ENCLOSURE 1

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

REPORT NO.: 50-156/OL-91-01

FACILITY DOCKET NO.: 50-156

FACILITY LICENSE NO.: R-74

FACILITY: University of Wisconsin

EXAMINATION DATES: September 24-25, 1991

EXAMINER: Warren Eresian, Chief Examiner

SUBMITTED BY: Warren Eresian 10/21/91
Warren Eresian, Chief Examiner Date

APPROVED BY: James L. Caldwell 10/21/91
James L. Caldwell, Chief Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation, NRR

SUMMARY:

NRC administered written and operating examinations to two Senior Reactor Operators (Upgrade) and six Reactor Operator applicants. One Reactor Operator failed the written examination and another Reactor Operator failed the operating examination. All other applicants passed the examinations.

REPORT DETAILS

1. Examiners:

   Warren Eresian, Chief Examiner
   Paul Doyle, Examiner

2. Results:

	RO (Pass/Fail)	SRO (Pass/Fail)	Total (Pass/Fail)
NRC Grading:	4/2	2/0	6/2

3. Written Examination:

   See comments and resolutions in Enclosure 2. One applicant failed the written examination.

4. Operating Examinations:

   One applicant failed the examination.

5. Exit Meeting:

   Present at the exit meeting were:

   Richard Cashwell, University of Wisconsin
   Stephen Matusewic, University of Wisconsin
   Warren Eresian, NRC
   Paul Doyle, NRC

   Mr. Eresian thanked Mr. Cashwell and MR. Matusewic for their support during tne examination. No generic weaknesses were noted.

ENCLOSURE 2

FACILITY COMMENTS AND NRC RESOLUTION OF COMMENTS

COMMENT

Question A013 Answer c. (withdrawn 2 inches)

Reference Training Manual, Miscellaneous I, Page 2. The question and answer correlate with the assumption that pool water temperature may change without a change in fuel temperature. This is not true, and operators are trained that the fuel and pool water temperature coefficients are equal and opposite (reference- same as above, line immediately above pool temperature coefficient value.) The correct answer is no movement of the regulating blade as result of temperature change. The answer should be corrected by adding a choice of no regulating blade motion, and this question should be excluded from exam scoring.

RESPONSE

Comment accepted. Question has been deleted from the examination.

COMMENT

Question B005 Answer c. (individual who signed tag)

Reference UWNR 001, Standing Operating Instructions. The answer given correctly states facts given in the first sentence of the statement (item 12, page 3). The second and third sentences, however, establish that equipment tagged to assure SRO cognizance may be operated when authorized by another SRO. Therefore, answers b. (Reactor Director) and d. (Reactor Supervisor) could also be correct answers. We note that the wording of that section could be improved, and have noted this fact for the next scheduled revision of the reference.

RESPONSE

Comment not accepted, "Another SRO" was not a choice, and "Reactor Director" or "Reactor Supervisor" is not mentioned in the reference, and may not be qualified SRO's.

COMMENT

Question B007 Answer b. (bomb threat over the telephone)

Reference UWNR 006, Emergency Plan. The answer is correct, but requires answering from memory items in a table intended to be used as a diagnostic to determine how an event should be classified. It is not really a RO level decision, but even more importantly, it requires memorization of the classification of the 11 events in the table.

RESPONSE

Comment not accepted. Since the reactor may be operated with only the RO in the facility, that RO must be aware of SPO options.

COMMENT

Question B013 Answer a. (Nuclear Regulatory Commission)

Reference Technical Specification 6.3. The answer is correct, and a good question at SRO level. The question is not applicable to reactor operator level, since any startup from an unplanned shutdown must be authorized by a SRO at this facility. (Reference, UWAR 001, items 2. and 5.)

RESPONSE

Comment not accepted. See answer to comment on B007 above.

