



DEFENSE NUCLEAR AGENCY

ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
BETHESDA, MARYLAND 20814-5145

RSD

20 FEB 1991

Director, Operator Licensing Branch
Division Of Licensee Performance and
Quality Evaluation
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir:

As requested in your letter of January 30, 1991, enclosed are two copies each of the following reference materials:

1. Safety Analysis Report - The submitted version describes the current reactor system except that it includes fuel follower control rods which may not be installed before the examinations.
2. Technical Specifications
3. Emergency Plan
4. Operating Procedures - Always available to the operator and not required to be memorized.
5. Reference Package containing various reference equations, rod curves and technical data.
6. Portions of the textbook Fundamentals of Nuclear Reactor Engineering. Note that this text was designed for a year-long intensive course for power plant operators and includes a significant amount of material beyond the scope of AFRRRI training. It is used at AFRRRI to complement formal lectures. While the text includes material which AFRRRI operators are expected to study and retain, operators are not expected to learn everything presented in the text.
7. A "question bank" of questions and answers related to the AFRRRI reactor.

All these items are approved final issues except as noted for the SAR.

As also requested in your letter, adequate space will be provided to conduct the examinations in accordance with your procedures and all applicants will be informed of the Rules and Guidelines.

Should you have any questions, please contact me at 301-295-1290.

Sincerely,

Mark Moore
Reactor Facility Director

9105220304 910515
PDR ADOCK 05000170
V PDR

master copy

Nuclear Regulatory Commission
Operator Licensing
Examination

This document is removed from
Official Use Only category on
date of examination.

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

FACILITY: Armed Forces Rad Res Inst
 REACTOR TYPE: TRIGA-F
 DATE ADMINISTERED: 91/04/23
 REGION: 1
 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 | | | | 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. Print your name in the upper right-hand corner of each answer sheet.
7. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK. NOTE: partial credit will NOT be given on multiple choice questions.
8. Proportional grading 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.

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)

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

MULTIPLE CHOICE

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

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

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)

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

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

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

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)

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

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

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

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QUESTION: 001 (1.00)

Which ONE of the following will be the resulting reactor period when a \$0.50 reactivity insertion is made into a just critical reactor core?

- A. 46 seconds
- B. 22 seconds
- C. 11 seconds
- D. 5 seconds

QUESTION: 002 (1.00)

Which ONE of the following is classified as a FISSILE nuclide?

- A. Pu-241
- B. U-238
- C. Th-232
- D. Pu-239

QUESTION: 003 (1.00)

Which ONE of the following is the estimated shutdown margin of a fully loaded core given the indicated rod worths? (Assume the maximum K excess of the AFRRI core as defined by the Technical Specifications).

| Rod worth Data | |
|----------------|--------|
| Transient Rod | \$3.63 |
| Safety Rod | \$1.88 |
| Shim Rod | \$1.90 |
| Regulating Rod | \$1.87 |

- A. \$9.28
- B. \$5.00
- C. \$4.28
- D. \$5.65

QUESTION: 004 (1.00)

Which ONE of the following is the principle reason for operating with thermal neutrons rather than fast neutrons?

- A. Neutron efficiency is increased since thermal neutrons are less likely to leak out of the core.
- B. Reactors operating primarily on fast neutrons are inherently unstable and cannot be safely controlled.
- C. The fission cross section of the fuel is much higher for thermal neutrons.
- D. The fuel temperature and moderator temperature coefficients become positive as neutron energy increases.

QUESTION: 005 (1.00)

Which ONE of the following defines the term "Lf" in the formula $K_{eff} = K(\infty) L_t L_f$?

- A. Fast fission factor
- B. Thermal utilization factor
- C. Thermal non-leakage probability
- D. Fast non-leakage probability

QUESTION: 006 (1.00)

Which ONE of the following characterizes how heat is removed from the AFRRI TRIGA reactor core?

- A. Forced convection
- B. Free conduction
- C. Natural convection
- D. Thermal radiation

QUESTION: 007 (1.00)

The number of neutrons passing through a one square centimeter of target material per second is the definition of which ONE of the following?

- A. Neutron Population
- B. Neutron Impact Potential
- C. Neutron Flux
- D. Neutron Density

QUESTION: 008 (1.00)

Which ONE of the following represents the nominal worth of a standard control rod?

