ENCLOSURE 1

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

REPORT NO.: 50-186/OL-92-02

FACILITY DOCKET NO.: 50-186

FACILITY LICENSE NO.: R-103

FACILITY: University of Missouri - Columbia

EXAMINATION DATES: February 24-25, 1992

EXAMINER: Warren Eresian, Chief Examiner

SUBMITTED BY: Warren Eresian 3/27/92
Warren Eresian, Chief Examiner Date

APPROVED BY: James L. Caldwell 3/27/92
James L. Caldwell, Chief Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation, NRR

SUMMARY:

An initial licensing examination was administered to an RO candidate, and a written retake examination (Category A) was administered to an RO candidate. Both candidates passed the examinations.

REPORT DETAILS

1. Examiners:

Warren Eresian, Chief Examiner

2. Results:

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

3. Written Examination:

Both candidates passed the written examination.

4. Operating Examinations:

The candidates passed the operating examination, although a generic weakness was demonstrated (see comments below).

5. Exit Meeting:

The following personnel attended an exit meeting on February 25, 1992 to discuss the examinations:

Warren J. Eresian, OLB, Chief Examiner
James L. Caldwell, Section Chief, Non-Power Reactors
Walt A. Meyer, University of Missouri, Reactor Manager

The NRC noted that there is a continuing reluctance on the part of operators to refer to procedures. This problem had been previously identified during a requalification examination on November 11, 1991 and documented in the exam report (50-186/OL-91-02). In this examination, the candidate had to be prompted on two different occasions to consult the appropriate procedure for information/follow-up actions:

1. As a result of a "Off-Gas High Activity" alarm, an Unusual Event was declared. Candidate did not consult either REP-21 or SEP-2, but said that the reactor must be scrammed. Although erring in the conservative direction, this action is not called for.

2. During a complete loss of secondary cooling flow, REP-13 requires that power be reduced to 100 kW via rod run-in. (Power was 500 kW at the time). Candidate did not refer to the procedure during this evolution and as a result missed this step. Although this oversight does not have safety implications (such as failing to manually scram when required), it indicates an inattention to detail.

These comments have been noted on the candidate's examination report.

It was also noted that there was no guidance in procedure VII.7 with regard to interpreting the response of the "chirper" (a radiation detector) at the primary coolant sampling station. The candidate was not able to quantify what the chirper would sound like if there were a radiation problem.

Mr. Meyer acknowledged these concerns.

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: Univ. of Missouri

REACTOR TYPE: POOL

DATE ADMINISTERED: 02/25/92

REGION: 3

CANDIDATE: _____

INSTRUCTIONS TO CANDIDATE:

Answers are to be written on the exam page itself, or the answer sheet provided. Write answers one side ONLY. Attach any answer sheets to the examination. Points for each question are indicated in parentheses for each question. A 70% in each category 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 PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.33	_____	_____	C. PLANT AND RADIATION MONITORING SYSTEMS
60.00	100.00	_____	_____	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 the answer sheets.

7. The point value for each question is indicated in parentheses after the question.

8. 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.

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. 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)

For U-235, the thermal fission cross-section is 577 barns, and the capture cross-section is 106 barns. When a thermal neutron is absorbed by U-235, the probability that a fission will occur is:

a. 0.155

b. 0.184

c. 0.816

d. 0.845

QUESTION: 002 (1.00)

Which condition below describes a reactor which is exactly critical?

a. k = 1; delta k/k = 1

b. k = 1; delta k/k = 0

c. k = 0; delta k/k = 1

d. k = 0; delta k/k = 0

QUESTION: 003 (1.00)

Every fission of Uranium-235 produces an average of:

a. 2.00 neutrons

b. 2.30 neutrons

c. 2.42 neutrons

d. 2.87 neutrons

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

QUESTION: 004 (1.00)

K-effective differs from K-infinite in that K-effective takes into account:

a. leakage from the core

b. neutrons from fast fission

c. the effect of poisons

d. delayed neutrons

QUESTION: 005 (1.00)

