ENCLOSURE 1

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

REPORT NO.: 50-188/OL-92-01

FACILITY DOCKET NO.: 50-188

FACILITY LICENSE NO.: R-88

FACILITY: Kansas State University

EXAMINATION DATES. February 18-19, 1992

EXAMINER: Patrick Isaac, Chief Examiner

SUBMITTED BY: Patrick Isaac, Chief Examiner 3/30/92 Date

APPROVED BY: James L. Caldwell, Chief 3/30/92 Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation, NRR

SUMMARY:

NRC administered written and operating examinations to two Reactor Operator (RO) applicants. Both candidates passed the applicable portions of the examination.

## REPORT DETAILS

1. Examiner:

   Patrick Isaac

2. Results:

| | RO (Pass/Fail) | SRO (Pass/Fail) | Total (Pass/Fail) |
|---|---|---|---|
| NRC Grading: | 2/0 | N/A | 2/0 |

3. Written Examination:

   The written examination was administered on February 18, 1992 to two RO candidates. At the conclusion of the examination, the Chief Examiner immediately secured the master examination answer key and all of the candidate's answer sheets. A copy of the master "as given" examination with answer key was forwarded to the licensee's training staff for their formal review.

   Several deficiencies were noted concerning the reference materials provided for the preparation of the written examination.

   Systems descriptions were not detailed and presented only limited operational aspects of the systems being discussed. Various components of the rod drive mechanism were not described. A functional block diagram of the Reactor Instrumentation was not plant specific and contained generic descriptions of the rod control system. The licensee noted that their copy of the Reactor Instrumentation diagram (fig. 6) was different from the one provided to the NRC.

   The Linear and Safety channels Safety System setpoints provided to the NRC were different from their actual values. This was identified and corrected during a telephone conversation made to Mr. Burger prior to the administration of the examination.

   A review of the reference material on site indicated that there were many available reference manuals including the following, which were not provided for the preparation of the examination:

   Hazards Summary Report
   Technical Data (Plant curves)
   Instrumentation and Mechanical
     Maintenance Manuals

The limited amount of information provided for the development of the written examination resulted in numerous telephone conversations with the facility. This was necessary in order to generate valid and adequate test questions.

The facility's written examination comments and the NRC's resolution to those comments are found in Enclosure 2.

Both RO candidates passed this portion of the examination.

4. Operating Examinations:

Operating Examinations were administered on February 19, 1992. These examinations tested the candidates' integral system knowledge and ability to actually operate the reactor facility.

The newly installed computer system to monitor peak power during pulsing operations failed to function. The facility's staff promptly replaced it with another mean of recording peak power, allowing the examination process to continue.

Both candidates passed this portion of the examination.

5. Exit Meeting:

Personnel attending: Dr. Richard E. Faw, Director
Mr. Matthew Burger, Reactor Supervisor
Patrick J. Isaac, Chief Examiner

Mr. Patrick Isaac expressed appreciation to both Dr. Faw and Mr. Burger for their efforts in support of the examination. Mr. Isaac discussed the lack of and the inadequacies of the reference material provided for the preparation of the written examination. These deficiencies are addressed in detail in Paragraph 2.0.

ENCLOSURE 2

# NRC RESOLUTIONS - WRITTEN EXAMINATION

## SECTION A

Question 03:

Which ONE of the following is a correct statement concerning the factors affecting control rod worth?

a. Fuel burn up causes the rod worth for periphery rods to decrease.

b. Fuel burn up causes the rod worth to increase in the center of the core.

c. The withdrawal of a rod causes the rod worth of the remaining inserted rods to increase.

d. As Rx power increases rod worth increases.

Answer 03:

c

Facility Comment A3:

It seems to us that there are no unambiguously correct answers. Clearly, answers a,b, and d are incorrect. Answer c is incorrect for the following reasons. According to the statistical-weight theorem (or the $\emptyset^2$-weight theorem) of reactor physics control rod worth is independent of average reactor power (or neutron flux density). It just depends on local flux density relative to the average. While removal of a rod causes the average flux density to increase, it also causes the flux density in the region of the removed control rod to increase relative to the average and flux densities in the regions of remaining control rods to decrease relative to the average. The reactivities of the remaining (inserted) control rods therefore are decreased.

NRC Resolution A3:

The effect of a motion of a control rod on an adjacent control rod is not clear cut. In some instances, depending on their location, the rod worth of the remaining rods may either increase or decrease. (See "Nuclear Reactor Engineering," Third Edition, Glasstone and Sesonske, Section 5.183, for an excellent discussion of this matter.)

Clearly, answers a,b and d are incorrect and they would not be selected by a candidate with a good understanding of the subject. However since answer c is not always correct, the question will be deleted.

SECTION A

Question 5:

A short reactor period is a greater hazard when reactor power is:

a. Close to 100%

b. Above the Point of Added Heat (POAH)

c. Below the POAH

d. Close to source counts

Answer 5:

d

Facility Comments A5:

We suggest that answer a also be accepted, for the following reasons. What is meant by "hazard" is not clear, but it would seem to us that, if there is any hazard-based reason for a 100% power limit, then we would argue that the limit would most easily be challenged if there is a short (positive) period and the power is near the 100% limit. Our operators and trainees have been conditioned to avoid challenges to safety-limit settings.

NRC Resolution A5:

Comment not accepted. Initial startup requires careful regulation of the rate of increase of reactivity to prevent the possibility that the reactor may go critical on a short period. Since startup instruments may not be reliable at low neutron fluxes, the withdrawal of control rods is prevented until the neutron flux is large enough to be detectable. A reactor may also be equipped with a safety system which prevents further withdrawal of the control rods if the period reaches a predetermined small value. These added safety features emphasize the utmost importance of avoiding a rapid rate of power increase when close to source counts. If a short period is allowed to continue, the exponential rise of reactor power will rapidly exceed the high power trip setpoints. Eventually, before enough negative reactivity is inserted to turn power, fuel damage could occur. The reactor power overshoot from a short period at or near 100% power is not as large. The percent power trip (104%) and the fuel temperature coefficient will insert enough negative reactivity to turn power and prevent fuel damage. It is very important for the reactor operator to understand the above concept since he is the ultimate protection against core damage.