- A. 0.0105 delta K/K
- B. 0.0133 delta K/K
- C. 0.0161 delta K/K
- D. 0.0210 delta K/K

QUESTION: 009 (1.00)

Which ONE of the following is the power defect between the reactor at 10 KW and 1 MW?

- A. \$1.55
- B. \$2.60
- C. \$3.05
- D. \$3.90

QUESTION: 010 (1.00)

Which ONE of the following is the major source of Xenon in the reactor?

- A. Direct production by fission
- B. Decay of Promethium-149
- C. Decay of Cesium-135
- D. Decay of Iodine-135

QUESTION: 011 (1.00)

Which ONE of the following moderator conditions describes the most efficient thermalization of neutrons?

- A. Moderators with LOW atomic mass number and HIGH scattering cross-section.
- B. Moderators with HIGH atomic mass number and HIGH scattering cross-section.
- C. Moderators with LOW neutron absorption cross-section and LOW scattering cross-section.
- D. Moderators with LOW neutron absorption cross-section and HIGH scattering cross-section.

QUESTION: 012 (1.00)

Which ONE of the following fuel element rings has the highest individual element worth during non-pulse operations?

- A. B - element ring
- B. C - element ring
- C. E - element ring
- D. F - element ring

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

QUESTION: 013 (1.00)

Which ONE of the following statements describes the subcritical reactor response as K_{eff} approaches unity?

- A. A LARGER change in neutron level results from a given change in K_{eff} and SHORTER period of time is required to reach the equilibrium neutron level for a given change in K_{eff} .
- B. A LARGER change in neutron level results from a given change in K_{eff} and LONGER period of time is required to reach the equilibrium neutron level for a given change in K_{eff} .
- C. A SMALLER change in neutron level results from a given change in K_{eff} and SHORTER period of time is required to reach the equilibrium neutron level for a given change in K_{eff} .
- D. A SMALLER change in neutron level results from a given change in K_{eff} and LONGER period of time is required to reach the equilibrium neutron level for a given change in K_{eff} .

QUESTION: 014 (1.00)

Which ONE of the following explains why the transient rod is worth approximately twice as much as the regulating rod.

- A. The neutron absorbing material in the transient rod is hafnium, where as the regulating rod is boron.
- B. The active (absorber filled) section of the transient rod is longer than the regulating rod.
- C. The lower section of the transient rod contains a U-Rh fuel mixture where as the regulating rod contains air.
- D. The transient rod is located in a region of higher flux as compared to the regulating rod.

QUESTION: 015 (1.00)

The reactor is critical at 1 MW.

Which ONE of the following would be the stable reactor period resulting from a rod drop which inserted 0.003 delta K/K negative reactivity?

- A. negative 45 seconds
- B. negative 56 seconds
- C. negative 80 seconds
- D. negative 112 seconds

QUESTION: 016 (1.00)

Which ONE of the following allows more excess reactivity to be built into the core?

- A. A burnable poison (samarium) is built into the fuel elements
- B. A burnable poison (hafnium) is built into the control rods
- C. Zirconium Hydride is mixed with the fuel in the fuel elements
- D. Cadmium is mixed with the absorbing material in the control rods

QUESTION: 017 (1.00)

Which ONE of the following events will cause the Wide Range log channel indication to decrease while operating at high power levels?

- A. The Campbell portion of the fission chamber signal processing circuitry providing no signal.
- B. The Primary coolant flow rate increasing from 250 gpm to 350 gpm.
- C. The pool temperature increasing 10 degrees.
- D. The count rate portion of the fission chamber signal processing circuitry providing no signal.

QUESTION: 018 (1.00)

Which ONE of the following processes stops the prompt critical excursion during a pulse?

- A. Magnet power deenergized
- B. Xenon poisoning
- C. ZrH disadvantage factor
- D. Fission fragment contamination

QUESTION: 019 (1.00)

Which ONE of the following compounds is used for the AFRRI TRIGA's startup source?

- A. AmBe
- B. PuBe
- C. KrPu
- D. PoBe

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

QUESTION: 020 (1.00)

Which ONE of the following is the MAJOR contributor to the large negative temperature coefficient of reactivity.