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

a. Beta and gamma radiation

b. Prompt and delayed neutrons

c. Kinetic energy of the fission fragments

d. Alpha radiation

QUESTION: 006 (1.00)

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

a. Resonance escape probability

b. Fast fission factor

c. Neutron reproduction factor

d. Thermal utilization factor

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

QUESTION: 007 (1.00)

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

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

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

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

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

QUESTION: 008 (1.00)

Which ONE of the following is true concerning the differences between prompt and delayed neutrons?

a. Prompt neutrons account for less than one percent of the neutron population while delayed neutrons account for approximately ninety-nine percent of the neutron population

b. Prompt neutrons are released during fast fissions while delayed neutrons are released during thermal fissions

c. Prompt neutrons are released during the fission process while delayed neutrons are released during the decay process

d. Prompt neutrons are the dominating factor in determining the reactor period while delayed neutrons have little effect on the reactor period

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

QUESTION: 009 (1.00)

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

a. DRW is the area under the IRW curve

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

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

d. IRW is the area under the DRW curve

QUESTION: 010 (1.00)

In a subcritical reactor, K eff is increased from 0.861 to 0.946. Which ONE of the following is the amount of reactivity that was added to the reactor core?

a. 0.085 delta k/k

b. 0.104 delta k/k

c. 0.161 delta k/k

d. 0.218 delta k/k

QUESTION: 011 (1.00)

The term "Prompt Critical" refers to:

a. the instantaneous jump in power due to a rod withdrawal

b. a reactor which is supercritical using only prompt neutrons

c. a reactor which is critical using both prompt and delayed neutrons

d. a reactivity insertion which is less than Beta-effective

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

QUESTION: 012 (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% power

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

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

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

QUESTION: 013 (1.00)

The water temperature coefficient of reactivity is 1.0E-4 delta K/K/deg.C. When the water temperature decreases by 10 deg C, a regulating blade with a Differential Rod Worth of 0.05 % delta K/K/inch must be:

a. inserted 2 inches

b. withdrawn 2 inches

c. inserted 0.5 inches

d. withdrawn 0.5 inches

QUESTION: 014 (1.00)

The major contributor to the production of Xenon-135 in a reactor operating at full power is:

a. direct from the fission of Uranium-235

b. from the radioactive decay of Iodine

c. from the radioactive decay of Promethium

d. direct from the fission of Uranium-238

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

QUESTION: 015 (1.00)

During a reactor startup, as the reactor approaches criticality, the value of 1/M:

a. decreases toward zero

b. decreases toward one

c. increases toward infinity

d. increases toward one

QUESTION: 016 (1.00)

The term "Reactivity" describes:

a. the dose rate of an activated sample

b. the decay constant of an activated sample

c. the departure from K-effective = 1.00

d. the amount of supercriticality

QUESTION: 017 (1.00)

The term "Shutdown Margin" describes:

a. the time required for the rods to fully insert

b. the departure from K-effective = 1.00

c. the amount of subcriticality

d. the amount of subcriticality with the most reactive rod fully withdrawn

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

QUESTION: 018 (1.00)

Which ONE of the following elements has the highest neutron absorption cross-section?

a. Uranium 235

b. Samarium 149

c. Boron 10

d. Xenon 135

QUESTION: 019 (1.00)

Which ONE of the following explains the response of the subcritical reactor to equal insertions of positive reactivity as the reactor approaches critical?

a. Each reactivity insertion causes a SMALLER increase in the neutron flux, resulting in a LONGER time to stabilize

b. Each reactivity insertion causes a LARGER increase in the neutron flux, resulting in a LONGER time to stabilize

c. Each reactivity insertion causes a SMALLER increase in the neutron flux, resulting in a SHORTER time to stabilize

d. Each reactivity insertion causes a LARGER increase in the neutron flux, resulting in a SHORTER time to stabilize