COMMENT

Question B016 Answer c. (1.25 Rem whole body, 18.75 Rem hands and forearms, and 7.5 Rem skin)

Reference UWNR Training Manual, Health Physics. The question asks which of the following listings of limits apply to individuals per calendar quarter and includes the parenthetical statement (assume NRC Form 4 is on file). I object to this question because of the parenthetical statement, since a choice of 3 rem/quarter is not provided. Admittedly, just the parenthetical statement does not indicate that the 5(N-18) criterion is met and there is no other response that could ever be correct. What this does is to place the operator in a position to question a number that he memorized as 3 Rem/quarter against a response of 3.75 rem/quarter listed as a possible choice on an examination that is already placing him under stress.

RESPONSE

Comment not accepted. There was only one right answer. Since each operator is responsible for his or her exposure they should know the limits. However, the objectionable parenthetical statement will be removed.

COMMENT

Question C002 Answer a. (an alarm sounds)

Reference Training Manual Controls and Instrumentation I & II. The question requires memorization of a setpoint that is checked using a written procedure during prestart checkout. (Reference UWNR 110 item 2.A. and item H. (first startup of the week only)). Operators are to

perform this step in accordance with the procedure, not according to what they remember. If a procedure is changed I want my operators to follow the procedure. In addition, 20 seconds after the alarm sounds, the building evacuation alarm and an external alarm at Police and Security headquarters will occur. The question should not be used.

RESPONSE

Comment not accepted. It is reasonable to expect that operators can remember setpoints which they routinely check.

COMMENT

Question C004 Answer d. (for Safety Blade interlocks)

Reference Training Manual Controls and Instrumentation I & II. The question should be reworded before inclusion in the exam bank, to "An output of the Log Count Rate Channel..." since outputs also provide signals to alarm high count rate and to drive meter, recorder, and scaler. Same reference, diagram on page 5.

RESPONSE

Comment accepted.

COMMENT

Question C006 Answer d. (The output of a compensated ion chamber is compared to the demand level)

Reference Training Manual Controls and Instrumentation I & II. Answer a. is a better answer for positive power level changes, and actually describes channel operation more exactly than answer d. Admittedly, period has no effect on power level reductions, but candidates are likely to choose an answer that comes closer to what they have been taught.

RESPONSE

Comment accepted. Credit will be given for both answers a. and d.

COMMENT

Question C007 Answer a. (Log power level = 1 count /second)

Reference Training Manual Controls and Instrumentation I & II. The channel in question is Log Count Rate. Log power level might be interpreted as log N, which is calibrated in watts.

RESPONSE

Comment accepted. Question will be altered. (Clarification was made during the written exam.)

COMMENT

Question C008 Answer c. (it minimizes Ar-41 production)

Reference UWNR SAR, Section 2.4.4. The word "compressed" should be removed from the question. The gas used to drive the system is circulated, not specifically compressed. In addition, compressed air is used in the system to operate the stop valves.

RESPONSE

Comment accepted.

COMMENT

Question C010 Answer a. (Geiger-Mueller tube)

Reference Training Manual Controls and Instrumentation I & II. The question refers to the "Beam Port and Thermal Column Ventilation Systems." That system contains no radiation detectors, and thus none of the given answers are correct. The system intended is apparently the Beam Port Radiation Monitor System, which does use G-M tubes (same reference).

RESPONSE

Comment accepted. Question will be altered.

ENCLOSURE 3

NRC Official Use Only

Nuclear Regulatory Commission
Operator Licensing
Examination

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

NRC Official Use Only

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

FACILITY: Univ. of Wisconsin

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 91/09/23

REGION: 3

CANDIDATE: _____

LICENSE APPLIED FOR: REACTOR OPERATOR

INSTRUCTIONS TO CANDIDATE:

Answers are to be written on the exam page itself, or the answer sheet provided. Write answers one side ONLY. Attach any answer sheets to the examination. Points for each question are indicated in parentheses for each question. A 70% in each section is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20.00	33.33			A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	33.33			B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.33			C. PLANT AND RADIATION MONITORING SYSTEMS
60.00		FINAL GRADE	%	TOTALS

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

_____
Candidate's Signature

NRC RULES AND GU .S FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have not received or given assistance in completing the examination. This must be done after you complete the examination.

3. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

4. Use black ink or dark pencil only to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet.

6. Fill in the date on the cover sheet of the examination (if necessary).

7. The point value for each question is indicated in parentheses after the question. The amount of blank space on an examination question page is NOT an indication of the depth of answer required.

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

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

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

11. There is a time limit of (3) hours for completion of the examination.

12. When you are done and have turned in your examination, leave the examination area as defined by the examiner. If you are found in this area while the examination is still in progress, your license may be denied or revoked.

ANSWER SHEET

MULTIPLE CHOICE (Circle or X your choice)

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

001	a	b	b	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	_____

(***** 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	b	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 b 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 MATCHING (Fill in number)

a_____ e_____

b_____ f_____

c_____ g_____

d_____ h_____

013 a b c d _____

014 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 _____

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

QUESTION: 001 (1.00)

In a reactor at full power, the thermal neutron flux is 2.5 E12 neutrons per square centimeter per second and the macroscopic fission cross-section is 0.1 per centimeter. The fission reaction rate is:

a. 2.5 E11 fissions/sec

b. 2.5 E13 fissions/sec

c. 2.5 E11 fissions/cubic cm/sec

d. 2.5 E13 fissions/cubic cm/sec

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)

In the UWNR, a reactivity insertion of 20 cents corresponds approximately to:

a. 0.0010 delta k/k

b. 0.0014 delta k/k

c. 0.0070 delta k/k

d. 0.0020 delta k/k

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

QUESTION: 004 (1.00)

Thermalization of neutrons is accomplished most efficiently when the moderator has:

a. LOW atomic mass number and HIGH scattering cross-section

b. HIGH atomic mass number and HIGH scattering cross-section

c. LOW neutron absorption cross-section and LOW scattering cross-section

d. LOW neutron absorption cross-section and HIGH atomic mass number

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

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

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

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 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.

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

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

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

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

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)

What is the stable reactor period which produces a power rise from 15 watts to 50 kilowatts in 243 seconds?

a. 10 seconds

b. 30 seconds

c. 40 seconds

d. 60 seconds

(***** 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 for the UWNR 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

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

QUESTION: 014 (1.00)

When a neutron is absorbed by U-235, the probability that a fission event will occur is:

a. 0.14

b. 0.35

c. 0.50

d. 0.86

QUESTION: 015 (2.00)

A 1/M plot is used to predict criticality during fuel bundle loading. From the data below and the graph provided, criticality will occur after which fuel bundle is loaded?

a. 20th bundle

b. 22nd bundle

c. 24th bundle

d. 26th bundle

Count Rate	# of Fuel Bundles
842	2
976	4
1123	7
1684	12
2807	16

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

QUESTION: 016 (1.00)

Which ONE of the following is the time period in which the maximum amount of Xenon 135 will be present in the core?

a. 8 to 10 hours after a startup to 100% power.

b. 4 to 6 hours after a power increase from 50% to 100% power.

c. 4 to 6 hours after a power decrease from 100% to 50% power.

d. 8 to 10 hours after a shutdown from 100% power.

QUESTION: 017 (1.00)

Which ONE of the statements below describes why installed neutron sources are used in reactor cores?

a. To increase the count rate by an amount equal to the source contribution.

b. To increase the count rate by 1/M (M= Subcritical Multiplication Factor).

c. To provide neutrons to initiate the chain reaction.

d. To provide a neutron level high enough to be monitored by instrumentation.