- A. Doppler broadening
- B. Moderator Density
- C. ZrH disadvantage factor
- D. Fuel Enrichment

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

QUESTION: 001 (1.00)

Which ONE of the following personnel may authorize the entry of fire fighters into the AFRRI TRIGA facility if an emergency occurs after normal duty hours?

- A. Emergency Response Team Commander
- B. Health Physics Coordinator
- C. Reactor Facility Director
- D. Reactor Operations Supervisor

QUESTION: 002 (1.00)

Which ONE of the following is the number of Licensed Reactor Operators required to visually inspect the exposure room before the plug door is closed if Exposure Room Number One horn is disconnected for testing?

- A. 0
- B. 1
- C. 2
- D. 3

QUESTION: 003 (1.00)

Which ONE of the following detectors is set at full scale for the pulse mode of operation?

- A. R1 and CAM
- B. SGM and CAM
- C. R1 and R5
- D. SGM and R5

QUESTION: 004 (1.00)

Which ONE of the following individual(s) can initiate and approve a temporary change to a surveillance procedure on a nuclear safety system?

- A. Any RO with subsequent review and approval of the on duty SRO
- B. Only an SRO with subsequent review and approval of the Reactor Operations Supervisor
- C. Any RO with the subsequent approval of the Reactor Facility Director
- D. Only an SRO with the subsequent approval of the Reactor Facility Director

QUESTION: 005 (1.00)

Which ONE of the following may authorize the downgrading and termination of an emergency?

- A. ERT Commander
- B. AFRRI Director
- C. ECP Commander
- D. Emergency Coordinator

QUESTION: 006 (1.00)

In accordance with Operating Procedure VIII, Tab F1, Square Wave Operation (Mode II - Subcritical), which ONE of the following is the maximum power at which the SQUARE WAVE mode may be used?

- A. 200 KW
- B. 500 KW
- C. 1000 KW
- D. 5000 KW

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

QUESTION: 007 (1.00)

In accordance with the Emergency Plan, which ONE of the following is the PRIMARY assembly point for the Emergency Response Team (ERT)?

- A. Emergency Response Center
- B. Reactor Director's Office
- C. Reactor Control Room
- D. Front Patio

QUESTION: 008 (1.00)

Which ONE of the following fuel elements is removed to permit the use of the Core Experimental Tube ?

- A. C12
- B. D18
- C. F28
- D. E23

QUESTION: 009 (1.00)

In accordance with the AFRRI Emergency Action Procedures, Appendix B, Personnel Rosters, which ONE of the following positions is on the ECP Roster?

- A. HAZMAT Coordinator
- B. Operations Coordinator
- C. Special Assessment Coordinator
- D. Emergency Coordinator

QUESTION: 010 (1.00)

Which ONE of the following AFRRI technical specifications terms describes the introduction of a signal into the channel to verify that it is operable?

- A. Channel Check
- B. Channel Test
- C. Channel calibration
- D. Functional Test

QUESTION: 011 (1.00)

Which ONE of the following is the maximum allowable CAM reading above background prior to opening an exposure room?

- A. 200 cpm
- B. 2000 cpm
- C. 200 cps
- D. 2000 cps

QUESTION: 012 (1.00)

Which ONE of the following EMERGENCY CLASS designations is declared if a fire alarm occurs not involving the reactor facility?

- A. Class 0
- B. Class 1
- C. Class 2
- D. Class 3

QUESTION: 013 (1.00)

Which ONE of the following is the expected control rod positions when performing a K-excess determination if the reactor is brought critical using the regulator rod?

- A. Safety rod at 100%
Shim rod at 100%
Transient rod at 25%
- B. Safety rod at 100%
Shim rod at 25%
Transient rod at 100%
- C. Safety rod at 50%
Shim rod at 50%
Transient rod at 100%
- D. Safety rod at 50%
Shim rod at 100%
Transient rod at 25%

QUESTION: 014 (1.00)

A point source produces 5 mr/hr gamma at a distance of 50 feet.

Which ONE of the following is the distance from the source that a measured reading of 100 mr/hr would occur?