QUESTION: 020 (1.00)

A reactor has been operating at full power for one week when a scram occurs. Twelve hours later, the reactor is brought critical and quickly raised to full power. Considering xenon effects only, to maintain a constant power level for the next several hours, control rods must be:

a. inserted

b. maintained at the present position

c. withdrawn

d. withdrawn, then inserted to the original position

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

QUESTION: 001 (1.00)

SAFETY LIMITS, as defined by MURR Technical Specifications, are:

a. Settings for automatic protective devices related to those variables having significant safety functions

b. Administratively established constraints on equipment and operational characteristics which shall be adhered to during operation of the facility

c. Limits on important process variables which are found to be necessary to reasonably protect the integrity of certain physical barriers which guard against the uncontrolled release of radioactivity

d. Systems which are designed to initiate automatic reactor protection or to provide information for initiation of manual protective action

QUESTION: 002 (1.00)

In accordance with Administrative Policies, the minimum staffing requirement for reactor operation is:

a. a licensed Senior Reactor Operator in the control room

b. a licensed Reactor Operator in the control room, and another knowledgeable person in the facility

c. two licensed Reactor Operators, one of whom must be in the control room

d. one licensed Reactor Operator and one licensed Senior Reactor Operator, one of whom must be in the control room.

QUESTION: 003 (1.00)

The emergency diesel generator is started:

a. at least once per month and run for at least 30 minutes

b. at least once per week and run for at least one hour

c. for a period of about 30 minutes prior to each startup after a shutdown exceeding 24 hours

d. for a period of about 30 minutes prior to each startup

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

QUESTION: 004 (1.00)

Which ONE of the following statements define an "Instrument Channel Test?"

a. The introduction of a signal into a channel and observation of proper channel response

b. An arrangement of sensors, components and modules as required to provide a single trip or other output signal relating to a reactor or system operating parameter

c. The qualitative verification of acceptable performance by observation of channel behavior

d. The adjustment of a channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures

QUESTION: 005 (1.00)

How would an accessible area be posted if the radiation level in the area is 65 mR/hr?

a. CAUTION- RADIATION AREA

b. CAUTION- HIGH RADIATION AREA

c. CAUTION- AIRBORNE RADIOACTIVITY AREA

d. CAUTION- RESTRICTED AREA

QUESTION: 006 (1.00)

Unless extended, Radiation Work Permits expire in:

a. 8 hours

b. 24 hours

c. 48 hours

d. one week

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

QUESTION: 007 (1.00)

The SHUTDOWN MARGIN of the MURR shall be at least:

a. 2% delta k/k

b. 0.02% delta k/k with any one shim blade fully withdrawn

c. 0.02% delta k/k

d. 2% delta k/k with any one shim blade fully withdrawn

QUESTION: 008 (1.00)

Concentration of airborne radioactivity at the stack monitor which exceeds 3800 MPC when averaged over a 24-hour period would be classified as a (an):

a. Unusual Event

b. Alert

c. Site Area Emergency

d. Facility Emergency

QUESTION: 009 (1.00)

In the event of high stack monitor readings (in excess of alarm points), the reactor operator should immediately:

a. Notify the shift supervisor

b. Scram the reactor

c. Shut down the reactor

d. Silence the alarm

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

QUESTION: 010 (1.00)

In accordance with the Technical Specifications, which ONE of the following is the MINIMUM nuclear indication required to perform a reactor startup?

a. At least one (1) cps on the Source Range and two (2) watts on the Wide Range Monitor

b. At least two (2) cps on the Source Range and two (2) watts on the Wide Range Monitor

c. At least one (1) cps on the Source Range and one (1) watt on the Wide Range monitor

d. At least two (2) cps on the Source Range and one (1) watt on the Wide Range Monitor

QUESTION: 011 (1.00)

Which ONE of the following is NOT a requirement for placing the reactor in automatic reactor control?

