes, NRC

The NRC thanked the University for their cooperation in the administration of this examination.

Resolution of facility comments:

A.19: A short reactor period is of greater concern when reactor power level is:

a. close to 100%
b. above the point of adding heat
c. below the point of adding heat
d. near the source counts

Recommendation: Accept both c and d as correct. The answer of d is included in the response c. Near the source counts is considered below the point of adding heat.

Resolution: comment accepted the answer key has been modified.

C.17 The ventilation system for the UU Nuclear Engineering Laboratory is designed to provide the following flow rate:

a. a mean flow rat of 148 cfm
b. at least four air exchanges per hour
c. at lea wo air exchanges per hour
d. at leas six air exchanges per hour

Recommendation: Accept b. as the correct answer.

Resolution: Comment accepted. " b. at least four air exchanges per hour" is the correct answer. This was changed during the internal post exam review, the answer key has been modified.

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Key

Nuclear Regulatory Commission
Operator Licensing
Examination

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

FACILITY: Univ. of Utah

REACTOR TYPE: TRIGA-I

DATE ADMINISTERED: 92/06/~~23~~ 30

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 section 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
19.00	31.15			A.	REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	32.79			B.	NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
22.00	36.07			C.	PLANT AND RADIATION MONITORING SYSTEMS
61.00					TOTALS
		FINAL GRADE	%		

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

_____
Candidate's Signature

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. Fill in the date on the cover sheet of the examination (if necessary).

7. The point value for each question is indicated in parentheses after the question. The amount of blank space on an examination question page is NOT an indication of the depth of answer required.

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 scratch paper.

10. To pass the examination, you must achieve at least 70% in each category.

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

12. 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)

Beta and beta effective both describe the total fraction of delayed neutrons. The difference between these two is :

a. beta effective is smaller than beta since delayed neutrons are born at lower energy levels than prompt neutrons.

b. beta effective is larger than beta since delayed neutrons are born at lower energy levels than prompt neutrons.

c. beta effective is smaller than beta since delayed neutrons are born at higher energy levels than prompt neutrons.

d. beta effective is larger than beta since delayed neutrons are born at higher energy levels than prompt neutrons.

QUESTION: 002 (1.00)

How much reactivity is required to increase reactor power from 10 KW to 150 KW in 40 seconds ?

a. .0010 delta K/K
b. .0020 delta K/K
c. .0030 delta K/K
d. .0040 delta K/K

QUESTION: 003 (1.00)

70 thermal neutrons are absorbed in fuel atoms, 50 of these produce fission. What is the reproduction factor?

a. 0.45
b. 0.71
c. 1.4
d. 1.8

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

QUESTION: 004 (1.00)

If the average moderator temperat re in the core decreased suddenly by 10°F, approximately what reactor period would be initiated?

(αt= -15x10-5 $\Delta K/k/F$)

a. 10 seconds
b. 20 seconds
c. 30 seconds
d. 40 seconds

QUESTION: 005 (1.00)

A complete core load is in progre[illegible] the FNR. The following data has been recorded:

Number of elements installed	[illegible] (cpm)	Detector B (cpm)
0	16	30
12	22	32
24	29	37
36	48	60
42	70	140

Using the inverse count rate determine which of the following is the approximate number of fuel elements that will be required to be loaded for a critical mass.

a. 45
b. 50
c. 55
d. 60

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

QUESTION: 006 (1.00)

A reactor is operating at 2 KW (100%) and the reactor scram is set for 125%. What will be the peak power if an experiment creates a 100 millisecond period and the scram delay time is .1 sec?
(assume no period scram and no temperature effects)

a. 2.50 KW
b. 3.39 KW
c. 5.00 KW
d. 6.78 KW

QUESTION: 007 (1.00)

Consider two identical reactors, with the exception that one has a beta of 0.0075 and the other has a beta of 0.0062. Which one of the following will be the response of the reactors to a fixed reactivity(less than beta) insertion?

a. The resulting period will be shorter for the reactor with the 0.0075 beta fraction.

b. The resulting period will be shorter for the reactor with the 0.0062 beta fraction.

c. The resulting power level will be higher for the reactor with the 0.0075 beta fraction.

d. The resulting power level will be the same for both reactors.