SECTION A

Question 11

The reactor is exactly critical below the point of adding heat. Rods are manually inserted for 5 seconds. Reactor power will:

a. Decrease to a shutdown power level low in the source (startup) range.

b. Decrease temporarily, then return to the original value due to the resulting decrease in moderator temperature.

c. Decrease until inherent positive reactivity feedback causes the reactor to become critical at a lower neutron level.

d. Decrease temporarily, then return to the original value due to subcritical multiplication.

Answer 11:

a

Facility Comment All:

To the best of our recollection, the term "point of added heat (POAH)" has never been used in our training. Nor, to the best of our recollection, has it ever been used in AEC or NRC examinations at this facility. The term is not recognized by current Reactor Facility Staff or by current faculty members in the Nuclear Engineering Department. We would not expect our trainees to recognize the term. Trainees might not be able to tell unambiguously whether the initial point for the scenario would be in what we would call "zero power regime," for which answer a would be correct, or the "power regime," for which case answer c would be correct. Thus we urge that either answers a or c be accepted as correct.

NRC Resolution All:

Comment accepted. The answer key has been changed to accept a and c as correct. The term "point of added heat" (POAH) is widely used throughout the power industry. As stated in page 1 of the Training Manual, one of the primary functions of the KSU Reactor Facility is to train nuclear reactor operators. It may therefore be beneficial to them to include this term in their training as they are likely to encounter it in future activities.

SECTION A

Question 13

If, during a reactor startup, the startup rate is constant and positive without any further reactivity addition, then the reactor is:

a. At the Point of Added Heat (POAH).

b. Supercritical.

c. Subcritical.

d. Prompt critical.

Answer 13:

b

Facility Comment A13:

In this question, the term "startup rate" is not defined. Presumably, the question deals with a constant positive period, in which case answer b is correct. However examinees might reasonably infer that a constant startup rate means that the time derivative of the power is constant, a circumstance is more nearly associated with subcritical multiplication in a reactor with startup source present.

NRC Resolution A13:

Comment accepted. The question will be modified for future use. The term "startup rate" is widely used throughout the power industry. Since one of the primary functions of the KSU Reactor Facility is to train nuclear reactor operators, it may therefore be beneficial to them to include this term in their training as they are likely to encounter it in future activities.

**SECTION A**

Question 16

The purpose of the installed neutron source is to:

a. Compensate for neutrons absorbed in non-fuel materials in the core.

b. Generate a sufficient neutron population to start the fission chain reaction for each startup.

c. Provide a means to allow reactivity changes to occur in a subcritical reactor.

d. Generate a detectable neutron source level for monitoring reactivity changes in a shutdown reactor.

Answer 16:

d

Facility Comment A16:

Our trainees have been taught that there are two reasons, albeit related, for requiring a startup source: (1) to avoid the proverbial sourceless startup (supercriticality with multiplication triggered by photofission or another statistically unreliable neutron source), and (2) to assure that at least one neutron instrumentation channel receives a measurable signal even with the reactor secured. Thus, we would hope that either answer b or answer d be accepted as correct. On page 10 (para. B(1)a) of the "General Characteristics of the TRIGA Reactor," the prevention of a sourceless startup is stressed.

NRC Resolution A16:

Comment not accepted. Neutron sources, both intrinsic and installed, are essential to reactor operation in the sense that they provide both a source of neutrons to start the chain reaction and a visible neutron level on the source range monitors during reactor shutdown, reactor startup and extended periods of shutdown. A visible neutron level is required in order to verify the operability of the Source Range Monitors and to accurately predict an approach to criticality. Photo-neutron and other intrinsic sources are generally not strong enough to maintain a visible neutron level, particularly during extended shutdown periods. Installed sources are therefore used to supplement the intrinsic sources to ensure a visible neutron level is always present. (See "Nuclear Reactor Engineering," Third Edition, Glasstone and Sesonske, Section 5.286.)

Only answer d correctly describes the purpose of the installed neutron source.

SECTION A

Question 19

Which ONE of the following coefficients will be the first one to start turning reactor power after a power excursion from full power?

a. Fuel Temperature

b. Moderator Temperature

c. Void

d. Power

Answer 19:

a

Facility Comment A19:

In our operations, we make more use of the power coefficient of reactivity (about $0.01 per KW) than the temperature coefficient. Of course the two coefficients are related. But the power coefficient is easy to measure. It is constant for the operating range of the TRIGA because the temperature coefficient is constant and heat transfer is so poor that there is a direct proportionality between power and fuel temperature above zero-power conditions. Most importantly, the power coefficient has direct operational significance. We know, for example, that rod withdrawal worth $0.25 will lead to a power increase of 25 kW. The (fuel) temperature coefficient cannot be measured. It is based on core average fuel temperature. Our gauges read only B-ring fuel temperature. Thus, we expect our operators to think in terms of power feedback coefficient instead of temperature coefficient and would hope that answer d is also accepted. Experiment 4 (p. 46) on "Reactivity Coefficient Determination" stresses the link between temperature and power coefficient of reactivity.

NRC Resolution A19:

Comment not accepted. The large negative temperature coefficient that is inherent in the TRIGA fuel is the primary mechanism that acts to decrease reactivity if the fuel temperature rises. If the magnitude of the fuel temperature coefficient is large enough, it could compensate for an excess reactivity that is larger than one dollar, so the reactor might be operated in the pulsing mode without fuel damage. To describe the fuel temperature effect by another name does not change the physics of the process. The prospective reactor operator should understand that it is the negative temperature coefficient of the TRIGA fuel that allows the reactor to be operated safely and successfully in the pulse mode.

**SECTION B**

Question 16:

A maintenance technician has completed an authorized modification to the control rod drive electrical system. Which ONE of the following staffing requirements applies to the subsequent startup?

a. A Senior Reactor Operator may conduct the startup alone to verify operability prior to normal operations.

b. The maintenance technician may conduct the startup to evaluate proper response under direction of a Senior Reactor Operator.

c. A Senior Reactor Operator may conduct the startup if the Senior Health Physicist is in the facility.

d. A Reactor Operator and a trainee may conduct the startup if the Senior Reactor Operator is available in the facility.

