ENCLOSURE 1

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

REPORT NO.: 50-116/OL-91-01

FACILITY DOCKET NO.: 50-116

FACILITY LICENSE NO.: R-59

FACILITY: Iowa State University

EXAMINATION DATE: May 2, 1991

EXAMINER: Christopher Gratton, Chief Examiner

SUBMITTED BY: (FJ) for Chris Gratton — 5/20/91
Christopher Gratton, Chief Examiner — Date

APPROVED BY: Theodore L. Szymanski — 5/20/91
Theodore L. Szymanski, Chief — Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation, NRR

SUMMARY:

One operator was administered an instant SRO examination. The candidate passed the written and operating portions of the examination and was issued a license.

REPORT DETAILS

1. Examiner:

   Christopher Gratton, Chief Examiner

2. Results:

	RO (Pass/Fail)	SRO (Pass/Fail	Total (Pass/Fail)
NRC Grading:	N/A	1/0	1/0

3. Written Examination:

   See attached sheet for comments and resolutions.

4. Operating Examinations:

   One candidate passed the operating examination.

5. Exit Meeting:

   The following personnel attended the exit meeting:

   Christopher Gratton, NRC
   Dr. Hendrickson, ISU
   John Adams, ISU

   Mr. Gratton thanked Dr. Hendrickson for the assistance that he and the university provided in the preparation and administration of the examination.

ENCLOSURE 2

RESOLUTION TO COMMENTS FROM THE IOWA ST. UNIVERSITY EXAMINATION

A.007 The question is not appropriate to the reactor for which the license to operate is being sought.

NRC: Comment accepted. Question will be deleted from the examination.

A.013 The solution to the question relies too heavily on the successful application of algebra while testing for knowledge in the principles of reactor theory.

NRC: While the question does rely heavily on the use of algebra, the knowledge requirements to complete the question are within the minimum requirements expected an SRO candidate. In the future though, the question will be modified to place more emphasis on knowledge of reactor theory.

A.015 The question is not appropriate to the reactor for which a license is being sought.

NRC: Comment not incorporated. The theoretical application of the knowledge measured are applicable to reactor operations in general. In the future though, questions of this nature will be reviewed to ensure they are sensitive to the operational characteristics of the facility being examined.

A.019 The answer (b) is not correct; it should be (a).

NRC: This question, or the equation sheet, will be modified to include the expected B_∞ to be used for this question. For this examination, either response (a) or (b) will be accepted.

B.004 The answer (d) is not correct, it should be (a).

NRC: Typographical error. Correct answer is (a).

B.013 The scenario is impossible at ISU, but that is not important to understanding the question.

NRC: Comment accepted. Because the scenario does not affect the ability of the candidate to answer the question, it will not be deleted. However for future examinations, the question will be modified to reflect UTR-10 physical and operational characteristics.

B.018 Answer (b) is correct if the reading is abnormal for that monitor; however answer (a) is always correct.

NRC: Either answer will be accepted for credit on this question.

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: Iowa State Univ.

REACTOR TYPE: UTR-10

DATE ADMINISTERED: 91/05/02

REGION: 3

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	32.26			A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	32.26			B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
22.00	35.48			C. PLANT AND RADIATION MONITORING SYSTEMS
62.00			%	TOTALS

FINAL GRADE

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

Candidate's Signature

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	___
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 *****)

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)

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

001 a b c d ___

002 a b c d ___

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

020 a b c d ___

(***** END OF CATEGORY 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 ___

002 MATCHING

a ___

b ___

c ___

d ___

MULTIPLE CHOICE

003 a b c d ___

004 a b c d ___

005 MATCHING

a ___

b ___

c ___

d ___

MULTIPLE CHOICE

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 MATCHING

a ___

b ___

c ___

d ___

MULTIPLE CHOICE

012 a b c d ___

013 a b c d ___

014 MATCHING

a ___

b ___

c ___

d ___

MULTIPLE CHOICE

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

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

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have 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.

QUESTION: 001 (1.00)

Which one of the following describes the beta decay of a NUCLIDE?

a. Atomic mass number decreases by 1 and the number of protons remains constant

b. Atomic mass number remains the same and the number of protons increases by 1

c. Atomic mass number remains the same and the number of protons remains constant

d. Atomic mass number decreases by 1 and the number of protons decreases by 1

QUESTION: 002 (1.00)

Which one of the following is the reason that it is preferred to operate the primary coolant system near the lower end of the operating temperature range?

a. To reduce the void coefficient value

b. To reduce the corrosion of the aluminum components

c. To maintain a negative temperature coefficient

d. To maintain the reactor coolant temperature within the capacity of the heat exchanger

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

QUESTION: 003 (1.00)

Which one of the following explains fission fragment behavior in the reactor?

a. They have a large positive charge and pick up electrons in order to become neutral

b. They have neutral charge and lose energy by collisions with other dense materials

c. They have a large positive charge and lose energy by specific ionization in the dense materials

d. They have a neutral charge and lose energy only by radioactive decay

QUESTION: 004 (1.00)

Which one of the following is the major source of energy released during fission?

a. Prompt gamma rays

b. Capture gammas

c. Fission product decay

d. Kinetic energy of the fission fragments

QUESTION: 005 (1.00)

A reactor scram has resulted in the instantaneous insertion of .003 delta K/K of negative reactivity. Which one of the following is the stable negative reactor period resulting from the scram?

a. 45 seconds

b. 56 seconds

c. 80 seconds

d. 112 seconds

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

QUESTION: 006 (1.00)

Consider two reactors, one with a delayed neutron fraction (beta) of .0072 and the other with a delayed neutron fraction (beta) of 0.60. Which one of the following will be the response of the reactors to an equal reactivity insertion if both are initially exactly critical?