a. Channel 1 period must be greater than 35 seconds

b. The WRM selector switch must be in the 5 KW red scale position or above

c. Regulating blade 60% withdrawn annunciator alarm energized

d. The power trace pointer (black) on the WRM recorder must be reading greater than the auto control prohibits set point

QUESTION: 012 (1.00)

YELLOW tags are used to identify equipment which, if operated, could:

a. present a hazard to personnel

b. present a hazard to that or other equipment

c. result in a reactor scram

d. result in a reactor isolation

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

QUESTION: 013 (1.00)

If the reactor is not critical when the ECP limits are reached, the reactor operator must:

a. recalculate the ECP prior to any further rod withdrawal

b. shut down the reactor

c. verify the ECP with a 1/M plot

d. check the control rod position transmitters

QUESTION: 014 (1.00)

During a reactor startup to 10 MW, in order to ensure that the calorimetric meter stabilizes, reactor power is maintained at 5 MW for a period of at least:

a. 5 minutes

b. 8 minutes

c. 10 minutes

d. 12 minutes

QUESTION: 015 (1.00)

Following a normal reactor shutdown, the pool cooling system should remain in operation for a minimum of:

a. 5 minutes

b. 10 minutes

c. 15 minutes

d. 20 minutes

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

QUESTION: 016 (1.00)

If an irradiation container is stuck somewhere in the pneumatic tube, the reactor operator should immediately:

a. Scram the reactor

b. Reduce power by rod run-in

c. Notify the Reactor Manager

d. Notify the Shift Supervisor or Manager of Health Physics

QUESTION: 017 (1.00)

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

a. 1.9 hours

b. 3.8 hours

c. 5.6 hours

d. 7.8 hours

QUESTION: 018 (1.00)

The reactivity worth of a single secured moveable experiment is limited to:

a. 0.1 % delta k/k

b. 0.25 % delta k/k

c. 0.6 % delta k/k

d. 2.0 % delta k/k

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

QUESTION: 019 (1.00)

A Reactor Isolation is classified as a (an):

a. site area emergency

b. facility emergency

c. reactor emergency

d. unusual event

QUESTION: 020 (1.00)

If the reactor operator detects a stuck rod drive during reactor power operation, he should immediately:

a. drive all shim rods in, verifying that the stuck rod fails to move

b. stop all rod movement and notify the shift supervisor

c. attempt to drive in the affected rod

d. scram the reactor

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

QUESTION: 001 (1.00)

When the three-way solenoid valves which control the major isolation valves in the primary and pool system are energized:

a. the isolation valve remains in its present position

b. the vent side of the solenoid closes and air flows to the isolation valve operator

c. the vent side of the solenoid opens and air flows to the exhaust line

d. the isolation valve closes

QUESTION: 002 (1.00)

The Automatic Shim Control circuit assists in maintaining constant reactor power by:

a. adjusting the shim rod positions in response to a period signal

b. withdrawing shim rods to allow for regulating rod insertion

c. comparing actual power to the power set potentiometer

d. inserting shim rods to allow for regulating rod withdrawal

QUESTION: 003 (1.00)

Which ONE of the following conditions will result in a reactor scram while operating in Mode III?

a. Reactor Period = 11 seconds

b. Reactor Power = 115%

c. Reactor Outlet Temperature = 180 degrees F

d. Primary Coolant Loop Flow = 1800 gpm

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

QUESTION: 004 (1.00)

Match the detector type with the correct Nuclear Instrument Channel. Detector types may be used more than once.

a. NI Channel 1	1. Fission Chamber
b. NI Channel 2	2. Uncompensated Ion Chamber
c. NI Channel 3	3. Compensated Ion Chamber
d. NI Channel 4	
e. NI Channel 5	
f. NI Channel 6	

QUESTION: 005 (1.00)

Secondary Cooling System pumps should not be started at the same time because:

a. the power surge will trip the power supply breakers

b. initial high flow rates will result in thermal shock to the heat exchanger

c. the pressure surge may produce a water hammer in the heat exchanger

d. the basin level will be reduced reculting in a low sump level trip

QUESTION: 006 (1.00)