Answer 16:

d

Facility comment B16:

Answer a is technically correct in that it represents the minimum requirement. A reactor operator and trainee may perform as indicated in answer d, but the provisions of answer d are not requirements. The action described in part d is permitted but not required.

NRC Resolution B16:

Comments not accepted. Paragraph 4 of Procedure 15 (TRIGA MKII Reactor Startup) states that to conduct a reactor startup "a licensed operator shall be at the console and a senior operator shall be on call, within 10 minutes travel-time to the facility, and cognizant of reactor operations." This infers that a licensed operator, either RO or SRO, cannot perform a startup alone. At least two licensed individuals must be in the vicinity and cognizant of reactor operations. Answer a is therefore not correct.

SECTION C

Question 01:

The outside air temperature is -15°F. Assuming that the KSU TRIGA MKII reactor is operating at 80% power when the primary coolant temperature probe fails high, which ONE of the following actions is performed by the secondary automatic control system if the temperature of the secondary cooling water is 62°F?

a. The cooling tower fan shifts to slow speed

b. The cooling water flow is stopped

c. The cooling tower fan goes to high speed

d. The cooling water flow is diverted to the heat exchanger

Answer 01:

d

Facility Comment C1:

If the sensor fails high, the -10 F limit is bypassed and flow to the cooling tower is reestablished. (See Facility Description, p. 8.)

NRC Resolution C1:

Comment accepted. This question will be deleted from the examination.

SECTION C

Question 17:

Limit switches mounted on each drive assembly provide switching for console lights.

Which one of the following statements is TRUE?

a. The White light indicates that the control rod and the magnet draw tube are at their upper limits.

b. The Red light indicates that the control rod and rod drive are fully inserted.

c. The White light indicates that the control rod is fully withdrawn.

d. The Yellow light is always ON.

Answer 17:

c

Facility Comment C17:

There are no correct answers. A red light indicates that the magnet is fully up. A white light indicates that the magnet is fully down. The yellow light is on when both rod and magnet are in contact. The licensee has the main responsibility for this misunderstanding, in that the documentation provided the NRC did not identify the colors of the indicator lights.

NRC Resolution C17:

This question will be deleted from the examination.

Nuclear Regulatory Commission
Operator Licensing
Examination

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Official Use Only category on
date of examination.

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

FACILITY: Kansas State Univ.

REACTOR TYPE: TRIGA-II

DATE ADMINISTERED: 92/02/18

REGION: 4

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 | ______ | ______ | A. | REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS |
| 20.00 | 33.33 | ______ | ______ | B. | NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS |
| 20.00 | 33.33 | ______ | ______ | C. | PLANT 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

# 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 scrap 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.

## 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 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 1 2 3 ___

b 1 2 3 ___

c 1 2 3 ___

d 1 2 3 ___

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 1 2 3 4 5 ___

b 1 2 3 4 5 ___

c 1 2 3 4 5 ___

d 1 2 3 4 5 ___

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

QUESTION: 001 (1.00)

Which ONE of the following statements correctly describes the influence of delayed neutrons on the neutron life cycle?

a. Delayed neutrons decrease the average period of a reactivity addition because they thermalize more quickly than prompt neutrons.

b. Delayed neutrons take longer to thermalize because they are born at higher energies than prompt neutrons.

c. Delayed neutrons cause the length of the average neutron generation time to increase.

d. Delayed neutrons are born later than prompt neutrons and make up a larger fraction of the fission neutrons.

QUESTION: 002 (1.00)

With the reactor on a constant period, which transient requires the longest time to occur?

A reactor power change of:

a. 5% power -- going from 1% to 6% pwr

b. 10% power -- going from 10% to 20% pwr

c. 15% power -- going from 20% to 35% pwr

d. 20% power -- going from 40% to 60% pwr

QUESTION: 003 (1.00)

Which ONE of the following is a correct statement concerning the factors affecting control rod worth?

a. Fuel burn up causes the rod worth for periphery rods to decrease.

b. Fuel burn up causes the r d worth to increase in the center of the core.

c. The withdrawal of a rod causes the rod worth of the remaining inserted rods to increase.

d. As Rx power increases rod worth increases.

QUESTION: 004 (1.00)

The Rx is shutdown by 5% delta-K/K with a count rate of 100 cps on the startup channel. Rods are withdrawn until the count rate is 1000 cps. Which ONE of the following is the condition of the reactor after the rods are withdrawn?

a. Critical with Keff = 1.0

b. Subcritical with Keff = 0.995

c. Subcritical with Keff = 0.950

d. Supercritical with Keff = 1.005

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

QUESTION: 005 (1.00)

A short reactor period is a greater hazard when reactor power is:

a. Close to 100%

b. Above the Point of Added Heat (POAH)

c. Below the POAH

d. close to source counts

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

QUESTION: 006 (1.00)

A fuel loading is in progress. Using the data provided below, after how many fuel bundles loaded will criticality occur?

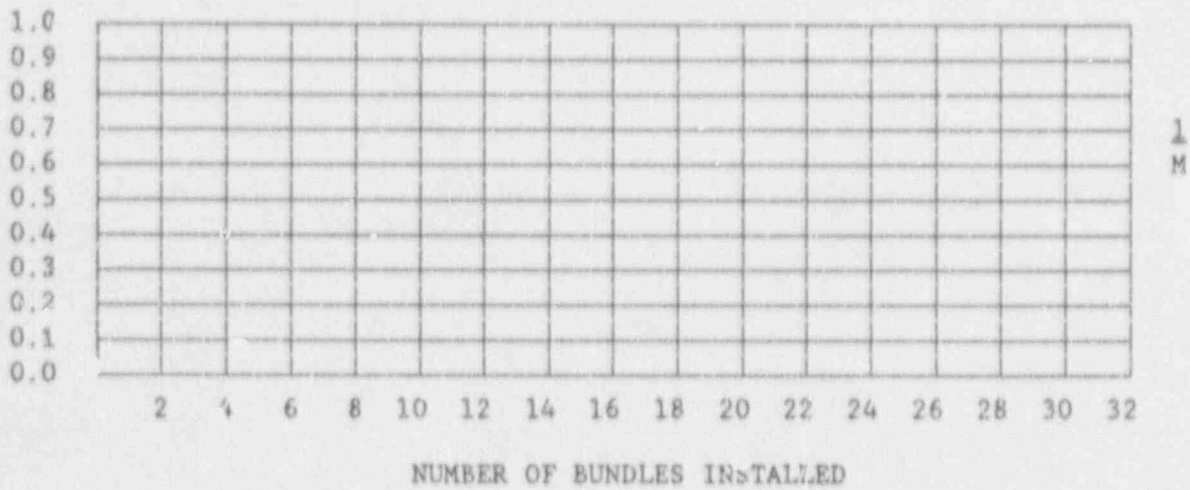
a) 20th bundle

b) 22nd bundle

c) 24th bundle

d) 26th bundle

| Count Rate | # of Fuel Bundles |
|---|---|
| 842 | 2 |
| 936 | 4 |
| 1123 | 7 |
| 1684 | 12 |
| 2807 | 16 |