a. The resulting power level will be higher for the reactor with the .0072 beta

b. The prompt neutrons contribute less to the resulting power level for the reactor with the .0060 beta

c. The resulting period will be shorter for the reactor with the .0072 beta

d. The resulting period will be shorter for the reactor with the .0060 beta

QUESTION: 007 (1.00)

Which one of the following describes the production and depletion of the xenon in the reactor?

a. Produced directly from fission only and depletes by neutron absorption only

b. Produced directly from fission only and depletes by radioactive decay and neutron absorption

c. Produced from radioactive decay of iodine and directly from fission and depletes by neutron absorption only

d. Produced from radioactive decay of iodine and directly from fission and depletes by radioactive decay and neutron absorption

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

QUESTION: 008 (1.00)

Which one of the following is the temperature coefficient for the UTR-10 reactor?

a. - 6.9 E-3% delta K/K/deg F

b. - 3.5 E-3% delta K/K/deg F

c. - 6.9 E-4% delta K/K/deg F

d. - 3.5 E-4% delta K/K/deg F

QUESTION: 009 (1.00)

Which one of the following describes the characteristics of a good moderator?

a. Low scattering cross section and low absorption cross section

b. Low scattering cross section and high absorption cross section

c. High scattering cross section and low absorption cross section

d. High scattering cross section and high absorption cross section

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

QUESTION: 010 (1.00)

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

a. Critical with Keff approximately 1.0

b. Supercritical with Keff approximately 1.005

c. Subcritical with Keff approximately 0.995

d. Subcritical with Keff approximately 0.950

QUESTION: 011 (1.00)

Which one of the following is the explanation of the source and importance of thermal neutrons in the reactor?

a. Thermal neutrons result from the decay of prompt and delayed neutrons and result in the major portion of the fissions occurring in U-235

b. Thermal neutrons result from prompt and delayed neutrons which lose energy after birth and result in the major portion of the fissions occurring in U-238

c. Thermal neutrons result from the decay of prompt and delayed neutrons and provide control of the reactor during power operation.

d. Thermal neutrons result from prompt and delayed neutrons which lose energy after birth and result in the major portion of the fissions occurring in U-235

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

QUESTION: 012 (1.00)

Which one of the following is the type of neutron source used at the Iowa State University reactor?

a. Americium-Beryllium (Am-Be)

b. Polonium-Beryllium (Po-Be)

c. Antimony-Beryllium (Sb-Be)

d. Plutonium-Beryllium (Pu-Be)

QUESTION: 013 (1.00)

The reactor is initially subcritical with a stable count rate of 10 cps. Rods are withdrawn to raise the stable count rate to 16 cps. Rods are again withdrawn to insert the same amount of reactivity as was inserted by the first rod withdrawal.

Which one of the following will be the new stable count rate?

a. 22 cps

b. 32 cps

c. 40 cps

d. 64 cps

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

QUESTION: 012 (1.00)

Which one of the following is the type of neutron source used at the Iowa State University reactor?

a. Americium-Beryllium (Am-Be)

b. Polonium-Beryllium (Po-Be)

c. Antimony-Beryllium (Sb-Be)

d. Plutonium-Beryllium (Pu-Be)

QUESTION: 013 (1.00)

The reactor is initially subcritical with a stable count rate of 10 cps. Rods are withdrawn to raise the stable count rate to 20 cps. Rods are again withdrawn to insert the same amount of reactivity as was inserted by the first rod withdrawal.

Which one of the following will be the new stable count rate?

a. 22 cps

b. 32 cps

c. 40 cps

d. 64 cps

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

QUESTION: 014 (1.00)

Which one of the following describes the response of the reactor to equal amounts of reactivity insertion as Keff approaches 1.0?

a. The fractional change in neutron population per generation is larger, therefore it takes more time to reach a new equilibrium count rate

b. The fractional change in neutron population per generation is larger, therefore it takes less time to reach a new equilibrium count rate

c. The fractional change in neutron population per generation is smaller, therefore it takes more time to reach a new equilibrium count rate

d. The fractional change in neutron population per generation is smaller, therefore it takes less time to reach a new equilibrium count rate

QUESTION: 015 (1.00)

How are core reactivity and control rod worth affected by an increase in moderator temperature?

a. Core reactivity decreases, control rod worth decreases

b. Core reactivity decreases, control rod worth increases

c. Core reactivity increases, control rod worth decreases

d. Core reactivity increases, control rod worth increases

* For future exams, Note that rod worth Δ due to ΔT and question is appropriate V because of the operating temp ΔT of the I-11 family. (80→100 ΔT no significant change in rod worth of the I-11 Control rods)

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

QUESTION: 016 (1.00)

Which one of the following is the length of time required for reactor power to increase from 10 watts to 12.5 kilowatts on a 10 second period? (Neglect heating effects)

a. 2.3 seconds

b. 25 seconds

c. 48 seconds

d. 71 seconds

QUESTION: 017 (1.00)

Which one of the following is the maximum allowable excess reactivity in the reactor as specified in the Iowa State University (ISU) UTR-10 Reactor Technical Specifications?

a. $0.94

b. $0.85

c. $0.78

d. $0.62

QUESTION: 018 (1.00)

Which one of the following is the reactor power level at which the source is removed from the core?

a. 1 E-5% (1 mW)

b. 5 E-5% (5 mW)

c. 1 E-4% (10 mW)

d. 5 E-4% (50 mW)

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

QUESTION: 019 (1.00)

With the reactor critical at 30 watts, the reactor operator withdraws the regulating rod a small amount. As power increases, an stable doubling time (DT) of 24 seconds is recorded. (Assume a lambda of 0.1 sec-1) Which one of the following is the reactivity added to the core by the operator?

a. 0.14% delta K/K

b. 0.16% delta K/K

c. 0.18% delta K/K

d. 0.20% delta K/K

QUESTION: 020 (1.00)

A complete core load is in progress on the reactor. The following data has been taken.