QUESTION: 008 (1.00)

Upon reaching criticality during a reactor startup, the operator establishes a positive reactor period. Upon reaching the point of adding heat (POAH), the period will become _____ due to the _____ reactivity feedback of moderator temperature. (POAH is when the pool temperature increases)

a. shorter; negative
b. shorter; positive
c. longer; negative
d. longer; positive

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

QUESTION: 009 (1.00)

Cavitation is the formation of vapor bubbles in the _____ pressure area of a pump followed by the _____ of these bubbles within the pump casing.

a. low; expansion
b. low; collapse
c. high; expansion
d. high; collapse

QUESTION: 010 (1.00)

A reactor has a count rate of 30 cps when it has a Keff of 0.95. What is the new count rate if the Keff is changed to 0.975?

a. 20 cps
b. 40 cps
c. 60 cps
d. 80 cps

QUESTION: 011 (1.00)

Reactor power is 10 watts and rising on a 30 second period. What will be the power after five minutes?

a. 11.81 W
b. 1.22 W
c. 220,265W
d. 22026.5W

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

QUESTION: 012 (1.00)

The principal source of heat in the reactor one hour after shutdown from 2 MW is :

a. Delayed neutrons
b. Delayed fission
c. Decay of fission products
d. Prompt, delayed and photo-neutrons

QUESTION: 013 (1.00)

Which ONE of the following is the reason for the -80 second period following a reactor scram?

a. the ability of U-235 to fission with source neutrons

b. the half-life of the longest-lived group of delayed neutron precursors is 55 seconds

c. the amount of negative reactivity added on a scram is greater than the Shutdown Margin

d. the doppler effect, which adds positive reactivity due to the temperature decrease following a scram

QUESTION: 014 (1.00)

Thermalization of neutrons is accomplished most efficiently when the moderator has:

a. LOW atomic mass number and HIGH scattering cross-section

b. HIGH atomic mass number and HIGH scattering cross-section

c. LOW neutron absorption cross-section and LOW scattering cross-section

d. LOW neutron absorption cross-section and HIGH atomic mass number

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

QUESTION: 015 (1.00)

Of the approximately 200 Mev of energy released per fission event, the largest amount appears in the form of:

a. Beta and gamma radiation

b. Prompt and delayed neutrons

c. Kinetic energy of the fission fragments

d. Alpha radiation

QUESTION: 016 (1.00)

A factor in the six-factor formula which is most affected by control rod position is:

a. Resonance escape probability

b. Fast fission factor

c. Neutron reproduction factor

d. Thermal utilization factor

QUESTION: 017 (1.00)

Which ONE of the following correctly describes the relationship between Differential Rod Worth (DRW) and Integral Rod Worth (IRW)?

a. DRW is the area under the IRW curve.

b. IRW is the slope of the DRW curve at a given location.

c. DRW is the value of the IRW at a given location.

d. IRW is the area under the DRW curve.

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

QUESTION: 018 (1.00)

Which ONE of the following is the time period in which the maximum amount of Xenon-135 will be present in the core?

a. 8 to 10 hours after a startup to 100% power.

b. 4 to 6 hours after a power increase from 50% to 100% power.

c. 4 to 6 hours after a power decrease from 100% to 50% power.

d. 10 to 12 hours after a scram from 100% power.

QUESTION: 019 (1.00)

A short reactor period is of greater concern when reactor power level is:

a. close to 100%
b. above the point of adding heat
c. below the point of adding heat
d. near the source counts

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

QUESTION: 001 (1.00)

An experiment has been removed from the reactor. A radiation reading of 1 R/hr was recorded at 3 feet when the experiment was removed. Fifteen minutes later a reading of 750 mr/hr was recorded at the same distance (3 feet). What is the approximate length of time required (measured from the time of removal) for the radiation level to decrease to 10 mrem/hr at 1 foot?

a. 4 hours

b. 5 hours

c. 6 hours

d. 12 hours

QUESTION: 002 (1.00)

In order to maintain an active RO or SRO license, how many hours per quarter must you perform the functions of an RO or SRO?

a. 2

b. 4

c. 8

d. 12

QUESTION: 003 (1.00)

A radioactive sample was removed from the reactor core, reading 25 Rem/ hour. Four (4) hours later, the sample reads 2.5 Rem/hour. What is the approximate time required for the sample to decay to 100 Mrem/hour from the 2.5 Rem/hour point?