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

QUESTION: 007 (1.00)

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

a. U-235 affinity for source neutrons.

b. Fuel temp. coefficient adding positive reactivity.

c. Longest lived delayed neutron precursors decay constant.

d. Amount of negative reactivity added on a scram exceeds the shutdown margin.

QUESTION: 008 (1.00)

Which statement describes Xe-135 behavior following a Rx Scram?

a. Xenon concentration decreases due to production rate from fission stops.

b. Xenon concentration decreases due to production rate from I-135 decay increasing.

c. Xenon concentration increases due to production rate from Pm-149 increasing.

d. Xenon concentration increases due to I-135 decay exceeding Xe-135 decay.

QUESTION: 009 (1.00)

Which one of the following statements is a characteristic of subcritical multiplication?

a. The number of neutrons gained per generation doubles for each succeeding generation.

b. A constant neutron population is achieved when the total number of neutrons produced in one generation is equal to the number of source neutrons in the next generation.

c. For equal reactivity additions, it takes less time for the equilibrium subcritical neutron population level to be reached as Keff approaches one.

d. Doubling the indicated count rate will reduce the margin to criticality by approximately one half.

QUESTION: 010 (1.00)

The following facility parameters are given:

-- Primary coolant flow rate --> 1500 GPM

-- Secondary system flow rate --> 1400 GPM

-- Primary side delta-T across the heat exchanger --> 11°F

-- Secondary side heat exchanger inlet temperature --> 73°F

Which one of the following is secondary side heat exchanger EXIT temperature.

a. 82°F

b. 85°F

c. 89°F

d. 92°F

QUESTION: 011 (1.00)

The reactor is exactly critical below the point of adding heat. Rods are manually inserted for 5 seconds. Reactor power will:

a. Decrease to a shutdown power level low in the source (startup) range.

b. Decrease temporarily, then return to the original value due to the resulting decrease in moderator temperature.

c. Decrease until inherent positive reactivity feedback causes the reactor to become critical at a lower neutron level.

d. Decrease temporarily, then return to the original value due to subcritical multiplication.

QUESTION: 012 (1.00)

Reactor power doubles in 0.66 minutes. Which ONE of the following is the time required for power to increase from 10 watts to 800 watts? (Assume a positive step change in reactivity.)

a. 10.1 minutes

b. 6.4 minutes

c. 4.2 minutes

d. 2.8 minutes

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

QUESTION: 013 (1.00)

If, during a reactor startup, the startup rate is constant and positive without any further reactivity addition, then the reactor is:

a. At the Point of Added Heat (POAH).

b. Supercritical.

c. Subcritical.

d. Prompt critical.

QUESTION: 014 (1.00)

If reactor power is increasing by a factor of 10 every minute, it has a period of:

a. 65 sec

b. 52 sec

c. 25 sec

d. 13 sec

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

QUESTION: 015 (1.00)

The shutdown margin (SDM), upon full insertion of all control rods following a reactor scram from full power, is:

a. Equal to the SDM prior to the scram

b. Less than the SDM prior to the scram

c. Greater than the SDM prior to the scram

d. Zero

QUESTION: 016 (1.00)

The purpose of the installed neutron source is to:

a. Compensate for neutrons absorbed in non-fuel materials in the core.

b. Generate a sufficient neutron population to start the fission chain reaction for each startup.

c. Provide a means to allow reactivity changes to occur in a subcritical reactor.

d. Generate a detectable neutron source level for monitoring reactivity changes in a shutdown reactor.

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

QUESTION: 017 (1.00)

Which ONE of the following defines the maximum excess reactivity and minimum Shutdown Margin (SDM) for the Kansas State TRIGA MARK II reactor?

a. Excess reactivity of 0.0250 delta K/K, SDM of 0.11 delta K/K

b. Excess reactivity of 0.0250 delta K/K, SDM of 0.0077 delta K/K

c. Excess reactivity of 0.0175 delta K/K, SDM of 0.0077 delta K/K

d. Excess reactivity of 0.0175 delta K/K, SDM of 0.11 delta K/K

QUESTION: 018 (1.00)

The KSU TRIGA MARK II reactor is operating at 250 KW (100% power). A nuclear excursion causes a rapid power increase with a period of 10 millisecond. Assuming the reactor scrams on "percent power channel high", with a scram delay time of 0.1 seconds, which ONE of the following will be the peak power attained by the reactor? (Assume no temperature or void reactivity effects.)

a. 275 KW

b. 2.2 EE 4 KW

c. 5.7 EE 6 KW

d. 6.7 EE 45 KW

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

QUESTION: 019 (1.00)

Which ONE of the following coefficients will be the first one to start turning reactor power after a power excursion from full power?

a. Fuel Temperature

b. Moderator Temperature

c. Void

d. Power

QUESTION: 020 (1.00)

An initial count rate of 100 is doubled five time during startup. Assuming an initial Keff=0.950, what is the new Keff?

a. 0.957

b. 0.979

c. 0.988

d. 0.998

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

QUESTION: 001 (1.00)

In accordance with Technical Specifications, which ONE of the following interlocks may be bypassed during fuel loading operations?

a. Movement of any rod except the transient rod

b. Shim and regulating rod withdrawal with less than two neutron induced counts per second on the start-up channel

c. Simultaneous manual withdrawal of two rods

d. Application of air to the transient rods unless regulating and shim rods are fully inserted

QUESTION: 002 (1.00)