- A. 7 feet
- B. 10 feet
- C. 11 feet
- D. 20 feet

QUESTION: 015 (1.00)

Which ONE of the following is the whole body QUARTERLY radiation exposure limit in accordance with 10 CFR 20?

- A. 1000 mrem
- B. 1250 mrem
- C. 1850 mrem
- D. 2000 mrem

QUESTION: 016 (1.00)

Which ONE of the following describes the AFRRI Technical Specification definition of REACTOR SHUTDOWN?

- A. All rods are inserted and the reactor is subcritical by at least \$1.00 of reactivity
- B. The console key is removed and no maintenance or work is in progress that involves movement of fuel elements in the core or movement of any control rod.
- C. All control rods are inserted and the console key has been removed and in the possession of the SRO
- D. The reactor is subcritical by at least \$0.50 of reactivity.

QUESTION: 017 (1.00)

Which ONE of the following describes the required minimum staff when the reactor is NOT "secured"?

- A. One RO and one SRO on site and a Radiation Control Technician on call
- B. One RO or SRO present in the control room and a Radiation Control Technician on site and another person within the AFRRI complex to assist
- C. One RO or SRO present in the control room, an SRO and Radiation Control Technician on call and another person within the AFRRI complex to assist
- D. One RO or SRO present in the control room and a Radiation Control Technician and another staff person on call to assist

QUESTION: 018 (1.00)

Which ONE of the following is the maximum temperature allowed in a standard TRIGA fuel element in accordance with the AFRRI MARK-F Technical Specifications?

- A. 400 deg C
- B. 600 deg C
- C. 800 deg C
- D. 1000 deg C

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

QUESTION: 019 (1.00)

Which ONE of the following evolutions requires a completed REACTOR USE REQUEST?

- A. Maintenance in Exposure Room #1 when the reactor is secured.
- B. Calibrating the multirange linear power channel.
- C. Performing an experiment that has previously been performed safely.
- D. Performing pulsing operations for reactor operator training.

QUESTION: 020 (1.00)

Which ONE of the following conditions will result in a ROD WITHDRAWAL PREVENT interlock action?

- A. Reactor pool level indicates 13.5 feet.
- B. Reactor power level indicates 850 watts.
- C. Reactor period indicates 7 seconds.
- D. Reactor pool inlet water temperature indicates 63 deg C

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

QUESTION: 001 (1.00)

Which ONE of the following describes the operation of the interlock system for the lead shielding doors?

- A. The limit switches on the reduction gears provide only indication and are not part of the interlock system.
- B. The control rod magnets cannot be energized unless the shielding doors are fully open.
- C. The shield doors must be full open to relocate the fuel support carriage.
- D. Fuel support carriage stops 6 inches prior to reaching the fully closed doors.

QUESTION: 002 (1.00)

Which ONE of the following conditions will NOT initiate a reactor scram?

- A. 20 % loss of voltage to safety channels.
- B. Pulse time in excess of 15 seconds.
- C. 20% loss of high voltage to the operational channel
- D. Reactor power level in excess of 1.1 MW.

QUESTION: 003 (1.00)

Which ONE of the following air operated components operates on 80 psi air pressure?

- A. Transient Rod
- B. Air compressor tank normal pressure
- C. Air damper pressure
- D. Load shield door bearing pressure

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

QUESTION: 004 (1.00)

Which ONE of the following is the type of detector used in the stack gas monitor?

- A. GM tube
- B. Scintillation detector
- C. Proportional detector
- D. Ionization chamber

QUESTION: 005 (1.00)

Which ONE of the following is the reactor power limit if the purification system inlet water temperature exceeds 60 deg C.?

- A. 1000 watts
- B. 5000 watts
- C. 10000 watts
- D. 50000 watts

QUESTION: 006 (1.00)

Which ONE of the following is the maximum amount of explosive material which can be placed in an exposure facility?

- A. 10 mg
- B. 25 mg
- C. 10 grams
- D. 25 grams

QUESTION: 007 (1.00)

Which ONE of the following fission products are most likely to be released from the POOL following a fuel element failure?

- A. Heavy Metals and argon
- B. Low Z materials and uranium
- C. Noble gases and Iodine
- D. Transuranium elements and zirconium

QUESTION: 008 (1.00)

Which ONE of the following describe the types of detectors located in the water monitor box?