a. 1.9 hours
b. 3.8 hours
c. 5.6 hours
d. 7.8 hours

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

QUESTION: 004 (1.00)

Gallontium has a biological half life of 5 days and a radiological half life of 12 days. What is the effective half life?

a. 3.53 days
b. 0.283 days
c. 11.78 days
d. 17.0 days

QUESTION: 005 (1.00)

How would an accessible area be posted, if the radiation level in that area was 50 Mrem/hr?

a. DANGER - HIGH RADIATION AREA
b. CAUTION - RADIATION AREA
c. CAUTION - RESTRICTED AREA
d. CAUTION - AIRBORNE RADIATION AREA

QUESTION: 006 (1.00)

What is the 10CFR20 quarterly exposure limit for the skin of whole body?

a. 1.25 Rem
b. 3.00 Rem
c. 7.50 Rem
d. 18.75 Rem

QUESTION: 007 (1.00)

A survey instrument with a window probe was used to measure an irradiated experiment. The results were 100 Mrem/hr window open, and 40 Mrem/hr window closed. What was the gamma dose?

a. 100 Mrem/hr
b. 60 Mrem/hr
c. 40 Mrem/hr
d. 140 Mrem/hr

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

QUESTION: 008 (1.00)

For fuel to be considered "self protecting", the radiation level must be at least 100 REM/hr at 3 feet in air without intervening shielding. Assumi, the average energy of radiation emitted for spent a fuel element is 1 MEV, SELECT from the following the minimum activity required to meet the "self-protecting" limit for a fuel element.

a. 10 ci
b. 15 ci
c. 100 ci
d. 150 ci

QUESTION: 009 (1.00)

A person is working 4 feet from a gamma point source emitting 8R/hr at one foot. Which of the following is the length of time that the person can work without exceeding the whole body QUARTERLY 10 CFR 20 dose limit. Assume no previous exposure history is available.

a. 37 minutes

b. 1.25 hours

c. 2.5 hours

d. 6.0 hours

QUESTION: 010 (1.00)

A cobalt-60 source has been dropped in the reactor laboratory. Thirty (30) feet from the source a beta-gamma detector reads 100 mr/hr. What is the curie content of the source? (Assume a 1.2 and a 1.5 Mev gamma emission.)

a. 90 curies

b. 30 curies

c. 6 curies

d. 2.5 curies

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

QUESTION: 011 (1.00)

An individual receives 100 Mrem of Beta, 25 Mrem of Gamma, and 5 Mrem of neutrons. What is his total dose?

a. 275 Mrem
b. 205 Mrem
c. 175 Mrem
d. 130 Mrem

QUESTION: 012 (1.00)

Which ONE of the following radioactive gases poses the most significant hazard at the University of Utah TRIGA reactor?

a. Nitrogen 16
b. Xenon 135
c. Argon 41
d. Tritium

QUESTION: 013 (1.00)

What is the technical specification staff requirement when the reactor is NOT shutdown?

a. One licensed SRO in the control room.
b. One licensed RO in the control room with one SRO one hour away.
c. One licensed RO in the control room with another person and one SRO on call.
d. None required in the control room, just available on short notice.

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

QUESTION: 014 (1.00)

To prevent damage to the reactor or excessive release of radioactive materials in the event of an experimental failure, corrosive materials must:

a. have a mass of less than 25 milligrams.
b. be neutralized by encapsulation and KRYLON spray.
c. be doubly encapsulated.
d. not be inserted into the reactor.

QUESTION: 015 (1.00)

Fuel, including fueled experiments and fueled devices not in the reactor, shall be stored in an array such that Keff is no greater than___ for all conditions.

a. 0.6
b. 0.7
c. 0.8
d. 0.9

QUESTION: 016 (1.00)

You are on shift at the controls, and you receive a bomb threat by phone. This event would be classified as a/an _____.

a. unusual event
b. alert
c. site-area emergency
d. general emergency

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

QUESTION: 017 (1.00)

Irradiated fuel assemblies must be inspected per technical specifications. This inspection includes a required measurement of length and bend(sagitta). Which ONE of the following describes this process per the FOM.

a. The assembly is placed on a bench next to the pool and measured with a caliper and a calibrated tape.

b. The assembly is placed on a bench next to the pool and passed through a containment tool and a measurement rig.

c. The assembly is sipped during low power operation for gross beta activity.

d. The assembly is placed in a fuel element containment tube, and measured in the pool by use of a measuring rig.