Select from column II the Mode when the Scrams/Interlocks from column I are effective. (Items in column II may be used once, more than once or not at all. Only one answer may occupy an answer space in column I). (Four answers required at 0.25 each)

| COLUMN I (Scrams/Interlocks) | COLUMN II (Required Mode) |
|---|---|
| _____a. Safety Channel at 110% of Full Power | 1. Pulse Mode |
| _____b. Fuel Temperature at 450°C | 2. SS Mode |
| _____c. Ion Chamber Power Supply Failure | 3. Pulse & SS Mode |
| _____d. Application of air to transient rods unless regulating and shim rods are fully inserted. | |

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

QUESTION: 003 (1.00)

As defined by Technical Specifications, which ONE of the following statements is NOT part of the de inition for a Secured Reactor.

a. The console key is in the "OFF" position and the key is removed from the console and under the control of a licensed operator.

b. No work is in progress involving fuel handling or maintenance of control rod drive mechanisms.

c. The minimum shutdown margin, with the most reactive of the operable control elements withdrawn shall be $1.10

d. Sufficient control rods are inserted so as to assure the reactor is subcritical by a margin greater than $0.87, cold without Xenon.

QUESTION: 004 (1.00)

In accordance with 10 CFR 20 (Standards for Protection Against Radiation), which ONE of the following is the radiation dose standard for individuals in restricted areas per calendar quarter? (Assume that NRC Form 4 is NOT on file.)

a. Whole body - 1.25 Rem
Active blood forming organs 1.25 Rem
Hands and forearms - 7.5 Rem
Skin of whole body - 18.75 Rem

b. Whole body - 3.75 Rem
Active blood forming organs 1.25 Rem
Hands and forearms - 7.5 Rem
Skin of whole body - 18.75 Rem

c. Whole body - 1.25 Rem
Active blood forming organs 1.25 Rem
Hands and forearms - 18.75 Rem
Skin of whole body - 7.5 Rem

d. Whole body - 3.75 Rem
Active blood forming organs 3.75 Rem
Hands and forearms - 18.75 Rem
Skin of whole body - 7.5 Rem

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

QUESTION: 005 (1.00)

10 CFR 20.105 sets "permissible" levels of radiation in unrestricted areas. What is the 10 CFR 20 whole body MAXIMUM dose limit, in any period of one calendar year in an "unrestricted" area?

a. 1.25 Rem

b. 500 mrem

c. 200 mrem

d. 100 mrem

QUESTION: 006 (1.00)

Calculate the amount of reactivity by which the reactor is shutdown if the Pulse rod is stuck all the way out.
Assume the following worths:

| | | |
|---|---|---|
| Control rods- | Shim: | $2.10 |
| | Reg: | $1.05 |
| | Pulse: | $1.10 |
| Excess reactivity: | | $2.05 |

a. $0.95

b. $1.10

c. $2.20

d. $4.25

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

QUESTION: 007 (1.00)

Which ONE of the following is the correct posting if the radiation level in the area is 75 mr/hr?

a. CAUTION RADIATION AREA

b. CAUTION RADIOACTIVE MATERIAL(S)

c. CAUTION AIRBORNE RADIOACTIVITY AREA

d. CAUTION HIGH RADIATION AREA

QUESTION: 008 (1.00)

Which ONE of the following is the amount of time a licensed operator must perform his/her licensed duties to maintain proficiency?

a. Four hours per month

b. Four hours per quarter

c. Six hours per month

d. Six hours per quarter

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

QUESTION: 009 (1.00)

Which ONE of the following statements is a condition for pulsing the KSU TRIGA MKII reactor?

a. In the Pulse mode, the reactor must be operated with a standard fuel TRIGA fuel element in the central thimble.

b. The fuel elements must be gauged after every pulse of magnitude greater than $1.00

c. Pulsing operations must not be done from a subcritical configuration

d. The worth of the poison section of the pulse rod with respect to water shall be $2.00

QUESTION: 010 (1.00)

Which ONE of the following statements describe a reactivity limitation imposed on experiments?

a. The absolute reactivity worth of all experiments in the reactor shall not exceed $2.00

b. An experiment which will not cause a 20-sec period can be inserted in the core when the reactor is at power.

c. When determining the absolute reactivity worth of an experiment, the reactivity effects associated with the moderator temperature is to be considered.

d. No experiment shall be inserted or removed unless all control blades are fully inserted.

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

QUESTION: 011 (1.00)

An irradiated sample having a half-life of 3 minutes provides a dose rate of 200 mr/hr at 3 ft. Approximately how far from the sample must a Radiation Area sign be posted?

a. 5 ft.

b. 8 ft.

c. 20 ft.

d. 50 ft.

QUESTION: 012 (1.00)

Which ONE of the following is the definition an UNUSUAL EVENT classification in accordance with the KSU TRIGA MKII Nuclear Reactor Facility Emergency Plan?

a. Events are in progress or have occurred which have resulted or could result in radiation levels in excess of 100 mrem/hr at the operations boundary.

b. Events are in progress or have occurred which indicate a potential degradation of the safety of the reactor facility with no release of radioactive material requiring off site response.

c. Events are in progress or have occurred which have resulted or could result in exposures at the facility boundary in excess of 10CFR20 limits.

d. Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility.

QUESTION: 013 (1.00)

In accordance with procedure "Experiment 42- Operation of Sample Rapid Transfer System (Rabbit)" which ONE of the following actions should the reactor operator take, if an irradiated rabbit sample becomes stuck?

a. Notify the reactor supervisor then purge the rabbit system by firing helium into the reactor bay from NAAL.

b. Notify the reactor supervisor then reduce reactor power to les than 500W and check gamma radiation levels in the reactor bay terminal.

c. Scram the reactor and notify the reactor supervisor.

d. Align the switching coupling in the reactor bay with the reactor bay terminal and notify the reactor supervisor.

QUESTION: 014 (1.00)

Which ONE of the following reactor facility conditions requires the use of personnel NEUTRON dosimetry in the reactor bay?

a. Anytime an escorted tour is conducted.

b. Anytime the reactor is secured.

c. Anytime the reactor is operating.

d. Anytime entrance is made in the reactor bay.

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

QUESTION: 015 (1.00)

(Which ONE of the following statements is FALSE?)