Number of Elements Installed	Detector A (cpm)	Detector B (cpm)
0	11	13
2	13	15
4	17	18
6	22	22
8	34	30

Using the inverse count rate figure #1 provided,determine which of the following is the approximate number of fuel elements that will be required to be loaded for a critical mass.

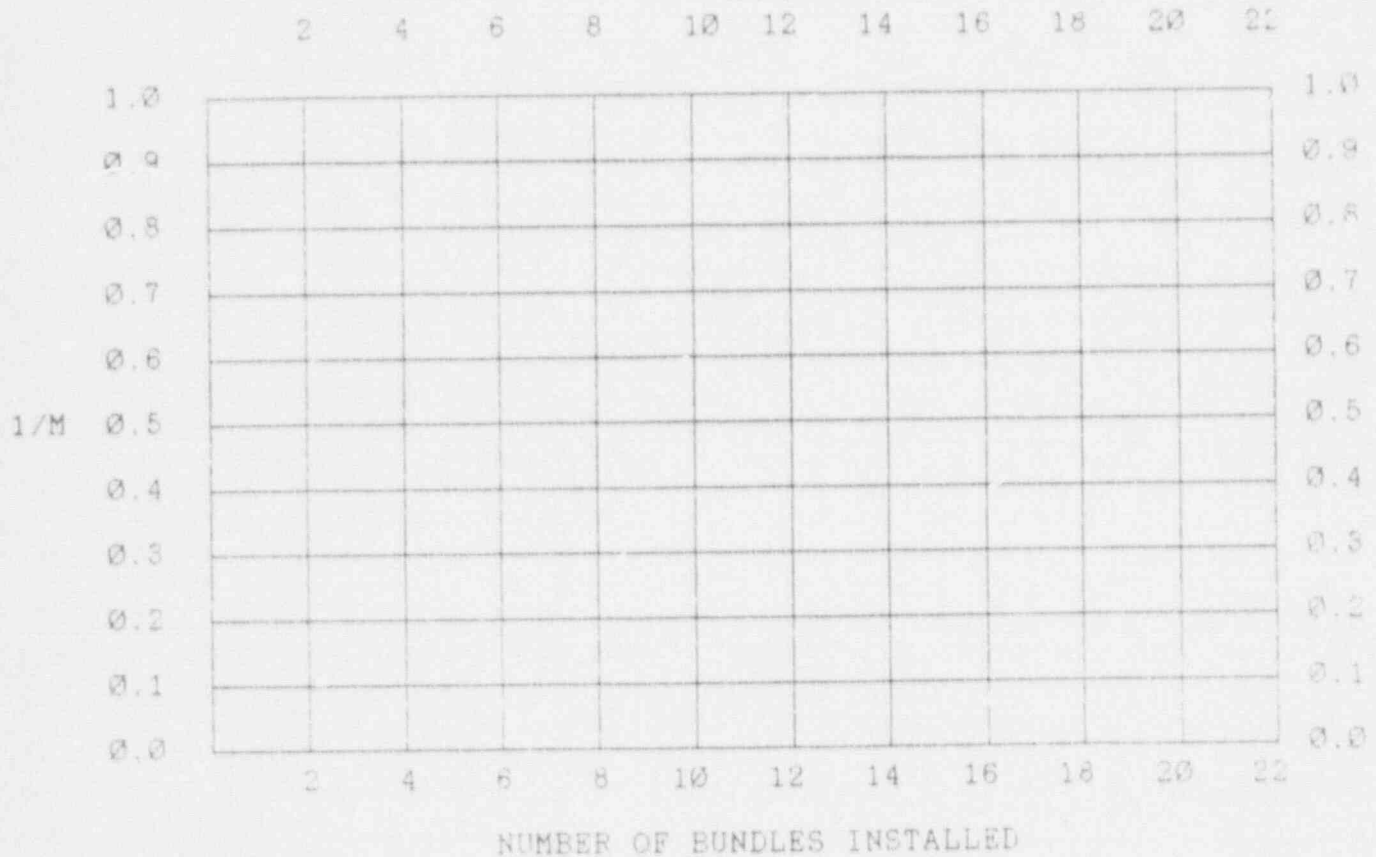
a. 8

b. 10

c. 12

d. 14

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


2 4 6 8 10 12 14 16 18 20 22
1.0
0.9
0.8
0.7
0.6
1/M 0.5
0.4
0.3
0.2
0.1
0.0
NUMBER OF BUNDLES INSTALLED

QUESTION: 001 (1.00)

During a startup the operator observes that #2 safety rod takes 4 minutes to fully withdraw. Which one of the following is the appropriate action to be taken?

a. Continue with normal startup

b. Discontinue startup and notify the SRO

c. Manually scram the reactor

d. Continue startup, maintain power less than 1 Kw

QUESTION: 002 (1.00)

Which one of the following is responsible for implementing the response procedure of the Emergency Plan?

a. The SRO

b. The Reactor Manager

c. The Radiation Safety Officer

d. The Lab Emergency Director

QUESTION: 003 (1.00)

Which one of the following radiation doses would have the most damaging biological effect if occurring from an ingested source?

a. 10 mrad alpha

b. 10 mrad fast neutrons

c. 100 mrem beta

d. 100 mrem gamma

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

QUESTION: 004 (1.00)

With the regulating rod above 5%, which of the following is the minimum power level required to place the reactor in the automatic control mode?

a. 1 watt

b. 5 watts

c. 50 watts

d. 100 watts

QUESTION: 005 (1.00)

Which one of the following actions should be taken if there is no momentary power decrease when the source is removed from the core during startup?

a. Scram the reactor

b. Immediately shutdown the reactor

c. Reinsert the source, allow power to increase by 10%, then remove the source again

d. Stop the power increase and notify the SRO

QUESTION: 006 (1.00)

With all rods fully inserted, which one of the following is the required condition for moderator when transferring fuel into or out of the core in accordance with the fuel transfer procedure?

