Enclosure 1

Examination Report No. 50-89/OL-90-01

Facility: General Atomics

Examinations administered at the General Atomics, Torrey Pines Facility, San Diego, California.

Examiner: Richard J. Laufer, Chief Examiner

Approved: _____ 11/7/90
Thomas R. Meadows, Acting Chief Date Signed
Operations Section

Summary:

Examinations from October 23 through October 24, 1990, (Report No. 50-89/OL-90-01)

Operator licensing examinations were administered to one Reactor Operator (RO) and one Senior Reactor Operator (SRO) candidate. Both of these candidates passed their examinations and were subsequently issued licenses.

REPORT DETAILS

1. Examiners

Richard J. Laufer, HQ, Chief Examiner

2. Persons attending the Exit Meeting on October 24, 1990

Richard Laufer, HQ Chief Examiner
*Junaid Razvi, Manager, TRIGA Reactors Facility
*William Whittemore, Senior Scientific Advisor, TRIGA Group

*Attended the written examination review on October 24, 1990.

3. Written Examination and Facility Review

The written examination was administered to the RO candidate on October [illegible], 1990 at the General Atomics, Torrey Pines Reactor Facility. At the conclusion of the examination the Chief Examiner held a formal review with the facility staff identified in paragraph (2) above, in accordance with NUREG 1021, The Operator Licensing Examiner Standards. The NRC resolutions of these comments are documented in Enclosure (3) of this report, which includes the licensee's formal record of this meeting [Attachment A to Enclosure (3)].

The RO candidate passed this portion of his examination.

4. Operating Examinations

The operating examinations were administered on October 23-24, 1990. These examinations were conducted using walk-through scenarios that tested the operator candidates' integral system knowledge and ability to actually operate the reactor facilities. Aspects of facility design and control, administration, security, and emergency plan were also thoroughly tested.

Both operator candidates passed the operating portion of their examinations.

5. Exit Meeting

On October 24, 1990, the Chief Examiner met with the representatives of the licensee's staff to discuss the examination.

Enclosure 3

WRITTEN EXAMINATION FACILITY COMMENTS/NRC
RESOLUTION OF COMMENTS (RO EXAMINATION)

Question A.011:

Comment:

"The "correct" answer (per exam key) is (b) and is only obtained by using an approximation to the in-hour equation. However, since the in-hour curve was also provided to the candidate, obtaining the stable period from the curve is also acceptable; this makes answers (c) and (d) closer to the correct value of stable reactor period. Therefore, answer (b), (c), and (d) are all acceptable, since the method of obtaining the period was not specified to the candidate."

NRC Resolution:

Comment not accepted. The wording of the question, by giving the candidate assumed values of Lambda-eff and B-eff, implies that a calculation is required. The wording of this question will be further clarified before uploading it to the exam bank.

Question B.008:

Comment:

"We suggest the wording of the question be changed to '...remain in MANUAL mode when the operator depresses the PULSE mode pushbutton?' This is to clarify the fact that for pulsing the reactor, the operator must first switch to pulse mode, then depress the pulse FIRE pushbutton. We are in agreement with the answer given in the answer key."

NRC Resolution:

Comment noted. The wording of this question will be modified prior to uploading to the exam bank.

Question C.001:

Comment:

"This question should be deleted. None of the answers apply. This was verified in the training manuals."

NRC Resolution:

Comment accepted. The Chief Examiner concurred that a mistake had been made in transcribing data from the reference material. Therefore, this question has been deleted from the examination.

Question C.013:

Comment:

"Two of the answers are equally correct - (a) and (b). One of the two answers is not discussed in the training materials because the UPS on the Mark I reactor is a recent addition to the facility. We accept this oversight. However, if the candidate gave either (a) or (b) as the correct answer, then it should be accepted. The addition of the UPS to the Mark I was pointed out to the examiner in the walk through."

NRC Resolution:

Comment accepted. Due to incomplete facility reference material this question has two correct answers. Both answers (a) and (b) will be accepted as correct answers.

Question C.016:

Comment:

"Two answers - (b) and (d), are correct. This was verified in the training materials."

NRC Resolution:

Comment accepted. Both answers (b) and (d) will be accepted as correct answers.

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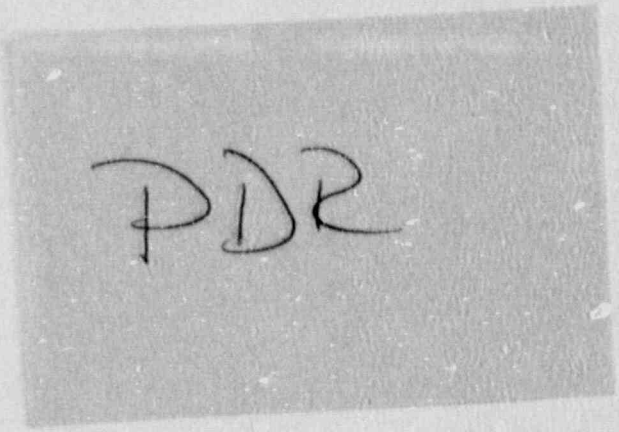

Nuclear Regulatory Commission
Operator Licensing
Examination

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Official Use Only category on
date of examination.

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

FACILITY: General Atomic Co.