Which Area Radiation Monitors listed below can cause a reactor isolation?

a. Reactor Bridge, Fuel Storage Room

b. Building Exhaust Plenum, Beamport Floor South Wall

c. Fuel Storage Room, Beamport Floor North Wall

d. Building Exhaust Plenum, Reactor Bridge

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

QUESTION: 007 (1.00)

Which ONE condition listed below is NOT an interlock for the withdrawal of a shim rod?

a. Thermal column door closed

b. Source Range greater than 2 counts per second

c. Rods in contact with magnet

d. "Rod Run-In" reset

QUESTION: 008 (1.00)

Which ONE of the following describes the operation of the Containment Building ventilation exhaust valves on a loss of electrical power to the Schrader valves?

a. Air is applied to the close side of the east valve (16A) causing the valve to close

b. Air is applied to the close side of the west valve (16B) causing the valve to close

c. Air is vented from the open side of the west valve (16B) allowing spring pressure to close the valve

d. Air is vented from the open side of the east valve (16A) allowing air pressure on the close side to close the valve

QUESTION: 009 (1.00)

Which ONE of the following is a load which is supplied by the Emergency Generator?

a. Reactor Exhaust Fan EF-14

b. Primary Coolant Isolation Valves 507 A/B

c. Ventilation Fan SF-1

d. Primary Pump P501A

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

QUESTION: 010 (1.00)

...e Pool Coolant Cleanup System water returns to the pool at about two feet below the pool surface in order to:

a. aid in the mixing of the water, which results in the pool attaining a uniform temperature

b. create a blanket of warm water to reduce mixing, and therefore to reduce the pool surface dose rate

c. reduce pool surface temperature, since the DI water is cooler

d. not interfere with the pool skimmer, which takes its suction at the pool surface

QUESTION: 011 (1.00)

The "Off Gas Hi Activity" annunciator may be activated by:

a. an iodine monitor which samples the exhaust stack

b. a particulate monitor which samples the building exhaust air plenum

c. a GM tube on the reactor bridge

d. a gamma scintillation probe in the anion column

QUESTION: 012 (1.00)

When the "Pressurizer Lo Press" annunciator alarms, it means that:

a. valve 526 has opened, which bleeds nitrogen gas from the pressurizer

b. PS 938 has sensed a pressure of 59.5 psi

c. PS 945 has sensed a pressure of 63 psi

d. safety relief valve 537 has opened

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

QUESTION: 013 (1.00)

When an annunciator panel is dimly lit, it means that:

a. an alarm condition has been acknowledged

b. an alarm condition has returned to normal

c. an alarm condition has returned to normal and the annunciator reset

d. the bulb may need to be changed

QUESTION: 014 (1.00)

The Fission Product Monitor samples primary coolant at:

a. the inlets to heat exchangers 503A and 503B

b. the inlets to heat exchangers 521A and 521B

c. the outlets of heat exchangers 503A and 503B

d. the outlets of heat exchangers 521A and 521B

QUESTION: 015 (1.00)

In the Automatic Control mode, the controlling signal is:

a. reactor power as measured by the Wide Range Monitor

b. reactor power as measured by Power Range Channel 5

c. reactor power as measured by Power Range Channel 6

d. reactor period as measured by Source Range Channel 1

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

QUESTION: 016 (1.00)

The neutron absorbing material of the shim rods is:

a. Aluminum

b. Boron carbide

c. Stainless steel

d. Boron Carbide-Aluminum

QUESTION: 017 (1.00)

A facility evacuation can be initiated from:

a. the control room and front lobby

b. the control room and equipment room 114

c. the reactor bridge and control room

d. the reactor bridge and front lobby

QUESTION: 018 (1.00)

Which ONE of the following operates/is operated to maintain a constant air flow through the Stack Monitor?