(***** 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)

The equations which describe the UWNR Startup Neutron Source are:

a. Ra-226 -> alpha + Rn-222
   Be-9 + alpha -> C-12 + neutron

b. Pu-239 -> alpha + U-235
   Be-9 + alpha -> C-12 + neutron

c. Ra-226 -> beta + Ac-226
   Be-9 + beta -> Li-8 + neutron

d. Pu-239 -> beta + Am-239
   B-10 + beta -> Be-9 + neutron

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

QUESTION: 001 (1.00)

UWNR Form 115 is required to be filled out following an automatic or emergency manual scram. Whose signature is required on this form before the reactor can be operated?

a. Reactor Director

b. Senior Reactor Operator

c. Reactor Supervisor

d. Reactor Safety Committee

QUESTION: 002 (1.00)

What is the maximum reactivity worth of a single experiment allowed by the Technical Specifications?

a. 0.7% delta k/k

b. 1.4% delta k/k

c. 0.2% delta k/k

d. 0.014% delta k/k

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

QUESTION: 003 (1.00)

Which ONE of the following statements describes the UWNR Technical Specification term "Channel Test?"

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

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

c. The introduction of a signal into a channel for verification of the operability of the channel

The combination of sensors, electronic circuits and output devices connected to measure and display the value of a parameter

QUESTION: 004 (1.00)

UWNR Emergency Procedures are in the:

a. 130 Series

b. 140 Series

c. 150 Series

d. 160 Series

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

QUESTION: 005 (1.00)

Equipment that is tagged with "Do Not Operate" tags may be operated with the approval of the:

a. Reactor Safety Committee

b. Reactor Director

c. Individual who signed the tag

d. Reactor Supervisor

QUESTION: 006 (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: 007 (1.00)

Which ONE of the following would be classified as an UNUSUAL EVENT accordance with the Emergency Plan?

a. Sample spill

b. Bomb threat over the telephone

c. Personnel injury with involvement of radiation

d. Severe fuel clad leak approaching MCA size, with pool near empty and ventilation system inoperative

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

QUESTION: 008 (1.00)

Which ONE statement below describes the basis for the Safety Limit applicable to fuel temperature?

a. Excessive gas pressure may result in loss of fuel cladding integrity

b. High fuel temperature combined with lack of adequate cooling could result in fuel melt

c. Excessive hydrogen produced as a result of the zirconium-water reaction is potentially explosive

d. High fuel temperature could result in clad melt

QUESTION: 009 (1.00)

A point source of radioactivity measuring 80 mR/hr at one meter has been detected. At what distance from the source will the radiation be reduced to 20 mR/hr?

a. 2 meters

b. 4 meters

c. 8 meters

d. 16 meters

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

QUESTION: 010 (1.00)

A sample has been irradiated using the Pneumatic Tube. To be removed from the Reactor Lab, the sample dose rate must be less than:

a. 25 mR per hour

b. 50 mR per hour

c. 25 mR per hour at one foot

d. 50 mR per hour at one foot

QUESTION: 011 (1.00)

Which ONE of the following gives approval for substantive written operating procedure changes?

a. The Reactor Director

b. The Reactor Safety Committee

c. A Senior Reactor Operator

d. The Reactor Supervisor

QUESTION: 012 (1.00)

The SHUTDOWN MARGIN of the UWNR shall be greater than:

a. 0.7% delta k/k

b. 0.2% delta k/k

c. 1.4% delta k/k

d. 0.014% delta k/k

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

QUESTION: 013 (1.00)

Who authorizes the restart of the reactor folowing a violation of a Safety Limit?

a. The Nuclear Regulatory Commission

b. The Reactor Director

c. The Reactor Safety Committee

d. The Reactor Supervisor

QUESTION: 014 (1.00)

When a major radioactive spill on the floor occurs (without injury to personnel), the operator must immediately:

a. Perform a radiation survey of the area

b. Flush the floor area with water

c. Attempt to clean up the spill

d. Assure that the reactor is secured

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

QUESTION: 015 (1.00)

UWNR Technical Specifications require that control rod scram times, from the fully withdrawn to the fully inserted position:

a. Shall not exceed 1 second and shall be measured annually

b. Shall not exceed 1 second and shall be measured semiannually

c. Shall not exceed 2 seconds and shall be measured annually

d. Shall not exceed 2 seconds and shall be measured semiannually

QUESTION: 016 (1.00)