a. Moderator level at least 14 feet above the core

b. Moderator temperature greater than 60 deg F

c. Moderator drained

d. Moderator temperature greater than 60 deg F

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

QUESTION: 007 (1.00)

Which one of the following is the minimum number and location of instruments used to follow a fuel movement into or out of the reactor?

a. Two wide range detectors set up for pulse counting and a fission chamber installed in the thermal column

b. Two fission chambers set up for pulse counting and a wide range detector installed in the thermal column

c. Two wide range detectors set up for pulse counting and a BF-3 chamber installed in the thermal column

d. Two BF-3 chambers set up for pulse counting and a wide range detector installed in the thermal column

QUESTION: 008 (1.00)

In accordance with 10 CFR 55.53(e), Operator Licenses, if a licensee has not actively performed the functions of an operator or senior operator for a minimum of four (4) hours in a period of _____ or longer, he(she) shall, prior to resuming licensed duties, demonstrate to _____ that his(her) knowledge and understanding of facility operation and administration are satisfactory.

a. Three months, the Nuclear Regulatory Commission

b. Three months, an authorized representitive of the facility licensee

c. One year, the Chairman of the Reactor Use Committee

d. One year, the Reactor Manager

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

QUESTION: 009 (1.00)

Which one of the following is the maximum amount of time that is allowed between full precritical checks before reactor start up?

a. 24 hours

b. 12 hours

c. 6 hours

d. 4 hours

QUESTION: 010 (1.00)

Which of the following conditions is required when experiments worth more than $0.22 are inserted or removed from the reactor?

a. The reactor shall be shutdown with all rods fully inserted

b. The reactor shall be in a condition no more reactive than HOT STANDBY

c. The reactor shall be shutdown with the safety rod fully withdrawn

d. The reactor shall be in HOT STANDBY with the safety rod fully withdrawn

QUESTION: 011 (1.00)

Which one of the following is the method used at ISU to limit the generation and release of argon-41 to the environs?

a. All gaseous releases from the facility pass through a HEPA and carbon filter prior to release

b. All experimental facilities, subjected to neutron flux, are ventilated prior to being opened

c. The usage pattern of the reactor controls the production and release of argon-41

d. Constant air monitors (CAM's) monitor all gaseous releases and scram the reactor if limits are exceeded

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

QUESTION: 012 (1.00)

Which one of the following approves all new experiments and classes of experiments that could affect reactivity or result in the release of radioactive materials?

a. Department of Nuclear Engineering

b. Nuclear Regulatory Commission

c. The Reactor Use Committee

d. Reactor Manager

QUESTION: 013 (1.00)

During emergency conditions it is determined that pool level is decreasing and fuel is going to be uncovered. In accordance with the ISU Emergency Plan, which one of the following is the maximum radiation dose allowed for re-entry into the facility with high radiation exposures for the purpose of preventing the draining of the pool?

a 10 rem

b 25 rem

c 50 rem

d. 75 rem

QUESTION: 014 (1.00)

Which one of the following actions should be taken if a smear on a floor area is 300 dpm/100 sq. cm?

a. Decontaminate the area immediately

b. Rope off and post as CONTAMINATED

c. Exclude all personnel, except Health Physics, from the area

d. Take additional measurements to identify the source of the contamination

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

QUESTION: 015 (1.00)

Which one of the following actions should be taken if the linear percent power channel fails downscale during full power operation? (Assume all suggested actions of Reactor Operations Procedure (abnormal and Emergency) Section 6 have failed)

a. Place the reactor in HOT STANDBY

b. Manually scram the reactor

c. Place the reactor in SHUTDOWN

d. Reduce reactor power to 50% until the instrument is repaired

QUESTION: 016 (1.00)

Following an announcement that the building is being evacuated, which one of the following actions, in addition to activating the evacuation bell, is to be taken by the operator on duty?

a. Place the reactor in HOT SHUTDOWN

b. Verify the circuit breakers are closed

c. Initiate a scram with the scram bar

d. Initiate a scram by removing the key from the magnet switch

QUESTION: 017 (1.00)

A material decays at a rate of 40 percent per day. Which of the following is the half-life of the material?

a. 9 hours

b. 18 hours

c 27 hours

d. 33 hours

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

QUESTION: 018 (1.00)

In accordance with Operations Procedure 13, which one of the following actions should be taken if an area radiation monitor alarm is received and the reading has been confirmed?

a. Above 50 mrem/hr, manually scram the reactor

b. Between 5 and 50 mrem/hr, place the reactor in HOT STANDBY

c. Above 50 mrem/hr, place the reactor in HOT STANDBY

d. Between 5 and 50 mrem/hr, manually scram the reactor

QUESTION: 019 (1.00)

While working in an area marked "Caution, Radiation Area," an operator discovers his dosimeter is off scale and leaves the area. If he had been working in the area for 45 minutes, which of the following is the maximum dose he should have received?

a. 1250 mrem

b. 100 mrem

c. 75 mrem

d. 15 mrem

QUESTION: 020 (1.00)

Which one of the following actions should be taken if the primary coolant inlet temperature indicator reads above the trip setpoint and more than four (4) degrees above the controller setpoint?

a. Manually scram the reactor

b. Place reactor in manual and reduce power until the temperature is below the setpoint

c. Place the reactor in the shutdown condition

d. Place the inlet temperature controller in manual

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

QUESTION: 001 (1.00)

Which one of the following is the reason for designing the fuel to be contained in two parallel Core Tanks?

a. The separation of the tanks provides for external monitoring of the core for fast neutron leakage

b. The separation of the tanks provides for two different low power levels to be maintained at the same time

c. The separation of the tanks provides for a "water tank" to enhance thermal neutron distribution

d. The separation of the tanks allows for a "graphite reflector" to reflect neutrons back into the core

QUESTION: 002 (2.00)