REACTOR TYPE: TRIGA-I/F

DATE ADMINISTERED: 90/10/23

RECION: 5

CANDIDATE:

LICENSE APPLIED FOR:

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
20.00	~~33.33~~ 33.90			A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	~~33.33~~ 33.90			B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
~~20.00~~ 19.00	~~33.33~~ 32.20			C. PLANT AND RADIATION MONITORING SYSTEMS
~~60.00~~ 59.00				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. Use only the answer sheets provided. Credit will only be given for answers properly marked on these sheets. Follow the instructions for filling out the answer sheets.

7. Print your name in the upper right-hand corner of each answer sheet.

8. Partial credit will NOT be given on multiple choice questions.

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

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

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

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

13. 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.

EQUATION SHEET

$f = ma$

$w = mg$

$E = mc^2$

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$W = v\Delta P$

$\Delta E = 931\Delta m$

$\dot{Q} = \dot{m}C_p\Delta T$

$\dot{Q} = UA\Delta T$

$Pwr = W_f \dot{m}$

$P = P_o\, 10^{SUR(t)}$

$P = P_o\, e^{t/T}$

$SUR = 26.06/T$

$T = 1.44\ DT$

$SUR = 26\left(\frac{\lambda_{eff}\rho}{\beta - \rho}\right)$

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

$T = \ell^*/(\rho - \beta)$

$T = (\beta - \rho)/\lambda_{eff}\rho$

$\rho = (K_{eff}-1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [\ell^*/TK_{eff}] + [\beta/(1 + \lambda_{eff}T)]$

$P = \Sigma\phi V/(3 \times 10^{10})$

$\Sigma = N\sigma$

$v = s/t$

$s = v_o t + \frac{1}{2}at^2$

$a = (v_f - v_o)/t$

$v_f = v_o + at$

$\omega = \theta/t$

Cycle efficiency = $\frac{\text{Net Work (out)}}{\text{Energy (in)}}$

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

$\lambda = \ln 2/t_{\frac{1}{2}} = 0.693/t_{\frac{1}{2}}$

$t_{\frac{1}{2}}(eff) = \frac{(t_{\frac{1}{2}})(t_{\frac{1}{2}})}{(t_{\frac{1}{2}} + t_b)}$

$I = I_o e^{-\Sigma x}$

$I = I_o e^{-\mu x}$

$I = I_o\, 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = 0.693/\mu$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$,

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = (1 - K_{eff})_0/(1 - K_{eff})_1$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 1 \times 10^{-5}$ seconds

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

$I_1 d_1 = I_2 d_2$

$I_1 d_1^2 = I_2 d_2^2$

$R/hr = (0.5\ CE)/d^2$ (meters)

$R/hr = 6CE/d^2$ (feet)

WATER PARAMETERS

1 gal. = 8.345 lbm

1 gal. = 3.78 liters

1 ft^3 = 7.48 gal.