- A. PH, conductivity and flow rate
- B. Conductivity, gamma activity and temperature
- C. Gamma activity, temperature and flow rate
- D. Ph, temperature and flow rate

QUESTION: 009 (1.00)

Which ONE of the following is the design purpose of the lead shielding doors in the reactor tank?

- A. Prevent gamma streaming to adjacent areas when performing irradiations in Exposure Room #1
- B. Prevent gamma streaming from stored irradiated fuel elements when performing gamma spectrometry
- C. Prevent gamma streaming from effecting neutron source calibration
- D. Prevent gamma streaming from the core on loss of pool water while repairs are made

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

QUESTION: 010 (1.00)

The cadmium-gadolinium (Cd-Gd) shields mounted on the pool tank projection are designed to reduce which ONE of the following types of radiation?

- A. Fast Neutrons
- B. Thermal Neutrons
- C. Beta particles
- D. Gamma radiation

QUESTION: 011 (1.00)

The Constant Air Monitors (CAMs) are most sensitive to which ONE of the following types of radiation?

- A. Noble Gases
- B. Nitrogen-16
- C. Fission Fragments
- D. Argon-41

QUESTION: 012 (1.00)

The reactor ventilation air filters should be changed when which ONE of the following differential pressures is reached?

- A. 3.6 inches of water
- B. 3.6 inches of mercury
- C. 3.6 psia
- D. 3.6 psig

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

QUESTION: 013 (1.00)

The AFRR1 TRIGA reactor is operating at 50% power steady state with the primary and secondary water system operating normally when a primary water system heat exchanger tube leak occurs.

Which ONE of the following events is a result of this malfunction?

- A. Reactor power decreases
- B. Reactor power increases
- C. Reactor pool level decreases
- D. Reactor pool level increases

QUESTION: 014 (1.00)

Which ONE of the following nuclides is the largest contributor to the stack gas monitor reading during operation?

- A. Nitrogen-13
- B. Oxygen-15
- C. Nitrogen-16
- D. Argon-41

QUESTION: 015 (1.00)

Which ONE of the following radiation monitoring devices will initiate a closure of the reactor room ventilation supply and exhaust dampers?

- A. RAM R-1 Pool Surface
- B. RAM R-6 On the Air Exhaust Duct
- C. Primary CAM In Reactor Room
- D. RAM E-3 In Prep Area

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

QUESTION: 016 (1.00)

Most of the penetrations into the reactor room are sealed and cannot be opened. Which ONE of the following is the exception?

- A. Control room air conditioner
- B. Windows between the control room and adjacent offices
- C. Conduit running through "expansion" penetrations
- D. Piping which penetrates to another contained area

QUESTION: 017 (1.00)

Which ONE of the following describes the range covered and the operation of the nuclear instrumentation WIDE RANGE LOG CHANNEL?

- A. Range 0.1 watt to 1.0 MW (eight decades)
The lower six decades use a pulse count technique;
the upper four decades use a campbelling technique.
- B. Range 0.001 watt to 1.0 MW (ten decades)
The lower four decades use a pulse count technique;
the upper six decades use a campbelling technique.
- C. Range 0.001 watt to 1.0 MW (ten decades)
The lower six decades use a pulse count technique;
the upper four decades use a campbelling technique.
- D. Range 0.1 watt to 1.0 MW (eight decades)
The lower four decades use a pulse count technique;
the upper six decades use a campbelling technique.

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

QUESTION: 018 (1.00)

Which ONE of the following is the reason air pressure at 9 psi is supplied to the shield door bearings?

- A. Prevents grease from escaping from the bearings and binding the door if the seals fail
- B. Prevents air leakage from the reactor tank to the outside atmosphere through the bearings
- C. Provides a lifting "cushion" to minimize bearing wear during door operation
- D. Provides a seal to minimize the ingress of water into the door bearing housings if the seals fail

QUESTION: 019 (1.00)

Which ONE of the following conditions must be satisfied before the Exposure Room #2 plug door can be opened?

- A. Reactor core is in POS I and the lead shield doors are closed.
- B. Reactor core is in POS II and the lead shield doors are closed.
- C. Reactor core is in POS III and the lead shield doors are open.
- D. Reactor core is in POS II and the lead shield doors are open.