Match the facility conditions in Column A with the type of automatic response expected to occur from the Reactor Safety System in Column B. (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 required at 0.50 each)

	COLUMN A (Condition)		COLUMN B (Automatic Response)
_____a.	Primary Coolant Outlet Temperature equals 162 deg F	1.	Alarm Only
		2.	Reactor Scram
_____b.	Moderator Level equals 40 inches	3.	Withdrawal of Control Rods is inhibited
_____c.	High Voltage Power Supply is Less than Minimum Voltage	4.	Closing the Dump Valve is prohibited
_____d.	Coolant flow Rate equals 7 gpm	5.	No Safety System Response

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

QUESTION: 003 (1.00)

Which one of the following is the maximum power level at which the reactor can be operated in the natural convection mode?

a. 10 watts

b. 100 watts

c. 1 Kw

d. 10 Kw

QUESTION: 004 (1.00)

Which one of the following area radiation monitors verifies that level in the shield tank is adequate?

a. North perimeter monitor

b. South perimeter monitor

c. East perimeter monitor

d. West perimeter monitor

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

QUESTION: 005 (2.00)

For the spaces in Column A and labeled a through d on the attached diagram for the Process System SELECT the corresponding component from the items listed in Column B. (Items in Column B may be used once or not at all. Only one answer may occupy a space in Column A) (4 required at 0.50 each)

COLUMN A (Labeled Item)	COLUMN B (Component Identification)
_____a.	1. Shield Tank
_____b.	2. Dump Tank
_____c.	3. Reactor Core Tank
_____d.	4. Primary Cooler
	5. De-ionizer
	6. Primary Circulating Pump
	7. Shield Tank Circulating Pump
	8. Primary Coolant Drain Tank

QUESTION: 006 (1.00)

Which one of the following describes the interlocks for withdrawing the control rods?

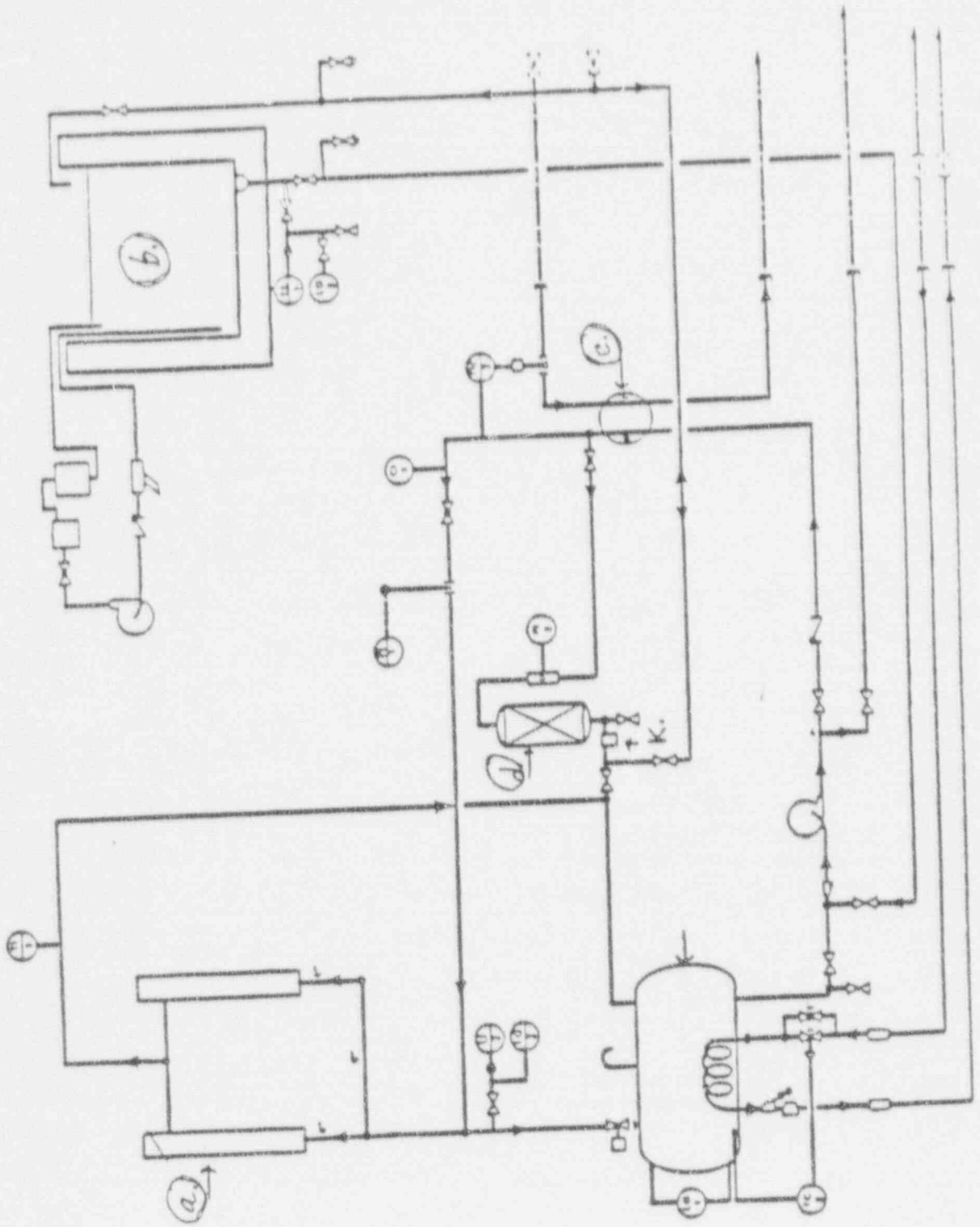
a. Simultaneously depressing the "UP" pushbutton on both safety rod #1 and Safety rod #2 will prevent both rods from moving

b. The shim safety rod must be withdrawn to the full out position before the regulating rod can be withdrawn

c. Safety rod #1 and safety rod #2 withdrawn to the upper limit automatically applies power to the shim and regulating rods

d. The shim safety rod and the regulating rod are interlocked so they cannot be driven into the core at the same time