Density = 62.4 lbm/ft^3

Density = 1 gm/cm^3

Heat of vaporization = 970 Btu/lbm

Heat of fusion = 144 Btu/lbm

1 Atm = 14.7 psi = 29.9 in. Hg

1 ft. H_2O = 0.4335 lbf/in^2

MISCELLANEOUS CONVERSIONS

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 hp = 2.54×10^3 BTU/hr

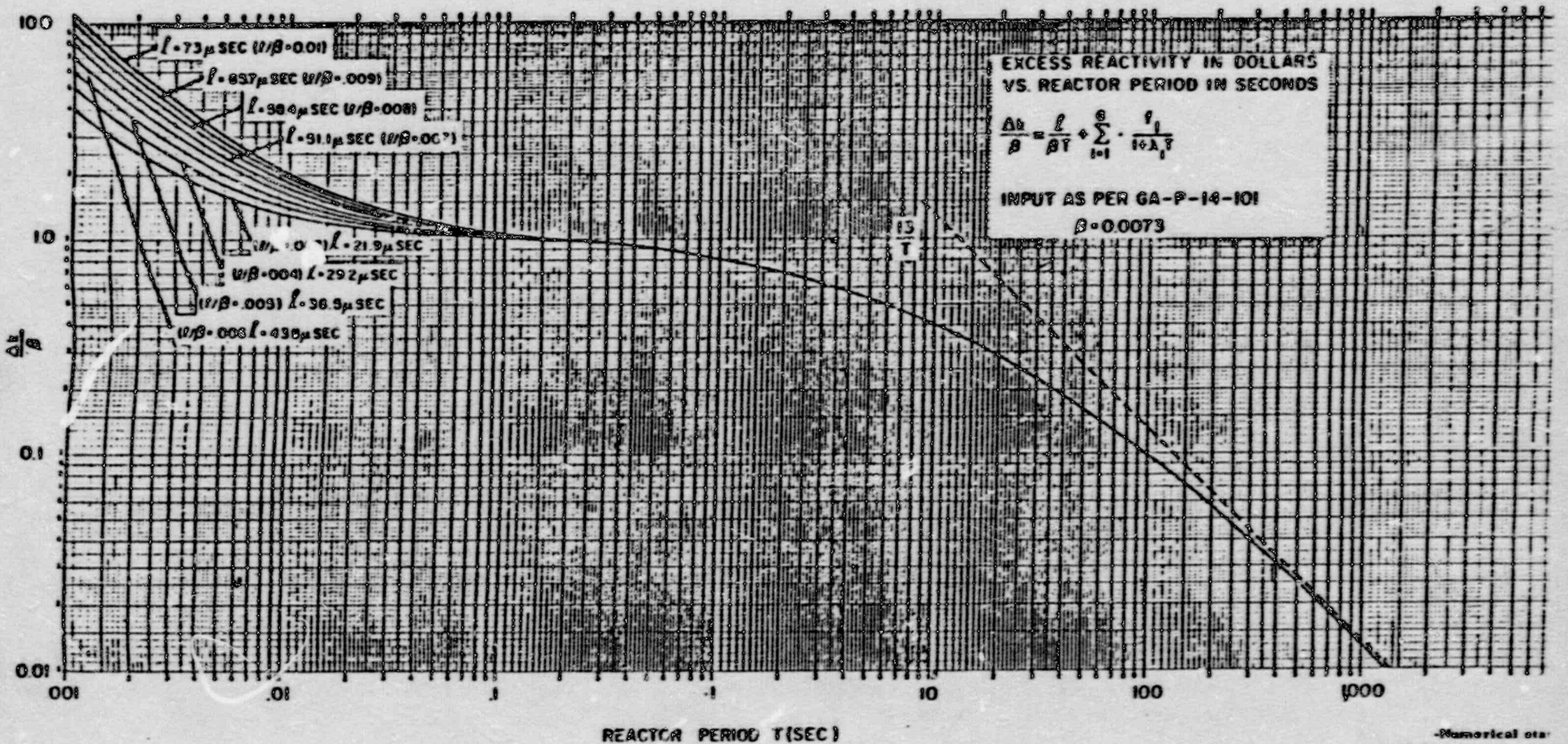
1 Mw = 3.41×10^6 Btu/hr

1 Btu = 778 ft-lbf

1 inch = 2.54 cm

$^\circ F = 9/5\,^\circ C + 32$

$^\circ C = 5/9\,(^\circ F - 32)$



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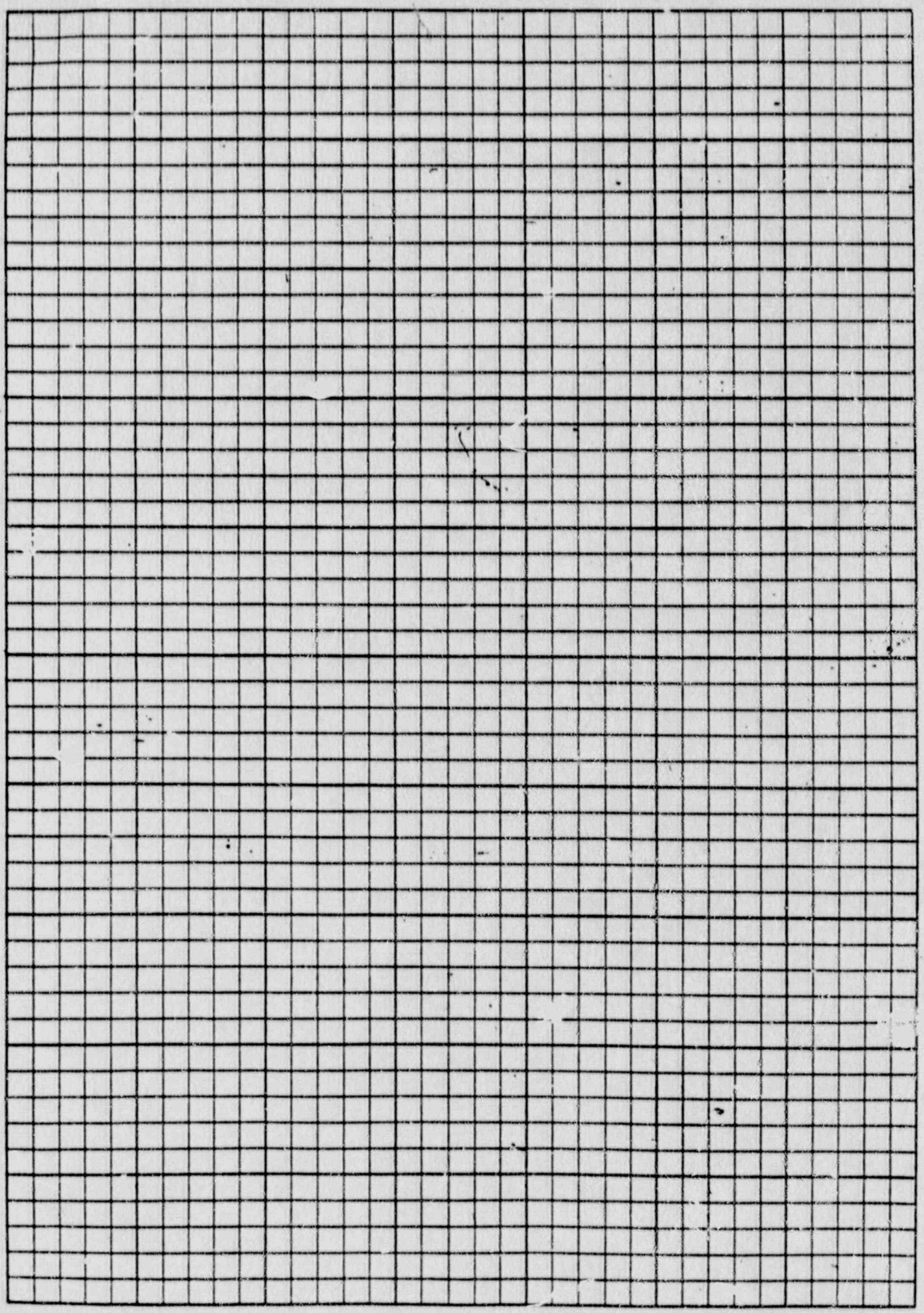


QUESTION: 001 (1.00)

Which one of the following terms is described as the total number of fast neutrons compared to the number in the original group?

a. resonance escape probability

b. fast fission factor

c. fast non-leakage probability

d. reproduction factor

QUESTION: 002 (1.00)

Which one of the following factors is most easily varied by the reactor operator?

a. reproduction factor

b. fast fission factor

c. fast non-leakage probability

d. thermal utilization factor

QUESTION: 003 (1.00)

Which one of the following is the correct reason that delayed neutrons enhance control of the reactor?

a. More delayed neutrons are produced than prompt neutrons.

b. Delayed neutrons increase the mean neutron lifetime.

c. Delayed neutrons take longer to thermalize than prompt neutrons.

d. Delayed neutrons are born at higher energies than prompt neutrons.