The Reactor Supervisor may authorize temporary changes to a procedure provided that:

a. the Facility Director approves the changes.

b. the changes do not alter the original intent of the procedure.

c. all licensed individuals are informed of the changes.

d. the changes are noted in the operations logbook.

QUESTION: 016 (1.00)

A maintenance technician has completed an authorized modification to the control rod drive electrical system. Which ONE of the following staffing requirements applies to the subsequent startup?

a. A Senior Reactor Operator may conduct the startup alone to verify operability prior to normal operations.

b. The maintenance technician may conduct the startup to evaluate proper response under direction of a Senior Reactor Operator.

c. A Senior Reactor Operator may conduct the startup if the Senior Health Physicist is in the facility.

d. A Reactor Operator and a trainee may conduct the startup if the Senior Reactor Operator is available in the facility.

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

QUESTION: 017 (1.00)

Which ONE of the following emergencies requires that the Outside Air Intake Flappers be shut as part of immediate actions?

a. Noble Gas and Iodine release to reactor bay

b. Fire in the Nuclear Reactor Facility

c. Gamma radiation level outside reactor control room is greater than 100 mr/hr

d. Fire Outside the Nuclear Reactor Facility

QUESTION: 018 (1.00)

The Reactor Facility must be evacuated due to high radiation readings caused by an accident during a refueling operation. Per KSU TRIGA MKII's Emergency Plan, where do contaminated personnel assemble?

a. Ward Hall basement restroom area

b. North Hall Emergency Supplies area

c. Lobby of Ward Hall

d. Ward Hall parking area

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

QUESTION: 019 (1.00)

Which ONE of the following is a restriction concerning the use of organic solvents in the reactor bay?

a. Acetone, gasoline and carbon tetrachloride are not to be used in the reactor bay.

b. Use of any organic solvents in the reactor bay must be approved by the Reactor Supervisor.

c. Organic solvents in quantities greater than 1 liter can be exposed in the reactor bay if properly secured.

d. The Radiation Safety Officer must approve the use of organic solvent in volume greater than 1/4 liter.

QUESTION: 020 (1.00)

What is the minimum exposure monitoring requirement for escorted visitors to the reactor bay?

a. 1 TLD badge per person

b. 1 neutron-gamma sensitive pocket dosimeter for the tour guide

c. 2 TLD badges for every 10 members of the group

d. 2 pocket dosimeters for every 15 members of the group

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

QUESTION: 001 (1.00)

The outside air temperature is -15°F. Assuming that the KSU TRIGA MKII reactor is operating at 80% power when the primary coolant temperature probe fails high, which ONE of the following actions is performed by the secondary automatic control system if the temperature of the secondary cooling water is 62°F?

a. The cooling tower fan shifts to slow speed

b. The cooling water flow is stopped

c. The cooling tower fan goes to high speed

d. The cooling water flow is diverted to the heat exchanger

QUESTION: 002 (1.00)

Which ONE of the following components provides the least ambiguous indication that fuel element cladding failure may have occurred?

a. CAM in reactor bay

b. Geiger tube in Water Monitor Vessel

c. Conductivity meter on the reactor console

d. GM detector located near the demineralizer

QUESTION: 0C3 (1.00)

Which ONE of the following is the flow through the primary loop and the cleanup loop?

a. 120 gpm total flo with 10 gpm through the cleanup loop

b. 110 gpm total flow with 10 gpm through the cleanup loop

c. 120 gpm total flow with 20 gpm through the cleanup loop

d. 110 gpm total flow with 20 gpm through the cleanup loop

QUESTION: 004 (1.00)

Which of the following methods is used to remove the gamma signal from the neutron signal in the LOG-N Channel?

a. The outer chamber prevents gammas from ionizing the inner chamber.

b. Inner chamber current cancels out gamma current in the outer chamber.

c. A pulse height discriminator does not allow the gamma signals to be counted.

d. Squaring the combined signal makes the gamma contribution insignificant.

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

QUESTION: 005 (1.00)

Which of the following statements describes the signal path from the Startup Channel detector to the level (cps) meter on the console?

a. Detector, Pre Amp, Discriminator, Log Circuit, Meter

b. Detector, Log Integrator, Pulse Shaper, Pulse Counter, Meter

c. Detector, Pre Amp, Log Integrator, Reg Rod Servo, Meter

d. Detector, Log Amp, Meter

QUESTION: 006 (1.00)

Which ONE of the following radiation detectors does not have an output intensity (current or pulse height) proportional to the incident radiation energy? (i.e., if the incident energy increases, the output intensity increase)

a. Ion Chamber

b. GM

c. Proportional Counter

d. Scintillation

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

QUESTION: 007 (1.00)

Which ONE of the following is the worth of all the control rods?

a. $1.80

b. $2.50

c. $4.50

d. $6.50

QUESTION: 008 (1.00)

The flow rate of the primary loop is maintained by which one of the following methods?

a. Flow orifice

b. Throttling the primary pump discharge valve

c. Adjusting the speed of the primary pump

d. Adjusting the filter ΔP

QUESTION: 009 (1.00)

Which ONE of the following is the purpose of the mechanical filter installed in the cleanup loop?

a. Maintain low electrical conductivity of the water and a neutral pH.

b. Maintain minimal radioactivity and low electrical conductivity of the water.

c. Maintain a neutral pH and optical transparency of the water.

d. Maintain optical transparency and minimal radioactivity of the water.

QUESTION: 010 (1.00)

Which ONE of the following parameters will result in a reactor scram but is not required to be operational by KSU TRIGA MKII Technical Specifications?

a. High fuel temperature

b. Recorder linear pen high indication

c. Short reactor period

d. Loss of high voltage to the nuclear instruments

QUESTION: 011 (1.00)

Which ONE of the following describes the neutron source utilized at the KSU TRIGA MKII reactor?

a. Americium beryllium with a reactivity worth of $0.046

b. Antimony beryllium with a [illegible]ctivity worth of $0.046

c. Americium beryllium with a [illegible]tivity worth of $1.025

b. Antimony beryllium with a reactivity worth of $1.025

QUESTION: 012 (1.00)

The thermocouple in the instrumented fuel bundle measures 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

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

QUESTION: 013 (1.00)

Which ONE of the following describes the action of the rod control system to drive the magnet draw tube down after a dropped rod?

a. Deenergizing the rod magnet initiates the down motion of the draw tube.

b. MAGNET DOWN limit switch initiates the down motion of the draw tube.

c. ROD DOWN limit switch initiates the down motion of the draw tube.

d. Deenergized contact light (DS317) and MAGNET UP limit switch initiate the down motion of the draw tube.