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



Reactor Cooling System

QUESTION: 007 (1.00)

Which one of the following is the mechanism whereby clutch current is applied to the control rod clutches?

a. Depressing the "ON" yellow pushbuttons for the individual rods if no scram signal present

b. Applied automatically when the core tanks have filled and no scram signal present

c. Applied automatically if all rods are fully inserted and no scram signal present

d. Applied automatically when the dump valve is closed and no scram signal present

QUESTION: 008 (1.00)

Which one of the following alarms is "latched" when activated and must be manually reset at the indicator module?

a. High coolant outlet temperature

b. High coolant conductivity

c. Scram circuit fault to ground

d. High area radiation

QUESTION: 009 (1.00)

The UTR-10 standby AC power system is required by the Technical Specifications to have an operating time of:

a. not less than SIX (6) hours without the radiation-evacuation alarm being activated.

b. not less than FIVE (5) hours with a nominal load applied

c. not less than TWO (2) hours with the radiation-evacuation alarm activated

d. at least ONE (1) hour with the radiation-evacuation alarm activated

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

QUESTION: 010 (1.00)

Which one of the following will prevent the Dump Valve Motor from operating?

a. The regulating rod down limit switch not closed

b. Any control rod in the full out position

c. The coolant pump motor circuit breaker open

d. Less than 5 cps on the nuclear instrumentation

QUESTION: 011 (2.00)

For the components labeled a through d on Figure 1 and listed in Column A, SELECT the name the components listed in Column B. (Items in Column B will be used only once and only one answer may occupy a space in Column A)
(4 required at 0.50 each)

COLUMN A (Labels)	COLUMN B (Components)
_____a.	1. Lead Gamma Curtain
_____b.	2. Core Reflector
_____c.	3. Core Tank
_____d.	4. Thermal Column
	5. Shield Experiment Duct
	6. Shield Experiment Tank
	7. Beam Port
	8. Radiation Cavity
	9. Pneumatic Rabbit Tube
	10 Source Positioner

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

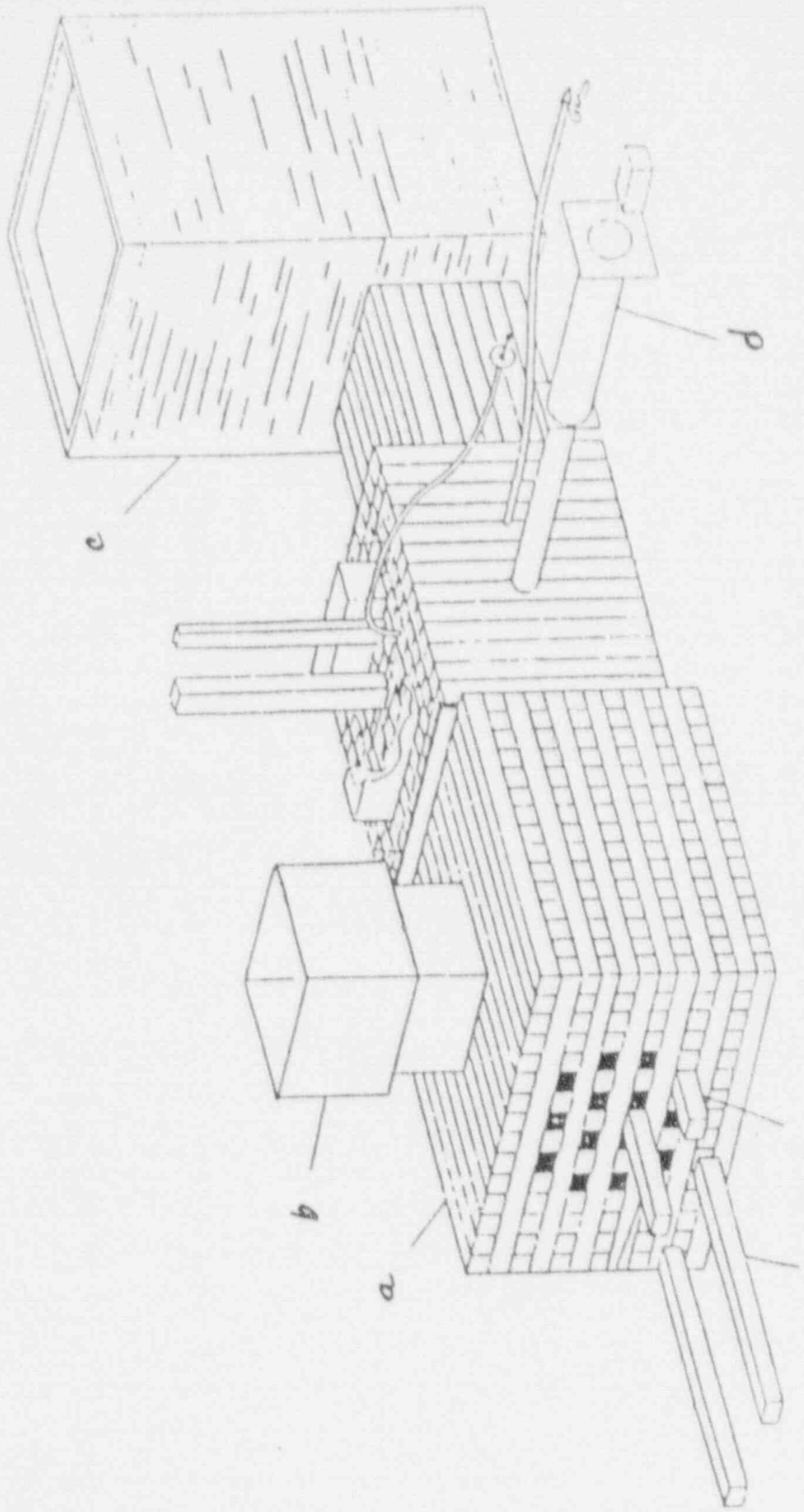


Figure 1 Experimental Facilities

QUESTION: 012 (1.00)

Which one of the following is the type of detector used to measure the primary coolant temperature?

a. Thermocouple (TC)

b. Resistance Temperature Device (RTD)

c. Resistance Bridge Monitor (RBM)

d. Remote Reading Thermometer (RRT)

QUESTION: 013 (1.00)

The inlet coolant temperature control system was designed with an upper and lower temperature limit.