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

QUESTION: 020 (1.00)

In accordance with Procedure VII, REACTOR CORE LOADING AND UNLOADING, which ONE of the following is the correct core unloading sequence?

- A. The core is unloaded starting with "F" ring and ending with the "B" ring.
- B. The core is unloaded starting with "B" ring and ending with the "F" ring.
- C. The core is unloaded starting with "A1" ring and ending with the "F" ring.
- D. The core is unloaded starting with "F" ring and ending with the "A1" ring.

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

ANSWER: 001 (1.00)

~~D.~~ C

REFERENCE:

Fundamentals of Nuclear Reactor Engineering (Pg 62-65)

ANSWER: 002 (1.00)

D.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering (Pg 8)

ANSWER: 003 (1.00)

C.

REFERENCE:

AFRRI Technical Specifications 3.1.3.a (pg 8)

ANSWER: 004 (1.00)

C.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering, (pg 14)

ANSWER: 005 (1.00)

D.

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

REFERENCE:

Fundamentals of Nuclear Reactor Engineering, (pg 55)

ANSWER: 006 (1.00)

C.

REFERENCE:

Operations manual for the AFRK1 TRUGA Mark-F Reactor (pg 37)

ANSWER: 007 (1.00)

C.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering (pg 23)

ANSWER: 008 (1.00)

B.

REFERENCE:

AFRRI TRIGA MARK-F Reference Package

ANSWER: 009 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Reference Package, Power Coefficient of
Reactivity Curve

ANSWER: 010 (1.00)

D.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering (pg 85)

ANSWER: 011 (1.00)

A.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering (pg 120)

ANSWER: 012 (1.00)

A.

REFERENCE:

AFRRI TRIGA MARK-F Reference Package, Reactor Parameters

ANSWER: 013 (1.00)

B.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering (pg 63)

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

ANSWER: 014 (1.00)

D.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering, C. 3, Para. 85. (pg 76)

ANSWER: 015 (1.00)

C.

REFERENCE:

Fundamentals of Nuclear Reactor Engineering, (pg 69)

ANSWER: 016 (1.00)

A.

REFERENCE:

Safety Analysis Report (pg 4-16)

ANSWER: 017 (1.00)

A.

REFERENCE:

Safety Analysis Report (p 4-27)

ANSWER: 018 (1.00)

C.

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

REFERENCE:

Safety Analysis Report, section 4.16.3 (pg 4-39)

ANSWER: 019 (1.00)

A.

REFERENCE:

Safety Analysis Report, section 4.7, (pg 4-12)

ANSWER: 020 (1.00)

C.

REFERENCE:

AFRRI Question Bank

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

ANSWER: 001 (1.00)

A.

REFERENCE:

AFRRI Emergency Response Guidebook

ANSWER: 002 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Operating Procedure I Tab A, section 8.a

ANSWER: 003 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Operating Procedure VIII, Tab G, step 2

ANSWER: 004 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Technical Specification 6.3.2

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

ANSWER: 005 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Emergency Plan, Section 3.1.1, pg 3-1

ANSWER: 006 (1.00)

B.

REFERENCE:

AFRRI TRIGA MARK-F Operating Procedure VIII, Tab F-1

ANSWER: 007 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Emergency Plan, Section 6.2, pg 6-1

ANSWER: 008 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Operating Procedures, Procedure I, Tab B,
section 1.e

ANSWER: 009 (1.00)

D.

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

REFERENCE:

AFRRI Emergency Action Procedures, Appendix B, Personnel Rosters, pg B-1

ANSWER: 010 (1.00)

B.

REFERENCE:

AFRRI Technical Specifications 1.4, pg 1

ANSWER: 011 (1.00)

B.

REFERENCE:

AFRRI TRIGA MARK-F Reactor Operating Procedures, Procedure I, Tab A, section 3.a

ANSWER: 012 (1.00)

A.

REFERENCE:

Emergency Classification System and Emergency Action levels, Table 4-1, pg 4-2

ANSWER: 013 (1.00)

A.

REFERENCE:

AFRRI MARK-F Reactor Operating Procedures Section III, Tab D

ANSWER: 014 (1.00)

C.