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

QUESTION: 004 (1.00)

Which one of the following conditions describes a reactor that is exactly critical?

a. Keff = 1; delta-K/K = 0

b. Keff = 1; delta-K/K = 1

c. Keff = 0; delta-K/K = 0

d. Keff = 0; delta-K/K = 1

QUESTION: 005 (1.00)

With Keff = 0.987, how much reactivity must be added to make the reactor critical?

a. 1.30% delta-K/K

b. 1.32% delta-K/K

c. 1.34% delta-K/K

d. 1.36% delta-K/K

QUESTION: 006 (1.00)

A subcritical reactor has an initial source range count rate of 150 cps with a shutdown reactivity of -2.0% delta-K/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

a. 0.5% delta-K/K

b. 1.0% delta-K/K

c. 1.5% delta-K/K

d. 2.0% delta-K/K

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

QUESTION: 007 (1.00)

While withdrawing control rods during an approach to criticality, the count rate doubles. What will occur if the same amount of reactivity that caused the first doubling is added again?

a. count rate will increase slightly

b. count rate will double

c. the reactor will remain subcritical

d. the reactor will be critical or slightly supercritical

QUESTION: 008 (1.00)

Two identical reactors are operating at power. Reactor "A" is at 1 MW and reactor "B" is at 100 KW. If both reactors scram at the same time, xenon-135 will peak first in reactor _____ and the highest xenon-135 reactivity peak will occur in reactor _____.

a. "A"; "A"

b. "A"; "B"

c. "B"; "A"

d. "B"; "B"

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

QUESTION: 009 (1.00)

Which one of the following statements correctly states how neutron flux is affected by the addition of a reflector around a reactor core?

a. With a reflector in place thermal flux is higher at the edge of the core.

b. With a reflector in place thermal flux is lower at the edge of the core.

c. With a reflector in place fast flux is higher at the edge of the core.

d. With a reflector in place fast flux is lower at the edge of the core.

QUESTION: 010 (1.00)

With the reactor at a power of 10 watts and a period of 20 seconds, how long will it take for power to reach 1 KW?

a. 41 seconds

b. 69 seconds

c. 92 seconds

d. 117 seconds

QUESTION: 011 (1.00)

The Mark I reactor is at a power of 0.1 watt and 25 cents of reactivity is added. What is the resulting stable reactor period? (Assume lamda-eff = 0.08 and Beff = 0.007)

a. 48 seconds

b. 36 seconds

c. 28 seconds

d. 22 seconds

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

QUESTION: 012 (1.00)

The Mark F reactor is subcritical with a Keff of 0.96 and 30 cps indicated. After a fuel element is removed the count rate drops to 10 cps. No other changes have occurred. What is the Keff of the core with the fuel element removed?

a. 0.9733

b. 0.8800

c. 0.8400

d. 0.6666

QUESTION: 013 (1.00)

The Mark F reactor uses _____ as its reflector and the Mark I uses _____.

a. water; graphite

b. zirconium; water

c. graphite; water

d. water; aluminum

QUESTION: 014 (1.00)

Which one of the following is a reason for using Graphite Dummy Elements in the TRIGA core?

a. to provide additional shielding

b. to absorb neutrons that would otherwise leak from the core

c. to reduce the fuel element requirements

d. to reduce the thermal flux at the core boundary

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

QUESTION: 015 (1.00)

Which one of the following statements describes a reactor's excess reactivity?

a. The amount of reactivity needed to achieve criticality.

b. The amount of reactivity required to shut the reactor down.

c. The amount of reactivity available above that which is required to keep the reactor subcritical.

d. The amount of reactivity available above that which is required to keep the reactor critical.

QUESTION: 016 (1.00)

Which one of the following is one of the advantages of the neutron source used in the Mark F reactor?

a. It can be reactivated by power operation of the reactor.

b. It has a relatively long half life.

c. It has a relatively short half life.

d. It has a large gamma ray yield.

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

QUESTION: 017 (1.00)

Which one of the following statements correctly describes the effect of a fuel temperature increase on a fuel-moderator element?

a. The probability that a thermal neutron will lose energy in a collision with an excited sta' Hydrogen atom increases.

b. The probability tha a neutron will escape from the element before being captured significantly increases.

c. The thermal neutron spectrum in the fue element shifts to a lower average energy.

d. The mean free path for neutrons in the element is decreased appreciably.

QUESTION: 018 (1.00)

Which one of the following is the reason that power decreases on the same stable negative period following a reactor scram regardless of the initial power level?

a. The rate of power change is dependent on the mean lifetime of the longest lived delayed neutron precursor.

b. The rate of power change is dependent on the constant decay rate of prompt neutrons.