QUESTION: 018 (1.00)

Which ONE of the following assures the integrity of the reactor tank to prevent inadvertent leakage?

a. The interior and exterior surfaces of the tank have protective coatings.
b. The interior tank is stainless steel separated from the exterior tank by sand.
c. The tank is of the double containment design with a concrete liner between them.
d. The tank is of the double containment design with sand between the liners.

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

QUESTION: 019 (1.00)

In the event of a fire deemed out of immediate local control, the Reactor Operator shall perform certain duties. These are:

a. evacuate the building and contact the reactor supervisor.

b. take charge until the reactor supervisor arrives

c. scram the reactor, sound the fire alarm, and order evacuation of the laboratory.

d. scram the reactor, sound the fire alarm, and attempt to handle the fire using local equipment

QUESTION: 020 (1.00)

Which ONE of the following describes the relationship between the Safety Limit (SL) and the Limiting Safety System Setting (LSSS)?

a. The SL is a maximum operationally limiting value that prevents the LSSS from being reached during normal runs.

b. The SL is a parameter that ensures the integrity of the fuel cladding. The LSSS initiates protective action to preclude reaching the SL.

c. The LSSS is a parameter that ensures the integrity of the fuel cladding. The SL initiates protective action to preclude reaching the LSSS.

d. The SL is a maximum setpoint for instrumentation response. The LSSS is the minimum number of channels required to be operable.

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

QUESTION: 001 (1.00)

With the reactor at 100KW and the heat exchanger operating, which ONE of the following is the rate of increase of the pool temperature?

a. 1°F/hr

b. 2°F/hr

c. 5°F/hr

d. 7°F/hr

QUESTION: 002 (1.00)

Which ONE of the following has been designated as the maximum hypothetical accident at the UUTR facility?

a. Total loss of coolant accident.

b. Accidental misplacement of an experiment with the maximum allowed reactivity worth.

c. Breaching the cladding of a spent fuel element during fuel handling.

d. Loss of all electrical power.

QUESTION: 003 (1.00)

The absorber rods are used for reactivity control. The material utilized for this control is primarily_____.

a. hafnium

b. boron carbide

c. gallomide

d. aluminum

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

QUESTION: 004 (1.00)

What is the total reactivity of the rods?

a. $2.80
b. $2.35
c. $4.83
d. $7.00

QUESTION: 005 (1.00)

Which ONE of the following is the type of detector used for the input to the Log N Recorder?

a. BF3 detector
b. ion chamber
c. compensated ion chamber
d. fission chamber

QUESTION: 006 (1.00)

The instrumented fuel moderator element has end reflectors made of____?

a. stainless steel
b. lead
c. Graphite
d. heavy water

QUESTION: 007 (1.00)

Which ONE of the following is the Log N instrument channel indicated range?

a. 1 watt to 5 X EE 3 watts

b. 5 X EE-4 watts to 5 X EE 5 watts

c. 5 X EE 3 watts to 5 X EE 5 watts

d. 1 watt to 5 X EE 5 watts

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

QUESTION: 008 (1.00)

In event of a sustained elec'rical outage, battery power supplies the facility's radiation monito and the ntrusion detectors. About how long would this power source be av lable?

a. 24 hours
b. 8 hours
c. 4 hours
d. 2 hours

QUESTION: 009 (1.00)

The upper beam tube is shielded with _____ and capped on the end with a steel cap for security.

a. deionized water
b. sand bags *
c. wood,poly inserts
d. air

QUESTION: 010 (1.00)

What is the alarm setpoint for the reactor room ceiling area radiation monitor?

a. 0.2 mr/hr
b. 0.8 mr/hr
c. 10 mr/hr
d. 20 mr/hr

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

QUESTION: 011 (1.00)

What region of the gas amplification, verses detector voltage curve, does the area monitors operate within?

a. ionization region
b. proportional region
c. recombination region
d. geiger-mueller region

QUESTION: 012 (1.00)