a. Automatically controlled valve at the discharge of the filter

b. Automatically controlled valve in a bypass line around the filters

c. Manual valve at the discharge of the filter

d. Manual valve in a bypass line around the filter

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

QUESTION: 019 (1.00)

Which ONE of the following conditions must be met to bypass the control rod startup interlock?

a. Master Switch in "AUTO" and rod magnets energized

b. Master Switch in "AUTO" and rod magnets de-energized

c. Master Switch in "TEST" and rod magnets energized

d. Master Switch in "TEST" and rod magnets de-energized

QUESTION: 020 (1.00)

Waste water from the primary and pool sampling station discharges directly to the:

a. containment hot sump

b. liquid waste tank

c. labyrinth sump

d. drain collection tank

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

A. RX THEORY, THERMO & FAC OP CHARS

ANSWER: 001 (1.00)
D.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-2

ANSWER: 002 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-21

ANSWER: 003 (1.00)
C.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-3

ANSWER: 004 (1.00)
A.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-17

ANSWER: 005 (1.00)
C.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-5

ANSWER: 006 (1.00)
D.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-19

ANSWER: 007 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 4-12

ANSWER: 008 (1.00)
C.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-7

ANSWER: 009 (1.00)
D.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 7-7

ANSWER: 010 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 3-20

ANSWER: 011 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 4-2

ANSWER: 012 (1.00)
A.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 4-4

ANSWER: 013 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 6-5

ANSWER: 014 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 8-3

ANSWER: 015 (1.00)
A.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 5-16

ANSWER: 016 (1.00)
C.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 6-2

ANSWER: 017 (1.00)
D.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 6-4

ANSWER: 018 (1.00)
D.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 2-59

ANSWER: 019 (1.00)
B.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 5-7

ANSWER: 020 (1.00)
A.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 8-10

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

B. NORMAL/EMERG PROCEDURES & RAD CON

ANSWER: 001 (1.00)
C.
REFERENCE:
MURR Technical Specifications, Section 1.23

ANSWER: 002 (1.00)
D.
REFERENCE:
SOP I.4.2.C

ANSWER: 003 (1.00)
C.
REFERENCE:
SOP VII.3.1

ANSWER: 004 (1.00)
A.
REFERENCE:
MURR Technical Specifications, Section 1.8

ANSWER: 005 (1.00)
A.
REFERENCE:
10CFR 20.202

ANSWER: 006 (1.00)
B.
REFERENCE:
SOP/A-10A

ANSWER: 007 1.00)
D.
REFERENCE:
MURR Technical Specifications, Section 3.1.e

ANSWER: 008 (1.00)
A.
REFERENCE:
SEP-2

ANSWER: 009 (1.00)
A.
REFERENCE:
REP-21

ANSWER: 010 (1.00)
A.
REFERENCE:
MURR Technical Specifications, Section 3.4.e

ANSWER: 011 (1.00)
A.
REFERENCE:
SOP II.1.3

ANSWER: 012 (1.00)
B.
REFERENCE:
SOP I.4.11.2

ANSWER: 013 (1.00)
B.
REFERENCE:
SOP I.4.3

ANSWER: 014 (1.00)
A.
REFERENCE:
SOP II.1.1.Q

ANSWER: 015 (1.00)
A.
REFERENCE:
SOP V.2.1

ANSWER: 016 (1.00)
D.
REFERENCE:
MURR Hazards Summary, Page 8-25

ANSWER: 017 (1.00)
C.
REFERENCE:
Introduction to Nuclear Reactor Operations, Page 2-34

ANSWER: 018 (1.00)
C.
REFERENCE:
MURR Technical Specifications, Section 3.1.g

ANSWER: 019 (1.00)
B.
REFERENCE:
FEP-2

ANSWER: 020 (1.00)
D.
REFERENCE:
REP-8

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

C. PLANT AND RAD MONITORING SYSTEMS

ANSWER: 001 (1.00)
B.
REFERENCE:
Training Manual for Reactor Operators, Page I-57