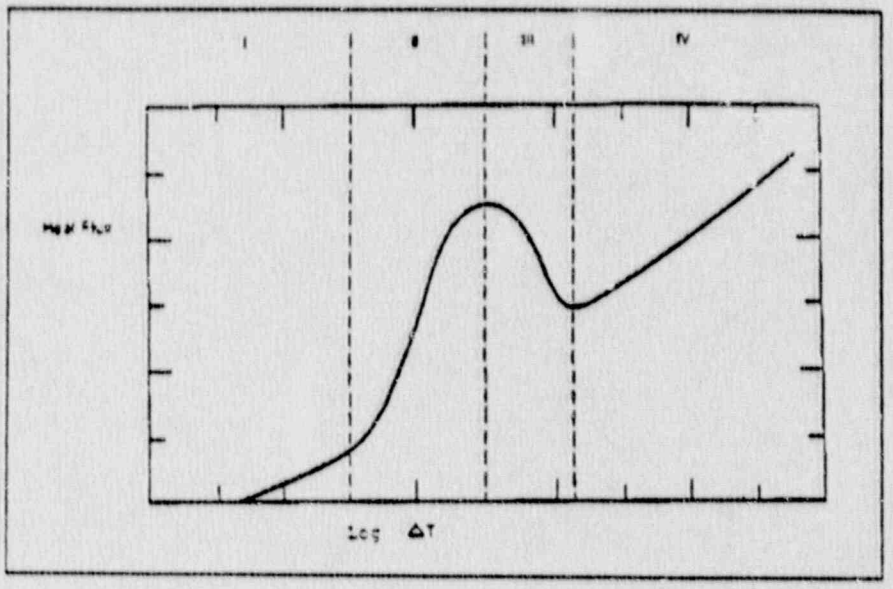
c. The rate of power change is dependent on the mean lifetime of the shortest lived delayed neutron precursor.

d. The rate of power change is dependent on the constant decay rate of prompt gamma emitters.

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

QUESTION: 019 (1.00)

Using the heat flux curve pictured below, select the region of the curve where the TRIGA reactor core cooling normally occurs.



a. region I

b. region II

c. region III

d. region IV

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

QUESTION: 020 (1.00)

A Triga reactor is being loaded for criticality. The following tabulation summarizes the number of elements added and the resulting steady state count rate. The source level [Ro] is considered to be 1000 CPM. [R/Ro = count rate/source level].

NO. OF ELEMENTS	COUNT RATE [CPM]	R/Ro	Ro/R
50	3000	3.00	0.333
55	4255	4.25	0.235
60	7000	7.00	0.143

Which one of the following is the number of fuel elements that will be required for criticallity?

a. 57

b. 62

c. 67

d. 72

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

QUESTION: 001 (1.00)

An accessible area with a radiation level of 75 mrem/hr should be posted as a(n)_____.

a. restricted area

b. radiation area

c. high radiation area

d. radiologically controlled area

QUESTION: 002 (1.00)

Prior to returning to power following an unplanned or unscheduled shutdown, the Reactor Operator must obtain the approval of the _____.

a. Senior Reactor Operator

b. Associate Physicist-in-Charge

c. Physicist-in-Charge

d. Criticality Safeguards Committee

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

QUESTION: 003 (1.00)

A modified routine experiment is to be performed and it has been determined and documented that the hazards associated with the experiment are neither significantly different nor greater than the corresponding referenced routine experiment.

Which one of the following individuals or groups is required to approve the performance of the modified routine experiment described above?

a. SRO

b. Associate Physicist-in-Charge

c. Physicist-in-Charge

d. Criticality Safeguards Committee

QUESTION: 004 (1.00)

The Reactor Start up Checklist is required to be performed in which one of the following cases?

a. prior to all reactor start ups

b. prior to each day's reactor operations

c. only prior to the start up of an operation expected to last more than 12 hours

d. only prior to the start up following a shutdown of greater than 6 hours

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

QUESTION: 005 (1.00)

Maintenance work which requires the manual movement of a control rod is scheduled to be accomplished on your shift. Which one of the following is a requirement that must be met or verified in order to perform such maintenance?

a. The reactor will be shutdown with the rod being worked on removed from the core.

b. The worth of the shutdown rods in the core is at least two times the available excess reactivity.

c. The work must be performed by a licensed SRO.

d. The magnet power supply to all rods must be turned off.

QUESTION: 006 (1.00)

Which one of the following correctly describes the dosimetry that would be required to be worn by a sixteen year old boy who was touring the reactor facility as part of a large group?

a. The boy would not be issued dosimetry or be allowed to tour the facility since he is under 18 years of age.

b. The boy would be required to wear a pocket dosimeter.

c. The boy would not need any dosimetry as long as at least one dosimeter was issued for every five persons in the group.

d. The boy would be required to wear a film badge or TLD.