The inherent shut down property of U-ZrHx fuel provides a feed back mechanism which serves as a backup to the protective systems. The characteristic which best describes this feature is the fuel's_____.

a. positive doppler coefficient
b. negative temperature coefficient
c. ability to dissipate heat rapidly
d. low enrichment

QUESTION: 013 (1.00)

Which ONE of the following is the fuel element failure that is prevented by limiting the maximum temperature of the fuel element?

a. Cladding hot spot perforations due to fuel hydrogen generation and oxidation from the metal water reaction.

b. Fuel melt, due to exceeding the fuel hydride failure temperature.

c. Fuel element cladding failure due to the internal pressure build up from fission gases.

d. Ductile failure of the fuel element due to clad creep and fracture from excessive heat.

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

QUESTION: 014 (1.00)

Which ONE of the following describes the operation of the ventilation system in the event of an accidental release of particulate or gaseous activity?

a. The inlet isolation damper closes and the reactor room filter damper opens forcing air through the filter and maintaining a negative pressure in the reactor room.

b. The inlet and outlet dampers close and the air is bypassed through a HEPA filter maintaining the reactor room at a negative pressure.

c. The outlet damper closes forcing air through the HEPA filter and maintaining the reactor room at a slight positive pressure in relation to the laboratory.

d. The inlet and outlet dampers close, and the ventilation fans shut down to prevent an over pressurization of the reactor room.

QUESTION: 015 (1.00)

Which ONE of the following is the type of detector used to provide a control rod interlock which would prevent rod withdrawal unless the initial count rate was above a preset limit?

a. compensated ion chamber
b. ion chamber
c. BF_3
d. fission chamber

QUESTION: 016 (1.00)

Which ONE of the following describes how the control rod position indication is provided to the operator at the console?

a. multiple limit switches which indicate throughout the control rod's travel.

b. a potentiometer

c. a selsyn motor

d. a mechanical counter which transmits an electrical output

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

QUESTION: 017 (1.00)

The ventilation system for the UU Nuclear Engineering Laboratory is designed to provide the following flow rate:

a. a mean flow rate of 148 cfm
b. at least four air exchanges per hour
c. at least two air exchanges per hour
d. at least six air exchanges per hour

QUESTION: 018 (1.00)

A tritium spill in the reactor area is best monitored and measured using a :

a. liquid scintillation detector
b. beta/gamma survey meter
c. ion chamber
d. NaI detector

QUESTION: 019 (1.00)

The neutron source with in the core of the TRIGA reactor is:

a. PuBe
b. RaBe
c. Cf-252
d. PuBr

QUESTION: 020 (1.00)

What devic ovides the upper and lower control rod indication to the consele?

a. reed switches
b. limit switches
c. mechanical counter
d. the magnet

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

QUESTION: 021 (1.00)

Which ONE best describes the normal power supply to the area radiation monitors within the facility?

a. Directly from the 120 VAC facility service.
b. 24 VDC from rectified 120 VAC power
c. 12 VDC from rectified 120 VAC power
d. internal Ni Cad batteries

QUESTION: 022 (1.00)

When performing the experimental facility reactivity worth determination of a new experimental facility, the reactor may be utilized to perform this evaluation. Which ONE of the choices describes this process?

a. With the reactor critical at 100 watts insert the experimental facility and measure the power change to determine reactivity.

b. With the facility critical at 1 watt take rod worths then insert the experiment and take the new rod worths to determine its reactivity.

c. With the reactor critical at 100 watts take rod positions, shut down, insert the experiment, start up and at 100 watts again take rod worths to determine the reactivity difference.

d. With the reactor critical at 1 watt take rod positions, shut down, insert the experiment, start up and at 1 watt again take rod worths to determine the reactivity difference.

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

ANSWER: 001 (1.00)

b.

REFERENCE:

eqb ques # 4622 1987/08/22
lloU reactor dynamics one and six delayed groups

ANSWER: 002 (1.00)

c.

REFERENCE:

Equation sheet
$P=P_0e^{t/T}$
$T=t/\ln(P/P_0)= 40/\ln(150/10) = 40/\ln(15)$
$= 40/2.7$
$T = 14.8$ sec
$\rho = B/(1+\lambda T)$
$= .0075/(1+(.1)(14.8)$
$= .0030\ \Delta K/K$

ANSWER: 003 (1.00)

d.