Which one of the following is/are the design reason(s) for the UPPER temperature limit?

a. To compensate for excess reactivity and maintain shutdown margin requirements

b. To ensure the fuel cladding temperature design limit is not exceeded

c. To ensure resin breakdown in the deionizer does not occur

d. To ensure the design limit of the dump tank is not exceeded

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

QUESTION: 014 (2.00)

For the primary coolant parameters listed in Column A SELECT the limiting condition for operation (LCO) listed in Column B. (A limiting condition 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 required at 0.50 each)

COLUMN A (Primary Coolant Parameter)		COLUMN B (Limiting Condition)
_____a.	Primary coolant outlet temperature	1. 120 deg F
		2. 140 deg F
_____b.	Primary coolant flow rate	3. 160 deg F
_____c.	Primary coolant conductivity	4. 5 gpm
		5. 10 gpm
_____d.	Primary Deionizer radiation level	6. 15 gpm
		7. 2 micromhos
		8. 5 micromhos
		9. 10 micromhos
		10. 5 mrem/hour
		11. 10 mrem/hour
		12. 20 mrem/hour

QUESTION: 015 (1.00)

Which one of the following would be the effect on indicated power level if the compensating voltage on the multirange linear power channel were lost at 100% power?

a. Significant increase

b. Significant decrease

c. Little or no change

d. Slight decrease

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

QUESTION: 016 (1.00)

Which one of the following is the collection point for water from a leak in the primary coolant system?

a. Sanitary Sewer

b. Dump Tank

c. Process Pit

d. Basement Sump

QUESTION: 017 (1.00)

Which of the following pieces of equipment assures the positive positioning of fuel element assemblies within the core tanks?

a. The lower bolted space assembly

b. The end positioning devices

c. The fuel chambers

d. Fuel plate positioning

QUESTION: 018 (1.00)

Which one of the following is the reason for setting the normal operating level of 49.5 inches for the core tanks?

a. Provides NPSH for the Primary Circulating Pump

b. Minimizes loss of De-ionizer resins due to insufficient back pressure

c. Minimizes the loss of neutron signal due to water shielding

d. Provides sufficient head to prevent flashing in the Dump Tank when heating with steam

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

ANSWER: 001 (1.00)

b.

REFERENCE:

Nuclear Reactor Engineering, Glasstone and Sesonski pp 31
Chart of the Nuclides

ANSWER: 002 (1.00)

b.

REFERENCE:

Iowa State UTR-10 Reactor Technical Specification 5.2

ANSWER: 003 (1.00)

c.

REFERENCE:

Introduction to Nuclear Engineering, John R. Lamarsh Section 3.9 pp 95

ANSWER: 004 (1.00)

d.

REFERENCE:

Introduction to Nuclear Engineering, John R. Lamarsh Section 3.7 pp 74

ANSWER: 005 (1.00)

c.

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

REFERENCE:

Introduction to Nuclear Engineering, John R. Lamarsh Section 7.5 pp 255

ANSWER: 006 (1.00)

d.

REFERENCE:

Introduction to Nuclear Engineering, John R. Lamarsh Section 7.1 pp 248

ANSWER: 007 (1.00)

d.

REFERENCE:

Introduction to Nuclear Engineering, John R. Lamarsh Section 7.4 pp 285

ANSWER: 008 (1.00)

b.

REFERENCE:

ISU SAR Table 4.1-1

ANSWER: 009 (1.00)

c

REFERENCE:

Introduction to Nuclear Reactor Theory, John R. Lamarsh
Chapter 6 pp 167-171

ANSWER: 010 (1.00)

c.

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

REFERENCE:

Equation Sheet

ANSWER: 011 (1.00)

d.

REFERENCE:

Introduction to Nuclear Reactor Theory, John R. Lamarsh
Chapter 3 pp 94-95

ANSWER: 012 (1.00)

d.

REFERENCE:

ISU Training Manual Section 4.2.5

ANSWER: 013 (1.00)

c.

REFERENCE:

ISU Reactor Operation Project

ANSWER: 014 (1.00)

c.

REFERENCE:

ISU Reactor Operation Project

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

ANSWER: 015 (1.00)

b.

REFERENCE:

ISU Reactor Operation Project, Reactivity Coefficients

ANSWER: 016 (1.00)

d.

REFERENCE:

Basic reactor theory
Equation Sheet

ANSWER: 017 (1.00)

c.

REFERENCE:

ISU Technical Specification 3.1

ANSWER: 018 (1.00)

d.

REFERENCE:

ISU Training Manual Operating Procedure, Reactor Operations (Normal Conditions) Section E.2.f

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

ANSWER: 019 (1.00)

b.

REFFRENCE:

Equation Sheet

ANSWER: 020 (1.00)

c.

REFERENCE:

Nuclear Reactor Theory, John R. Lamarsh Section 4.2 pp 109

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

ANSWER: 001 (1.00)

b

REFERENCE:

ISU Operations Procedure (Normal) pp 4

ANSWER: 002 (1.00)

d.

REFERENCE:

ISU Emergency Plant Procedure pp 10

ANSWER: 003 (1.00)

a.

REFERENCE:

10 CFR 20

ANSWER: 004 (1.00)

~~d.~~ a. Incorrect answer found during review

REFERENCE:

ISU Startup Sequence

ANSWER: 005 (1.00)

d.