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

QUESTION: 007 (1.00)

According to the Mark I Reactor Start up Procedure, if all systems are operating properly, core excess should be determined at a power level less than _____.

a. 100 W

b. 1 KW

c. 3 KW

d. 5 KW

QUESTION: 008 (1.00)

Which one of the following conditions will cause the Mark I Reactor Control System to remain in MANUAL mode after the PULSE button is depressed?

a. reactor power is 750 W

b. the transient rod is all the way down

c. air is applied to the transient rod drive

d. reactor period is 30 seconds

QUESTION: 009 (1.00)

Which one of the following is the reason that the conductivity of the pool water is required by Technical Specifications to be maintained less than or equal to 5 umho/cm?

a. to enhance the effectiveness of the demineralizer at removing ions

b. to more easily detect an abnormal increase in ion concentration

c. corrosion of reactor components is minimized at lower conductivity levels

d. a higher conductivity level would change the moderating effect of the water

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

QUESTION: 010 (1.00)

How long can you work in an area with a general background radiation level of 250 mr/hr before you would exceed the minimum 10 CFR 20 whole body quarterly limit?

a. 3.0 hours

b. 5.0 hours

c. 7.5 hours

d. 10.0 hours

QUESTION: 011 (1.00)

A point source of gamma radiation measures 50 mr/hr at a distance of 2 feet. Assuming 100% detector efficiency for gamma, what will the exposure rate be at a distance of 16 feet from the source?

a. 0.625 mr/hr

b. 0.78 mr/hr

c. 6.25 mr/hr

d. 7.8 mr/hr

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

QUESTION: 012 (1.00)

During a Reactor Power Calibration on the Mark I Reactor the %error on one channel is 5%. Which one of the following adjustments must be made to correct this error?

a. No adjustment is necessary unless one %error is greater than or equal to 7%.

b. The gain of the neutron detector must be adjusted to match the measured thermal power.

c. The neutron detector compensating voltage must be adjusted to match the measured thermal output.

d. The neutron detector height must be adjusted to match the measured thermal output.

QUESTION: 013 (1.00)

According to the Mark I Reactor Technical Specifications, which one of the following individuals is authorized to make temporary changes to procedures that do not change the original intent of the procedure?

a. Senior Reactor Operator on duty

b. Associate Physicist-in-Charge

c. Physicist-in-Charge

d. Criticality Safeguards Committee Chairman

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

QUESTION: 014 (1.00)

Aside from a licensed RO on each reactor, which one of the following describes the additional personnel required to meet the minimum manning requirements with both the Mark I and Mark F reactors operating?

a. a third individual capable of initiating emergency action present in the Triga Reactors Facility, and an SRO readily available on call

b. a third licensed individual present in the Triga Reactors Facility and an SRO readily available on call

c. an SRO present in the Triga Reactors Facility

d. an SRO readily available on call

QUESTION: 015 (1.00)

The Technical Specification minimum pool level for the Mark F reactor is _____ feet above the top grid plate.

a. 8

b. 10

c. 14

d. 16

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

QUESTION: 016 (1.00)

Which one of the following is an action that should be taken if the Mark F reactor's bulk pool temperature reaches 40 degrees C during an extended operation?

a. No action is required until the 65 degree C bulk pool temperature limit is reached.

b. The reactor should be shutdown, and the PIC should be notified.

c. The water treatment system should be turned off.

d. The coolers normally used for the Mark I reactor should be shifted to the Mark F reactor.

QUESTION: 017 (1.00)

According to the Mark I Reactor's Technical Specifications, the reactivity worth of any individual experiment shall not exceed _____, and the total absolute reactivity worth of a combination of experiments shall not exceed _____.

a. $1.00; $3.00

b. $3.00; $4.00

c. $3.00; $5.50

d. $3.25; $5.00

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

QUESTION: 018 (1.00)

One step in the Mark I reactor's Alarm and Scram Procedure for a "Failure of the Control Rods to Drop on a Scram" directs you to secure console power, but then to restore it if securing it did not effect a scram. Which one of the following is the reason power should be restored to the console?

a. so that the radiation monitors will still function

b. so that fuel temperature can still be monitored

c. so that the conductivity monitors will still function

d. so that the power channels can still be monitored

QUESTION: 019 (1.00)

A reactor control rod reactivity worth calibration is being conducted using the "bump period method" in accordance with the Mark I Standard Operating Procedures. The REG rod being calibrated has been withdrawn in SIX equal reactivity increments to go from fully inserted to fully withdrawn. After EACH withdrawal the STABLE PERIOD measured [between 5 watts and 1 KW] was +37 seconds.

Which one of the following is the TOTAL worth of this control rod?

a. $10.05

b. $4.64

c. $2.64

d. $1.20

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

QUESTION: 020 (1.00)

Following an emergency which required facility evacuation, which one of the following individuals will determine when the facility may be reentered?

a. Emergency Coordinator

b. Emergency Response and Recovery Director

c. Emergency Response Team Leader

d. Security Officer

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

QUESTION: 001 (1.00)

Deleted

Self protecting fuel refers to fuel that _____.

a. has a negative fuel temperature coefficient

b. has built in burnable poisons

c. has an external dose rate < 1000 Rem/hr with no intervening shielding

d. contains uranium enriched above 20 weight percent

QUESTION: 002 (1.00)

Which one of the following correctly describes the location where the water treatment system takes suction from the reactor pool, and the reason this location is used?

a. from the upper region to limit siphoning of pool water in case of system leakage

b. from the upper region to allow N-16 gammas time to decay before the water enters the treatment system

c. from the core region so N-16 gammas will enter the water treatment system rather than becoming a radiation hazard at the pool surface

d. from the core region so impurities will be filtered out before they become irradiated

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

QUESTION: 003 (1.00)

Which one of the following statements best describes the purpose of the diffuser system on the Mark F reactor?

a. it enhances the natural circulation flow in the pool

b. it creates turbulence in the pool to dissolve N-16 before it rises to the pool surface

c. it provides additional decay time for N-16 before it rises to the pool surface

d. it deaerates the pool water to reduce the formation of Ar-41

QUESTION: 004 (1.00)

Which one of the folowing color combinations would be displayed on the Mark I high resolution CRT for a standard control rod and drive that are completely withdrawn with the magnet making contact?