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

REFERENCE:

N = no of fast n produced by thermal fission
no thermal n absorbed in the fuel
2.5 neutrons produced per fission
(50) X (2.5) = 125 fast n
thermal n absorbed in the fuel = 70
N = 125/70 = 1.790

ANSWER: 004 (1.00)

d.

REFERENCE:
$\rho = \alpha T \Delta T$
$= 15 \times 10^{-4} \Delta K/K$
$T = (\beta - \rho)/\lambda\rho$
$= (.0075 - .0015)/(.1)(.0015)$
= 40 seconds

ANSWER: 005 (1.00)

c.

REFERENCE:

FOM 13.2.1 C. approach to critical using inverse multiplication data
previous exam question 2/12/91 fnr

ANSWER: 006 (1.00)

d.

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

REFERENCE:

equation sheet
$P=P_o e^{t/T}$
$P_o = 1.25(2KW)=2.5KW$
$T = .1sec$
$t = .1sec$
$P = 2.5\ e^{-1/.1}$
$= 2.5e$
$=6.78\ KW$

ANSWER: 007 (1.00)

b.

REFERENCE:

eqb ques 4617 1987/08/22 modified
UoU Reactor dynamics delayed neutrons and control

ANSWER: 008 (1.00)

c.

REFERENCE:

intro to nuc rx ops chap 6

ANSWER: 009 (1.00)

b.

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

REFERENCE:

FNR thermal sciences

ANSWER: 010 (1.00)

c.

REFERENCE:

facility ques # a-314
C1 = 30 = S/1-K1 = S/1-.95
C2 = S/1-K2 = S/1-.975
C2/C1 = 1-.95/1-.975=2
C2 = 2C1 = 60 cps

ANSWER: 011 (1.00)

c.

REFERENCE:
$P = P_o e^{t/T}$
$P = 10\ e^{300/30}$
P = 220265 watts
EQB
Intro to nuc RXops chap 4

ANSWER: 012 (1.00)

c.

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

REFERENCE:

Intro to nuc rector operations chap 4 pp 4-23 decay heat power

ANSWER: 013 (1.00)

b.

REFERENCE:

ANSWER: 014 (1.00)

a.

REFERENCE:

eqb

ANSWER: 015 (1.00)

c.

REFERENCE:

ANSWER: 016 (1.00)

d.

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

REFERENCE:

ANSWER: 017 (1.00)

d.

REFERENCE:

ANSWER: 018 (1.00)

d.

REFERENCE:

xenon oscillations uou fig 5-5

ANSWER: 019 (1.00)

d.

REFERENCE:

eqb nc state exam

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

ANSWER: 001 (1.00)

c.

REFERENCE:

eq sheet $DR = DR_o e^{-\gamma}$

$.75 = 1X e^{-\gamma}$

$\ln .75 = -\gamma(.25hr)$

$-0.28768/.25 = 1.15 \gamma$

$DR_2 = DR_1(3/1)^2$

$= 9$

$DR = DR_o e^{-\gamma}$ solve for t

$.01 = 9 e^{-\gamma}$

$\ln(.01/9) = -1.15t$

$t = 5.9hr$

ANSWER: 002 (1.00)

b.

REFERENCE:

ANSWER: 003 (1.00)

c.

REFERENCE:

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

$\ln 0.1 = -\lambda 4$

$-2.30 = -\lambda$

$= .575$

$.1/2.5 = e^{-.575(t)}$

$-3.218 = -.575\ t$

$5.598 = t$

ANSWER: 004 (1.00)

a.

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

B. NORMAL/EMERG PROCEDURES & RAD CON

REFERENCE:

T1/2 eff = product/sum
= 60/17
=3.53

ANSWER: 005 (1.00)

b.

REFERENCE:

10CFR20

ANSWER: 006 (1.00)

c.

REFERENCE:

10CFR20.101

ANSWER: 007 (1.00)

c

REFERENCE:

window closed shield beta 40 Mrem/hr must be gamma

ANSWER: 008 (1.00)

d.

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

REFERENCE:

eqb exam 2-12-91 sec B ques # 20 NPPH? &rp chap 7 pp7-14

ANSWER: 009 (1.00)

c.