ANSWER: 002 (1.00)
D.
REFERENCE:
Training Manual for Reactor Operators, Page II-81

ANSWER: 003 (1.00)
C.
REFERENCE:
SOP I-20

ANSWER: 004 (1.00)
A,1; B,3; C,3; D,3; E,2; F,2
REFERENCE:
Training Manual for Reactor Operators, Pages II-13, II-24, II-34

ANSWER: 005 (1.00)
D.
REFERENCE:
SOP VI.1.H

ANSWER: 006 (1.00)
D.
REFERENCE:
Training Manual for Reactor Operators, Page II-64

ANSWER: 007 (1.00)
B.
REFERENCE:
Training Manual for Reactor Operators, Page II-77

ANSWER: 008 (1.00)
B.
REFERENCE:
Training Manual for Reactor Operators, Page I-87

ANSWER: 009 (1.00)
A.
REFERENCE:
Training Manual for Reactor Operators, Page III-12

ANSWER: 010 (1.00)
B.
REFERENCE:
MURR Hazards Summary, Page 7-20

ANSWER: 011 (1.00)
A.
REFERENCE:
Training Manual for Reactor Operators, Page I-89

ANSWER: 012 (1.00)
C.
REFERENCE:
Training Manual for Reactor Operators, Page I-47

ANSWER: 013 (1.00)
B.
REFERENCE:
MURR Hazards Summary, Page 9-19

ANSWER: 014 (1.00)
C.
REFERENCE:
Training Manual for Reactor Operators, Page II-46

ANSWER: 015 (1.00)
A.
REFERENCE:
Training Manual for Reactor Operators, Page II-39

ANSWER: 016 (1.00)
D.
REFERENCE:
MURP Hazards Summary, Page 4-7

ANSWER: 017 (1.00)
A.
REFERENCE:
Training Manual for Reactor Operators, Page II-54

ANSWER: 018 (1.00)
B.
REFERENCE:
Training Manual for Reactor Operators, Page I-89

ANSWER: 019 (1.00)
D.
REFERENCE:
MURR Hazards Summary, Page 9-21

ANSWER: 020 (1.00)
D.
REFERENCE:
Training Manual for Reactor Operators, Page I-75

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

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)

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

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

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

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)

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

001 a b c d _____

002 a b c d _____

003 a b c d _____

004 a b c d _____

005 a b c d _____

006 a b c d _____

007 a b c d _____

008 a b c d _____

009 a b c d _____

010 a b c d _____

011 a b c d _____

012 a b c d _____

013 a b c d _____

014 a b c d _____

015 a b c d _____

016 a b c d _____

017 a b c d _____

018 a b c d _____

019 a b c d _____

020 a b c d _____

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

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)

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

001 a b c d _____

002 a b c d _____

003 a b c d _____

MATCHING

004 a_____ b_____ c_____ d_____ e_____ f_____

MULTIPLE CHOICE

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 C *****)

EQUATION SHEET

$Q = m\ c_p\ \Delta T$	$DR = 6CiE/D^2$
$CR_1\ (1\text{-}Keff)_1 = CR_2\ (1\text{-}Keff)_2$	$SUR = 26.06/\tau$
$P = P_0\ 10^{SUR(t)}$	$P = P_0\ e^{(t/\tau)}$
$\tau = (\ell^*/\rho) + [(\beta\text{-}\rho)/\lambda_{eff}\rho]$	$\tau = \ell^*/(\rho\text{-}\beta)$
$\rho = (Keff\text{-}1)/Keff$	$\lambda_{eff} = 0.1\ seconds^{-1}$
$DR_1D_1^2 = DR_2D_2^2$	$DR = DR_oe^{-\lambda t}$

1 Curie = 3.7×10^{10} dps	1 BTU = 778 ft-lbf
$°F = 9/5°C + 32$	$°C = 5/9\ (°F - 32)$