	ROD COLOR	MAGNET BOX
a.	grey	black
b.	magenta	yellow
c.	green	yellow
d.	magenta	black

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

QUESTION: 005 (1.00)

While operating the Mark I reactor at 50 KW the operator accidentally pushes and immediately releases the MAGNET pushbutton for the REG rod. Which one of the following is the correct response of the reactor control system?

a. all rods scram

b. only the REG rod scrams

c. the REG rod momentarily drives inward until the pushbutton is released

d. the YELLOW color in the MAGNET box will momentarily be eliminated but the REG rod will not move

QUESTION: 006 (1.00)

While the Mark I reactor is operating in the automatic mode, the actual power input used by the servo system to adjust power to the demanded level is provided by _____.

a. the NM-1000 channel

b. the NP-1000 channel

c. the NPP-1000 channel

d. the highest reading channel

QUESTION: 007 (1.00)

Loss of the mma compensating signal to a compensated ion chamber will result in which one of the following?

a. a sudden increase in indicated power at low power

b. a sudden decrease in indicated power at low power

c. a sudden increase in indicated power at high power

d. a sudden decrease in indicated power at high power

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

QUESTION: 008 (1.00)

Which one of the following will be the response of the Mark F reactor if while operating at 1000 KW the K1 power channel fails high?

a. The reactor will scram because the K1 channel has exceeded the scram setpoint.

b. The reactor will continue operating because the K1 channel provides startup indication but no scram function.

c. The reactor will continue operating because the required 2 of 3 logic for a reactor scram has not been met.

d. The reactor will continue operating because the required 2 of 4 logic for a reactor scram has not been met.

QUESTION: 009 (1.00)

Which one of the following describes how gamma compensation is accomplished in the Mark F reactor's K3 power channel?

a. A pulse height discriminator is used to eliminate the gamma signal.

b. A Campbelling circuit is used to eliminate the gamma signal.

c. A compensated ion chamber is used to eliminate the gamma signal.

d. Compensation is not required at the power levels monitored by the K3 channel.

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

QUESTION: 010 (1.00)

Which one of the following describes the rate of power change for the Mark I reactor while operating in the automatic mode?

a. Power changes on a fixed preset period of 5.0 seconds.

b. Power changes on a fixed preset period of 6.5 seconds.

c. Power changes on a variable period automatically determined by the magnitude of the desired power change

d. Power changes on a variable period manually set by the operator.

QUESTION: 011 (1.00)

Which one of the following devices is used to reduce the bottoming impact of a Mark I reactor control rod after a reactor scram?

a. a water dashpot device

b. an air dashpot device

c. a mechanical shock absorber

d. the rod compression spring

QUESTION: 012 (1.00)

Which one of the following conditions will cause an automatic scram of the Mark I reactor?

a. NP-1000 channel reading 250 KW

b. reactor period of 3 seconds

c. NPP-1000 high voltage power supply momentarily decreases 5%

d. fuel temperature reading 750 degrees C

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

QUESTION: 013 (1.00)

On a sustained loss of electrical power to the TRIGA Reactors Facility, which one of the following components will be powered by the Uninterrupted Power Supply (UPS)?

a. Mark F wide range power channel

b. Mark I NPP-1000 and NP-1000 power channels

c. Mark I and Mark F radiation area monitors

d. Mark I and Mark F continuous monitors

QUESTION: 014 (1.00)

Which one of the following conditions will automatically activate the evacuation alarm?

a. One RAM alarming at the high alarm setpoint.

b. Two RAMs alarming at the low alarm setpoint.

c. Two RAMs alarming, one of which must be a high alarm.

d. The CAM alarming at 10,000 cpm.

QUESTION: 015 (1.00)

How does the rod control system adjust power in the automatic mode of operation?

a. By movements of the regulating, shim, and safety control rods.

b. By movements of the regulating and safety control rods.

c. By movements of the regulating and shim control rods.

d. By movement of the regulating control rod only.

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

QUESTION: 016 (1.00)

In the event of a leak from a fuel element during full power operation, what are the PREDOMINANT isotopes that will be detected by the continuous air monitor?

a. nitrogen-16 and argon-41

b. fission product gasses [Kr-88 and Xe-135]

c. fission product iodine [I-131 and I-133]

d. fission product daughters [Rb-88 and Cs-139]

QUESTION: 017 (1.00)

How does the transfer system function to MINIMIZE contamination while inserting and removing samples from the terminus in the core?

a. The blower exhausts through a filter into the reactor room exhaust duct and pressurizes the system to move the sample into and out of the terminus.

b. The blower exhausts through a filter into the reactor room exhaust duct and draws a vacuum on the system to move the sample into and out of the terminus.

c. The blower draws air through a filter from the reactor room exhaust duct and pressurizes the system to move the sample into and out of the terminus.

d. The blower draws air through a filter from the reactor room exhaust duct and draws a vacuum on the system to move the sample into and out of the terminus.