REFERENCE:

10CFR.101

ANSWER: 010 (1.00)

c.

REFERENCE:

eq sheet

ANSWER: 011 (1.00)

d.

REFERENCE:

10CFR20 rem = rem

ANSWER: 012 (1.00)

c.

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

REFERENCE:

eqb question
ser 12.8

ANSWER: 013 (1.00)

c.

REFERENCE:

T.S.

ANSWER: 014 (1.00)

c.

REFERENCE:

T.S. 3.6(3) pp 14

ANSWER: 015 (1.00)

c.

REFERENCE:

T.S 5.5 fuel storage

ANSWER: 016 (1.00)

a.

REFERENCE:

Table 5.2 Emergency classification criteria FOM manual

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

ANSWER: 017 (1.00)

d.

REFERENCE:

FOM 13.5

ANSWER: 018 (1.00)

d.

REFERENCE:

ser

ANSWER: 019 (1.00)

c.

REFERENCE:

FOM sec 5.5.4

ANSWER: 020 (1.00)

b.

REFERENCE:

T.S 2.0

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

ANSWER: 001 (1.00)

b.

REFERENCE:

Based on actual operational experience, the facility stated they experience a 2 degree per hr change. this is based on the new cooling system

ANSWER: 002 (1.00)

c.

REFERENCE:

SER 14.1, fuel handling accident

ANSWER: 003 (1.00)

b.

REFERENCE:

sys desc

ANSWER: 004 (1.00)

c.

REFERENCE:
sys desc table 1 principal design parameters

ANSWER: 005 (1.00)

c.

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

REFERENCE:

Fig 9 block diagram rx inst. (post 84 hardware description)

ANSWER: 006 (1.00)

c.

REFERENCE:

Post 1984 system hardware desc fig 2

ANSWER: 007 (1.00)

d.

REFERENCE:

12/91 uofu exam (modified)

ANSWER: 008 (1.00)

a.

REFERENCE:

SER 8-1 elctrical power system

ANSWER: 009 (1.00)

b.

REFERENCE:

SAR 5-22

ANSWER: 010 (1.00)

c.

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

REFERENCE:

Form NEL-023 sheet 1 calibration of area rad monitors

ANSWER: 011 (1.00)

d.

REFERENCE:

CAF/ nuc rx eng third edition 1991 pp310,311

ANSWER: 012 (1.00)

b.

REFERENCE:

ser pp4-9

ANSWER: 013 (1.00)

c.

REFERENCE:

SER 4-9

ANSWER: 014 (1.00)

b.

REFERENCE:

SAR 4.6.2

ANSWER: 015 (1.00)

d.

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

REFERENCE:

fig 9 new hardware

ANSWER: 016 (1.00)

b.

REFERENCE:

new hardware sys desc CONTROL RODS

ANSWER: 017 (1.00)

~~a.~~ b.

REFERENCE:

facility question

ANSWER: 018 (1.00)

a.

REFERENCE:

facility question

ANSWER: 019 (1.00)

a.

REFERENCE:

facility question

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

ANSWER: 020 (1.00)

b.

REFERENCE:

sysdesc

ANSWER: 021 (1.00)

c.

REFERENCE:

Facility comments 12/91 exam on sec C-10

ANSWER: 022 (1.00)

d.

REFERENCE:

NEL-028

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

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

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 *****)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

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 *****)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

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	___
021	a	b	c	d	___
022	a	b	c	d	___

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

ANSWER KEY

MULTIPLE CHOICE

001 b
002 c
003 d
004 d
005 c
006 d
007 b
008 c
009 b
010 c
011 c
012 c
013 b
014 a
015 c
016 d
017 d
018 d
019 d

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

A N S W E R K E Y

MULTIPLE CHOICE

001 c

002 b

003 c

004 a

005 b

006 c

007 c

008 d

009 c

010 c

011 d

012 c

013 c

014 c

015 c

016 a

017 d

018 d

019 c

020 b

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

ANSWER KEY

MULTIPLE CHOICE

001 b
002 c
003 b
004 c
005 c
006 c
007 d
008 a
009 b
010 c
011 d
012 b
013 c
014 b
015 d
016 b
017 d 3/4 b
018 a
019 a
020 b
021 c
022 d

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