REFERENCE:

Equation Sheet

ANSWER: 015 (1.00)

D.

REFERENCE:

10 CFR 20.101(a)

ANSWER: 016 (1.00)

D.

REFERENCE:

AFRRI MARK-F Definition 1.20 , pg 3

ANSWER: 017 (1.00)

C.

REFERENCE:

AFRRI MARK-F Technical Specifications 6.1.3.2, pg 30-31

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

ANSWER: 018 (1.00)

D. *1 P*

REFERENCE:

AFRRI MARK-F Technical Specification 2.1, pg 5

ANSWER: 019 (1.00)

C.

REFERENCE:

AFRRI TRIGA Technical Specification 6.4.2,pg 34

ANSWER: 020 (1.00)

D.

REFERENCE:

AFRRI TRIGA SAR, section 4.12, pg 4-31

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

ANSWER: 001 (1.00)

C. OR P

REFERENCE:

AFRRI TRIGA MARK-F Safe nalysis Report Section 4.3, pg 4-6

ANSWER: 002 (1.00)

C.

REFERENCE:

AFRRI SAR , pg 4-34/36

ANSWER: 003 (1.00)

A.

REFERENCE:

AFRRI TRIGA MARK-F Safety Analysis Report Section 3.7.4, pg 3-48

ANSWER: 004 (1.00)

B.

REFERENCE:

AFRRI TRIGA MARK-F Safety Analysis Report 3.6.3.2 , pg 3-42

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

ANSWER: 005 (1.00)

B

REFERENCE:

AFRRI TRIGA MARK-F Technical Specifications Section 3.3.a, pg 12

ANSWER: 006 (1.00)

B.

REFERENCE:

AFRRI TRIGA MARK-F Technical Specification 3.6.c, pg 16

ANSWER: 007 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Safety Analysis Report Section 6.3.2.2,pg 6-17

ANSWER: 008 (1.00)

B.

REFERENCE:

AFRRI TRIGA MARK-F Safety Analysis Report Section 3.3.3

ANSWER: 009 (1.00)

D. *OR A*

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

REFERENCE:

AFRRI Safety Analysis Report Section 6.6.3, pg 6-21/22

ANSWER: 010 (1.00)

B.

REFERENCE:

AFRRI Safety Analysis Report Section 5.2.1, pg 5-4

ANSWER: 011 (1.00)

C.

REFERENCE:

AFRRI TRIGA MARK-F Technical Specification 3.5.1

ANSWER: 012 (1.00)

A.

REFERENCE:

AFRRI Manual 82.1 pp 63

ANSWER: 013 (1.00)

D.

REFERENCE:

AFRRI Safety Analysis Report Section 3.3.6, pg 3-20

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

ANSWER: 014 (1.00)

D.

REFERENCE:

AF&RI Safety Analysis Report Section 3.4.1.2, pg 3-23

ANSWER: 015 (1.00)

C.

REFERENCE:

AF&RI TRIGA MARK-F Safety Analysis Report, Section 3.6.2

ANSWER: 016 (1.00)

A.

REFERENCE:

AF&RI Safety Analysis Report, Section 3.2.4 , pg 3-14

ANSWER: 017 (1.00)

C.

REFERENCE:

AF&RI TRIGA MARK-F Safety Analysis Report Section 4.11.2,pg 4-28

ANSWER: 018 (1.00)

D.

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

REFERENCE:

AFRRI TRIGA MARK-F Safety Analysis Report Section 3.7.4, pg 3-48

ANSWER: 019 (1.00)

A.

REFERENCE.

AFRRI SAR , pg 4-28

ANSWER: 020 (1.00)

A.