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

QUESTION: 018 (1.00)

Which one of the following detector types is utilized by the criticality alarm?

a. Geiger counter

b. scintillation detector

c. proportional counter

d. ionization chamber

QUESTION: 019 (1.00)

Which one of the following is the approximate worth of a standard control rod?

a. $1.00

b. $2.00

c. $3.00

d. $4.00

QUESTION: 020 (1.00)

Which one of the following statements correctly describes the automatic actions that will occur if the radioactivity monitor of the Mark I ventilation system absolute filter reaches a radiation level of 5 mr/hr while the reactor is operating?

a. no automatic action will occur until the 10 mr/hr setpoint is reached

b. an audible alarm and light will be activated in the Mark I control room

c. the ventilation system will be isolated

d. the reactor will scram and the ventilation system will be isolated

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

ANSWER: 001 (1.00)

b

REFERENCE:

GA Reactor Training Manual (p. VI-3)

ANSWER: 002 (1.00)

d

REFERENCE:

GA Reactor Training Manual (p.VI-8,9)

ANSWER: 003 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-10)

ANSWER: 004 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9)

ANSWER: 005 (1.00)

b

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

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9)

ANSWER: 006 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-16)

ANSWER: 007 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9,16)

ANSWER: 008 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (p.VI-27)

ANSWER: 009 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (p. VI-7)

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

ANSWER: 010 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (p. VI-15)

ANSWER: 011 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-15)

ANSWER: 012 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-16)

ANSWER: 013 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (p. I-16, VI-7)

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

ANSWER: 014 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (p. I-15, VI-18)

ANSWER: 015 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9, VI-18)

ANSWER: 016 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p.I-16)

ANSWER: 017 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-19)

ANSWER: 018 (1.00)

a

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

REFERENCE:

GA Reactor Operator Training Manual (p. VI-15)

ANSWER: 019 (.JC)

a

REFERENCE:

GA Reactor Operator Training Manual (p. I-32, VI-29, VI-31)

ANSWER: 020 (1.00)

c

REFERENCE:

GA Supplementary Material (IV: XI-1)
GA Reactor Operator Training Manual (p. 6-2 to 6-16)

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

ANSWER: 001 (1.00)

b

REFERENCE:

GA Supplementary Material (p.III-27)

ANSWER: 002 (1.00)

a

REFERENCE:

GA Supplementary Material (IV: p. I-4)

ANSWER: 003 (1.00)

c

REFERENCE:

GA Supplementary Material (III: p.4)

ANSWER: 004 (1.00)

b

REFERENCE:

GA Supplementary Material (IV: p.I-2)

ANSWER: 005 (1.00)

b

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

REFERENCE:

GA Supplementary Material (IV: p. I-2)

ANSWER: 006 (1.00)

d

REFERENCE:

GA Supplementary Material (III-19)

ANSWER: 007 (1.00)

b

REFERENCE:

GA Supplementary Material (V-1)

ANSWER: 008 (1.00)

c

REFERENCE:

GA Supplementary Material (VI: V-2)

ANSWER: 009 (1.00)

c

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

REFERENCE:

GA Reactor Operator Training Manual (p.I-32)
GA Technical Specifications (I: p.5, II: p.3)

ANSWER: 010 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (V-27)

ANSWER: 011 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. V-28)

ANSWER: 012 (1.00)

d

REFERENCE:

GA Supplementary Material (IV: VIII-2)

ANSWER: 013 (1.00)

c

REFERENCE:

GA Mark I Technical Specifications (p.19)

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

ANSWER: 014 (1.00)

d

REFERENCE:

GA Supplementary Material (IV: I-1)

ANSWER: 015 (1.00)

d

REFERENCE:

GA Mark F Technical Specifications (p. 3)

ANSWER: 016 (1.00)

c

REFERENCE:

GA Supplementary Material (V: 1-4)

ANSWER: 017 (1.00)

b

REFERENCE:

GA Mark I Reactor Technical Specifications (p.11)

ANSWER: 018 (1.00)

d

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

REFERENCE:

GA Supplementary Material (IV: VI-7)

ANSWER: 019 (1.00)

d

REFERENCE:

GA Supplementary Material (IV: IX-1)

ANSWER: 020 (1.00)

b

REFERENCE:

GA Supplementary Material (III: p.14)

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

ANSWER: 001 (1.00)

c

Deleted

REFERENCE:

GA Supplementary Material (III: p.22)

ANSWER: 002 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (I-33)

ANSWER: 003 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (I-32)

ANSWER: 004 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (II-26)

ANSWER: 005 (1.00)

b

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

REFERENCE:

GA Reactor Operator Training Manual (1-24)

ANSWER: 006 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (II-27)

ANSWER: 007 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (II-53)

ANSWER: 008 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (2-48)

ANSWER: 009 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (2-52)

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

ANSWER: 010 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (2-31)

ANSWER: 011 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (I-23)

ANSWER: 012 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (2-29)

ANSWER: 013 (1.00)

a , b

REFERENCE:

GA Supplementary Material (V: VI-10)

ANSWER: 014 (1.00)

c

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

REFERENCE:

GA Reactor Operator Training Manual (V-16)

ANSWER: 015 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (2-27)

ANSWER: 016 (1.00)

d , b

REFERENCE:

GA Reactor Operator Training Manual (V-5)

ANSWER: 017 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (I-41)

ANSWER: 018 (1.00)

d

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

REFERENCE:

GA Reactor Operator Training Manual (V-20)

ANSWER: 019 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (I-23)

ANSWER: 020 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (1-37, 2-33)

(***** 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.

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 *****)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

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

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

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

ANSWER KEY

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

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

ANSWER KEY

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

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

ANSWER KEY

~~001~~	~~c~~	deleted / per
002	a	
003	c	
004	b	
005	b	
006	a	
007	a	
008	c	
009	d	
010	b	
011	a	
012	d	
013	a , b	
014	c	
015	d	
016	d , b	
017	b	
018	d	
019	b	
020	b	

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