In accordance with 10 CFR 20, which ONE of the following is the radiation dose standard for individuals in restricted areas per calendar quarter (assume NRC Form 4 is on file)?

a. Whole body - 1.25 Rem
Hands and forearms - 7.5 Rem
Skin of whole body - 18.75 Rem

b. Whole body - 3.75 Rem
Hands and forearms - 7.5 Rem
Skin of whole body - 18.75 Rem

c. Whole body - 1.25 Rem
Hands and forearms - 18.75 Rem
Skin of whole body - 7.5 Rem

d. Whole body - 3.75 Rem
Hands and forearms - 18.75 Rem
Skin of whole body - 7.5 Rem

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

QUESTION: 017 (1.00)

SAFETY LIMITS, as defined by UWNR 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: 018 (1.00)

The two reactor parameters which are protected by Safety Limits are:

a. fuel element temperature and reactor power level

b. reactor power level and pool water level

c. fuel element temperature and pool water level

d. fuel cladding temperature and reactor power level

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

QUESTION: 019 (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. Which ONE of the following is the approximate time it would take for the sample to decay to 100 mRem/hour from the 2.5 Rem/hour reading?

a. 1.9 hours

b. 10.0 hours

c. 3.8 hours

d. 5.6 hours

QUESTION: 020 (1.00)

Which ONE of the following statements best describes the conditions which must be met prior to withdrawing a control rod which is being calibrated?

a. power is level; element to be calibrated at specified height; source removed

b. all control rods banked; source installed; power is level at approximately 1 watt

c. power is level at approximately 1 watt; previous motion of control rod to be calibrated in the outward direction; source installed

d. power is level; control rod to be calibrated at specified position; previous motion of control rod to be calibrated in the inward direction; source removed

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

QUESTION: 001 (1.00)

The compensated ion chamber is able to discriminate between:

a. Gamma and Beta radiation

b. Gamma and Alpha radiation

c. Neutrons and fission fragments

d. Neutrons and Gamma radiation

QUESTION: 002 (1.00)

When the Reactor Bridge Area Monitoring System reads 60 mrem/hour, which ONE of following occurs:

a. An alarm sounds

b. The reactor scrams

c. The building exhaust fans are turned off

d. No action occurs

QUESTION: 003 (1.00)

The thermocouples in an instrumented fuel element measure temperature at the:

a. interior surface of the cladding

b. center of the zirconium rod

c. outer surface of the fuel

d. interior of the fuel

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

QUESTION: 004 (1.00)

The output of the Log Count Rate Channel provides the signal:

a. for the period circuit

b. for the Safety Channels

c. to the Automatic Control Channel

d. for Safety Blade interlocks

QUESTION: 005 (1.00)

A Fission Chamber is used as a detector in the:

a. Log Count Rate Channel

b. Log N Channel

c. Safety Channel #1

d. Safety Channel #2

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

QUESTION: 006 (1.00)

Which ONE of the following describes the response of the UWNR in the Automatic mode of operation?

a. The power changes on a constant 20 second period until the power level reaches the demand level provided by the Power Schedule Potentiometer

b. Safety Blade #1 moves until the power level reaches the demand level

c. The period signal from the Fission Chamber is compared to the demand level

d. The output of a Compensated Ion Chamber is compared to the demand level

QUESTION: 007 (1.00)

Which ONE of the following will result in a Safety Blade withdrawal inhibit?

a. Log power level = 1 count/second

b. Reactor period = 10 seconds

c. Fuel temperature = 350 deg Centigrade

d. Regulating rod fully withdrawn

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

QUESTION: 008 (1.00)

CO2 is used in the pneumatic tube system instead of compressed air because:

a. it is more compressible.

b. it does not retain moisture.

c. it minimizes Ar-41 production.

d. it minimizes N-16 production.