REFERENCE:

AFRRI Operating Procedure VII, Section 3

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

A N S W E R K E Y

| | | | | | |
|-----|----------------|-----|---|-----|---|
| 001 | B C | 008 | B | 015 | C |
| 002 | D | 009 | C | 016 | A |
| 003 | C | 010 | D | 017 | A |
| 004 | C | 011 | A | 018 | C |
| 005 | D | 012 | A | 019 | A |
| 006 | C | 013 | B | 020 | C |
| 007 | C | 014 | D | | |

B. NORMAL/EMERG PROCEDURES & RAD CON

| | | | | | |
|-----|---|-----|---|-----|--|
| 001 | A | 008 | C | 015 | B |
| 002 | C | 009 | D | 016 | D |
| 003 | C | 010 | B | 017 | C |
| 004 | C | 011 | B | 018 | B C D |
| 005 | C | 012 | A | 019 | C |
| 006 | B | 013 | A | 020 | D |
| 007 | C | 014 | C | | |

C. PLANT AND RAD MONITORING SYSTEMS

| | | | | | |
|-----|---|-----|--------|-----|---|
| 001 | C | 008 | B | 015 | C |
| 002 | C | 009 | D or A | 016 | A |
| 003 | A | 010 | B | 017 | C |
| 004 | B | 011 | C | 018 | D |
| 005 | B | 012 | A | 019 | A |
| 006 | B | 013 | D | 020 | A |
| 007 | C | 014 | D | | |

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

S R O Exam ? ? ? R e a c t o r
O r g a n i z e d b y Q u e s t i o n N u m b e r

| <u>QUESTION</u> | <u>VALUE</u> | <u>REFERENCE</u> |
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| 002 | 1.00 | 9000500 |
| 003 | 1.00 | 9000501 |
| 004 | 1.00 | 9000502 |
| 005 | 1.00 | 9000503 |
| 006 | 1.00 | 9000504 |
| 007 | 1.00 | 9000505 |
| 008 | 1.00 | 9000506 |
| 009 | 1.00 | 9000507 |
| 010 | 1.00 | 9000508 |
| 011 | 1.00 | 9000509 |
| 012 | 1.00 | 9000510 |
| 013 | 1.00 | 9000511 |
| 014 | 1.00 | 9000512 |
| 015 | 1.00 | 9000513 |
| 016 | 1.00 | 9000514 |
| 017 | 1.00 | 9000515 |
| 018 | 1.00 | 9000516 |
| 019 | 1.00 | 9000517 |
| 020 | 1.00 | 9000518 |
| ----- | | |
| | 20.00 | |
| 001 | 1.00 | 9000519 |
| 002 | 1.00 | 9000520 |
| 003 | 1.00 | 9000521 |
| 004 | 1.00 | 9000522 |
| 005 | 1.00 | 9000523 |
| 006 | 1.00 | 9000524 |
| 007 | 1.00 | 9000525 |
| 008 | 1.00 | 9000526 |
| 009 | 1.00 | 9000527 |
| 010 | 1.00 | 9000528 |
| 011 | 1.00 | 9000529 |
| 012 | 1.00 | 9000530 |
| 013 | 1.00 | 9000531 |
| 014 | 1.00 | 9000532 |
| 015 | 1.00 | 9000533 |
| 016 | 1.00 | 9000534 |
| 017 | 1.00 | 9000535 |
| 018 | 1.00 | 9000536 |
| 019 | 1.00 | 9000537 |
| 020 | 1.00 | 9000538 |
| ----- | | |
| | 20.00 | |
| 001 | 1.00 | 9000539 |
| 002 | 1.00 | 9000540 |
| 003 | 1.00 | 9000541 |

S R O Exam ??? Reactor
Organized by Question Number

| <u>QUESTION</u> | <u>VALUE</u> | <u>REFERENCE</u> |
|-----------------|--------------|------------------|
| 004 | 1.00 | 9000542 |
| 005 | 1.00 | 9000543 |
| 006 | 1.00 | 9000544 |
| 007 | 1.00 | 9000545 |
| 008 | 1.00 | 9000546 |
| 009 | 1.00 | 9000547 |
| 010 | 1.00 | 9000548 |
| 011 | 1.00 | 9000549 |
| 012 | 1.00 | 9000550 |
| 013 | 1.00 | 9000551 |
| 014 | 1.00 | 9000552 |
| 015 | 1.00 | 9000553 |
| 016 | 1.00 | 9000554 |
| 017 | 1.00 | 9000555 |
| 018 | 1.00 | 9000556 |
| 019 | 1.00 | 9000557 |
| 020 | 1.00 | 9000558 |
| | ----- | |
| | 20.00 | |
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| | 60.00 | |