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

REFERENCE:

ISU Training Manual Operating Procedure, Reactor Operations (Normal Conditions) Section E.2.f

ANSWER: 006 (1.00)

c.

REFERENCE:

ISU Operating Procedure, Fuel Transfer Section C.4

ANSWER: 007 (1.00)

a.

REFERENCE:

ISU Operating Procedure, Fuel Transfer, Section B.1.a and B.1.c

ANSWER: 008 (1.00)

b.

REFERENCE:

10 CFR 55.31(e)

ANSWER: 009 (1.00)

b.

REFERENCE:

ISU Operations Procedure Section D

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

ANSWER: 010 (1.00)

a.

REFERENCE:

ISU Training Manual - Operating Procedure, Normal, F.6

ANSWER: 011 (1.00)

c.

REFERENCE:

ISU SAR 4.5.4.a
ISU Technical Specifications 3.7.3 and 3.7.4

ANSWER: 012 (1.00)

c.

REFERENCE:

ISU Technical Specifications 3.8.3.A and 6.2.3(3)

ANSWER: 013 (1.00)

b.

REFERENCE:

ISU Emergency Plan Procedure Table 4

ANSWER: 014 (1.00)

d.

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

REFERENCE:

ISU SAR 4.5.4

ANSWER: 015 (1.00)

a.

REFERENCE:

ISU Reactor Operations (abnormal and Emergency) Section 6

ANSWER: 016 (1.00)

d.

REFERENCE:

ISU Training Manual Operating Procedure D.3.a
ISU Emergency Response Procedure pg. 10

ANSWER: 017 (1.00)

d.

REFERENCE:

Radiological Safety Exam

ANSWER: 018 (1.00) (a is also correct)

b.
REFERENCE
ISU Training Manual - Operating Procedure 13

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

ANSWER: 019 (1.00)

c.

REFERENCE:

10 CFR 20

ANSWER: 020 (1.00)

d.

REFERENCE:

ISU Reactor Operations (Abnormal and Emergency) Section 17

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

ANSWER: 001 (1.00)

d.

REFERENCE:

ISU Training Manual Section 4.2.1

ANSWER: 002 (2.00)

a. 1

b. 3

c. 2

d. 5

REFERENCE:

ISU SAR Table 4.6-1

ANSWER: 003 (1.00)

c.

REFERENCE:

ISU SAR 4.3.1

ANSWER: 004 (1.00)

a.

REFERENCE:

ISU SAR 4.5.4 pp 4-44

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

ANSWER: 005 (2.00)

a. 3

b. 1

c. 4

d. 5

REFERENCE:

ISU SAR pp 4-26

ANSWER: 006 (1.00)

c.

REFERENCE:

ISU Training Manual Section 4.6.4.b

ANSWER: 007 (1.00)

b.

REFERENCE:

ISU Training Manual Section 4.6.4.b

ANSWER: 008 (1.00)

d.

REFERENCE:

ISU Training Manual Section 4.6.3.b

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

ANSWER: 009 (1.00)

c.

REFERENCE:

ISU SAR 3.4
ISU Technical Specification 3.6

ANSWER: 010 (1.00)

c.

REFERENCE:

ISU SAR 4.5.2(b)(2)

ANSWER: 011 (2.00)

a. 4

b. 8

c. 6

d. 7 (4 required at 0.50 each)

REFERENCE:

ISU Training Manual Figure 4.2.7

ANSWER: 012 (1.00)

b.

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

REFERENCE:

ISU Training Manual, Section 4.4.3

ANSWER: 013 (1.00)

d.

REFERENCE:

ISU SAR pg. 4-40

ANSWER: 014 (2.00)

a. 3

b. 4

c. 7

d. 11 (4 required at 0.50 each)

REFERENCE:

ISU Technical Specifications 3.3.3 and 3.3.4

ANSWER: 015 (1.00)

c.

REFERENCE:

ISU Training Manual, pg 27

ANSWER: 016 (1.00)

c.

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

REFERENCE:

ISU SAR 4.5.4.b.1.i

ANSWER: 017 (1.00)

b.

REFERENCE:

ISU SAR 4.2.2

ANSWER: 018 (1.00)

c.

REFERENCE:

ISU SAR 4.5.3

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

A. RX THEORY, THERMO & FAC OP CHARS

A N S W E R K E Y

MULTIPLE CHOICE

001 b

002 b

003 c

004 d

005 c

006 d

007 d

008 b

009 c

010 c

011 d

012 d

013 c

014 c

015 b

016 d

017 c

018 d

019 b

020 c

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

A N S W E R K E Y

001 b

002 d

003 a

004 d

005 d

006 c

007 a

008 b

009 b

010 a

011 c

012 c

013 b

014 d

015 a

016 d

017 d

018 b

019 c

020 d

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

C. PLANT AND RAD MONITORING SYSTEMS

A N S W E R K E Y

001 d

002 MATCHING

a 1

b 3

c 2

d 5

MULTIPLE CHOICE

003 c

004 a

005 MATCHING

a 3

b 1

c 4

d 5

MULTIPLE CHOICE

006 c

007 b

008 d

009 c

010 c

011 MATCHING

a 4

b 8

c 6

d 7

MULTIPLE CHOICE

012 b

013 d

014 MATCHING

a 3

b 4

c 7

d 1

MULTIPLF CHOICE

015 c

016 c

017 b

018 c

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

SRO Exam ??? Reactor

Organized by Question Number

QUESTION	VALUE	REFERENCE
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009	1.00	9000088
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	20.00	

S R O E x a m ? ? ? 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

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010	1.00	9000109
011	2.00	9000110
012	1.00	9000111
013	1.00	9000112
014	2.00	9000113
015	1.00	9000114
016	1.00	9000115
017	1.00	9000116
018	1.00	9000117
	22.00	
	62.00	