QUESTION: 014 (1.00)

Which ONE of the following statements correctly describes the purpose of the potentiometer in the control rod drive assembly.

a. Provides rod position indication when the electromagnet engages the connecting rod armature.

b. Provides a variable voltage to the rod drive motor for regulating control rod speed.

c. Provides potential voltage as required for resetting the electromagnet current.

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

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

QUESTION: 015 (1.00)

Which ONE of the following statements correctly describes the purpose of the PULL ROD in the control rod drive assembly?

a. Provides rod full out position indication.

b. Provides a means for manually adjusting rod position by pulling rod out.

c. Actuates the rod bottom switch.

d. Automatically engages the control rod on a pull signal.

QUESTION: 016 (1.00)

What will be the effect of a high differential pressure across the filter on the primary water pump and the demineralizer flows?

a. Increase primary water pump flow and increase demineralizer flow.

b. No effect on primary water pump flow and decrease demineralizer flow.

c. Decrease primary water pump flow and increase demineralizer flow.

d. Decrease reactor water pump flow and decrease demineralizer flow.

QUESTION: 017 (1.00)

Limit switches mounted on each drive assembly prov'de switching for console lights.

Which one of the following statements is TRUE?

a. The White light indicates that the contr. rod and the magnet draw tube are at their upper limits.

b. The Red light indicates that the control rod and rod drive are fully inserted.

c. The White light indicates that the control rod is fully withdrawn.

d. The Yellow light is always ON.

QUESTION: 018 (1.00)

Which ONE of the following nuclear channels provides the operator with a continuous record of neutron flux from approximately one watt to full power?

a. Period channel

b. Log power channel

c. Count rate channel

d. Linear power channel

QUESTION: 019 (2.00)

Select from column B the actual rod movement that would result from attempting to simultaneously move the combination of rods in column A. (Items in column B may be used once, more than once or not at all. Only one Answer may occupy a space in column A.)
(4 answers required at 0.50 points each)

| Column A | Column B |
|---|---|
| Attempted Rod Move | Resulting Rod Movement |
| ______a. Pulse mode is engaged and attempt to withdraw reg rod | 1. Shim rod moves up |
| | 2. Reg rod moves up |
| ______b. In steady state mode and attempt to withdraw shim and reg rods | 3. Shim and reg rods move up |
| ______c. Attempt to withdraw pulse and reg rod (steady state mode) | 4. Pulse rod moves up |
| ______d. Shim rod is up 250 units and attempt to raise pulse rod (steady state mode) | 5. No rod motion |

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

EQUATION SHEET

---

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

$\dot{Q} = \dot{m} \Delta h$

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

$SUR = \frac{26.06 (\lambda_{eff}\rho)}{(\beta - \rho)}$

$SUR = 26.06/\tau$

$P = P_0 10^{SUR(t)}$

$P = P_0 e^{(t/\tau)}$

$P = \frac{\beta(1-\rho)}{\beta-\rho} P_o$

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

$\rho = (Keff-1)/Keff$

$\rho = \Delta Keff/Keff$

$\bar{\beta} = 0.0077$

$DR_1D_1^2 = DR_2D_2^2$

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

$SCR = S/(1-Keff)$

$CR_1 (1-Keff)_1 = CR_2 (1-Keff)_2$

$M = \frac{(1-Keff)_0}{(1-Keff)_1}$

$M = 1/(1-Keff) = CR_1/CR_0$

$SDM = (1-Keff)/Keff$

$Pwr = W_f \dot{m}$

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

$\tau = \ell^*/(\rho-\bar{\beta})$

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

$T_{1/2} = \frac{0.693}{\lambda}$

$DR = DR_0 e^{-\lambda t}$

---

1 Curie = $3.7 \times 10^{10}$ dps

1 hp = $2.54 \times 10^3$ BTU/hr

1 BTU = 778 ft-lbf

1 kg = 2.21 lbm

1 Mw = $3.41 \times 10^6$ BTU/hr

°F = 9/5°C + 32

°C = 5/9 (°F - 32)

ANSWER: 001 (1.00)

c

REFERENCE:

KSU TRIGA MKII Trng. Manual, Period-Reactivity Relationships

ANSWER: 002 (1.00)

a

REFERENCE:

KSU TRIGA MKII Trng. Manual, Power Excursions

ANSWER: 003 (1.00)

c

REFERENCE:

Basic Reactor Theory

ANSWER: 004 (1.00)

b

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

REFERENCE:

KSU TRIGA MKII Trng. Manual, Multiplication and Criticality

ANSWER: 005 (1.00)

d

REFERENCE:

KSU TRIGA MKII Trng. Manual, Power Excursions

ANSWER: 006 (1.00)

b

REFERENCE:

KSU TRIGA MKII Trng. Manual, Multiplication and Criticality pp 3

ANSWER: 007 (1.00)

c

REFERENCE:

KSU TRIGA MKII Trng. Manual, Period-Reactivity Relationships pp 2

ANSWER: 008 (1.00)

d

REFERENCE:

KSU TRIGA MKII Trng. Manual, Poison Compensation

ANSWER: 009 (1.00)

d

REFERENCE:

KSU TRIGA MKII Trng. Manual, Multiplication and Criticality

ANSWER: 010 (1.00)

b

REFERENCE:

HTFF Operating Characteristics

ANSWER: 011 (1.00)

a

REFERENCE:

KSU TRIGA MKII Trng. Manual, Operating Characteristics

ANSWER: 012 (1.00)

c

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

REFERENCE:

KSU TRIGA MKII Trng. Manual, Power Excursions

ANSWER: 013 (1.00)

b

REFERENCE:

KSU TRIGA MKII Operating Characteristics

ANSWER: 014 (1.00)

c

REFERENCE:

KSU TRIGA MKII Trng. Manual, Period-Reactivity Relationships

ANSWER: 015 (1.00)

a

REFERENCE:

Operating Characteristics

ANSWER: 016 (1.00)

d

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

REFERENCE:

KSU TRIGA MKII Trng. Manual, Multiplication & Criticality

ANSWER: 017 (1.00)

c

REFERENCE:

KSU TRIGA MK II Reactor Operating Characteristics

ANSWER: 018 (1.00)

c

REFERENCE:

KSU TRIGA MKII Trng. Manual, Power Excursions

ANSWER: 019 (1.00)

a

REFERENCE:

KSU TRIGA MKII Training Manual - Temperature Compensation

ANSWER: 020 (1.00)

d

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

REFERENCE:

KSU TRIGA MKII Trng. Manual, Multiplication & Criticality

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

ANSWER: 001 (1.00)

b

REFERENCE:

KSU TRIGA MKII Tech. Specs, Table II - Minimum Interlocks

ANSWER: 002 (1.00)

a-2 / b-1 / c-3 / d-2

REFERENCE:

ANSWER: 003 (1.00)

c

REFERENCE:

KSU TRIGA MKII Tech Specs.

ANSWER: 004 (1.00)

c

REFERENCE:

10 Cfr 20 sect. 20.101

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

ANSWER: 005 (1.00)

b

REFERENCE:

10 CFR 20.105

ANSWER: 006 (1.00)

b

REFERENCE:

KSU TRIGA MKII Training Manual - Operating Characteristics

ANSWER: 007 (1.00)

a

REFERENCE:

10 CFR 20.202

ANSWER: 008 (1.00)

b

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

REFERENCE:

KSU TRIGA MKII - Study Guide 10 CFR 55

ANSWER: 009 (1.00)

d

REFERENCE:

KSU TRIGA MKII Experiment 23 & 30 / Tech Specs

ANSWER: 010 (1.00)

a

REFERENCE:

KSU TRIGA MKII Tech. Specs I.3(a)

ANSWER: 011 (1.00)

c

REFERENCE:

10CFR20

ANSWER: 012 (1.00)

b

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

REFERENCE:

KSU TRIGA MKII Emergency Plan

ANSWER: 013 (1.00)

c

REFERENCE:

KSU TRIGA MKII Experiment 42- Operation of Rabbit system

ANSWER: 014 (1.00)

c

REFERENCE:

KSU TRIGA MKII Procedure 9- Entrance to the reactor bay

ANSWER: 015 (1.00)

a

REFERENCE:

KSU TRIGA MKII Operations Manual pg 4

ANSWER: 016 (1.00)

d

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

REFERENCE:

KSU TRIGA MKII Operation, Test, and Maintenance Procedures no. 15

ANSWER: 017 (1.00)

d

REFERENCE:

KSU TRIGA MKII Emergency Procedure no. 8 -- Fire Fighting

ANSWER: 018 (1.00)

a

REFERENCE:

KSU TRIGA MKII Emergency Procedure no. 4 / Emergency Plan Review & Survey map

ANSWER: 019 (1.00)

b

REFERENCE:

KSU TRIGA MKII Operations Manual, Sect. 8.1.d pp 6

ANSWER: 020 (1.00)

d

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

REFERENCE:

KSU TRIGA MKII Operations, Test and Maintenance Procedure no. 9

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

ANSWER: 001 (1.00)

d

REFERENCE:

KSU TRICA MKII Facility Description pp 8

ANSWER: 002 (1.00)

b

REFERENCE:

KSU TRIGA MKII Facility description pp 7

ANSWER: 003 (1.00)

b

REFERENCE:

KSU TRIGA MKII Facility description Figure 5

ANSWER: 004 (1.00)

b

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

REFERENCE:

KSU TRIGA MKII Facility Description pp 9

ANSWER: 005 (1.00)

a

REFERENCE:

KSU TRIGA MKII Facility Description Fig. 6

ANSWER: )06 (1.00)

b

REFERENCE:

KSU TRIGA MKII Experiments #3 - Radiation Survey of Reactor

ANSWER: 007 (1.00)

d

REFERENCE:

KSU TRIGA MKII Operating Charact' 'istics

ANSWER: 008 (1.00)

a

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

REFERENCE:

KSU TRIGA MKII Facility Description Fig. 5

ANSWER: 009 (1.00)

d

REFERENCE:

KSU TRIGA MKII Facility Description pp 7

ANSWER: 010 (1.00)

c

REFERENCE:

KSU TRIGA MKII Facility Description pp 11 / Tech Specs

ANSWER: 011 (1.00)

a

REFERENCE:

KSU TRIGA MKII Facility Description pp 3

ANSWER: 012 (1.00)

d

REFERENCE:

KSU TRIGA MKII Facility Description pp 10

ANSWER: 013 (1.00)

c

REFERENCE:

KSU TRIGA MKII Facility Description Sect. 8 pp 11

ANSWER: 014 (1.00)

a

REFERENCE:

KSU TRIGA MKII Facility Description Sect. 8 pp 12

ANSWER: 015 (1.00)

c

REFERENCE:

KSU TRIGA MKII Facility Description Fig. 12

ANSWER: 016 (1.00)

d

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

REFERENCE:

KSU TRIGA MKII Facility Description Fig. 5

ANSWER: 017 (1.00)

b

REFERENCE:

KSU TRIGA MKII Facility Description pp 12

ANSWER: 018 (1.00)

b

REFERENCE:

KSU TRIGA MKII Facility Description pp 9

ANSWER: 019 (2.00)

a-5 / b-5 / c-2 / d-5

REFERENCE:

KSU TRIGA MKII Operation, Test and Maintenance Procedure #5 / Tech Specs

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

ANSWER KEY

MULTIPLE CHOICE

~~003~~ c deleted

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

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

ANSWER KEY

MULTIPLE CHOICE

001 b

002 a-2 b-1 c-3 d-2

003 c

004 c

005 b

006 b

007 a

008 b

009 d

010 a

011 c

012 b

013 c

014 c

015 a

016 d

017 d

018 a

019 b

020 d

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

ANSWER KEY

MULTIPLE CHOICE

~~001~~ d deleted

002 b

003 b

004 b

005 a

006 b

007 d

008 a

009 d

010 c

011 a

012 d

013 c

014 a

015 c

016 d

~~017~~ b deleted

018 b

019 a-5 b-5 c-2 d-5

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