QUESTION: 009 (1.00)

Which ONE of the following elements would most likely be found in the reactor pool water when a fuel element leak is present?

a. Iodine 135

b. Cesium 138

c. Uranium 235

d. Argon 41

QUESTION: 010 (1.00)

Which ONE of the following types of detector is used in the Beam Port and Thermal Column Ventilation Systems?

a. Geiger-Mueller tube

b. Scintillation Detector

c. Ionization Chamber

d. Proportional Counter

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

QUESTION: 011 (1.00)

Upon receipt of a scram signal:

a. the safety blades drop, the regulating rod drops, and the transient rod drops

b. the safety blades drop, the regulating rod drives in, and the transient rod drops

c. the safety blades drop, the regulating rod remains as is, and the transient rod drops

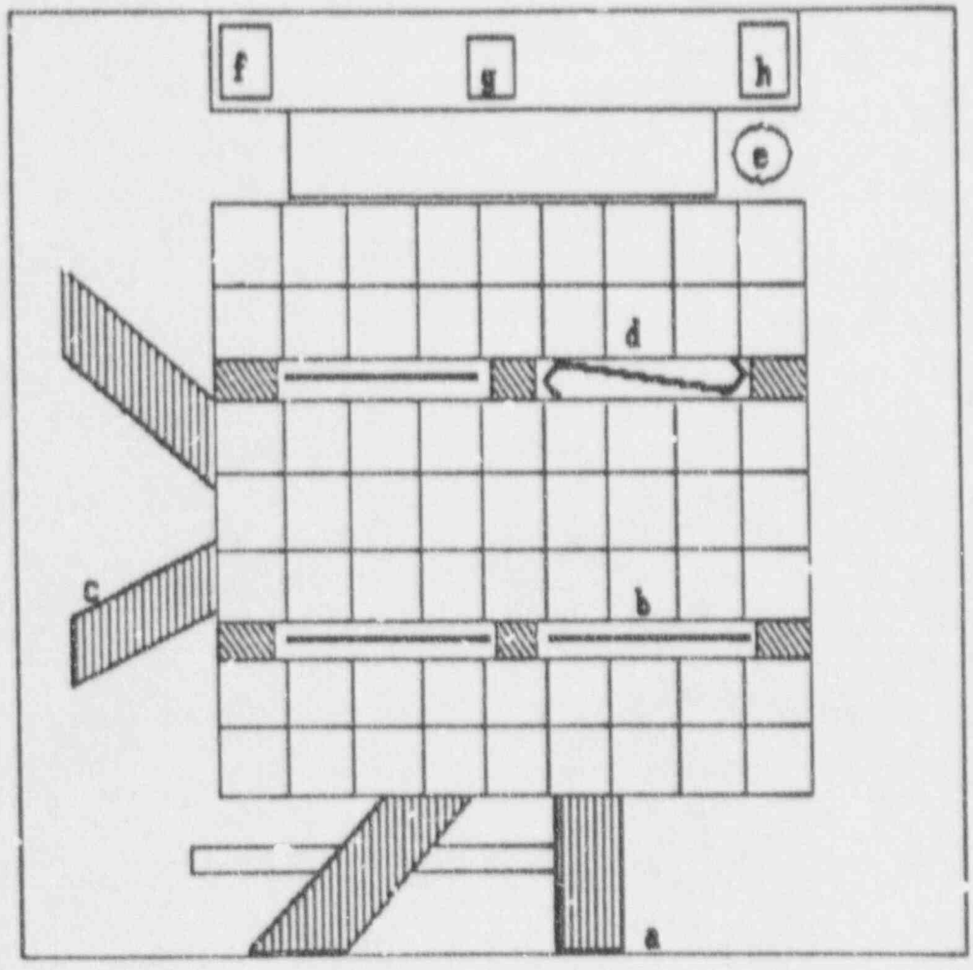
d. the safety blades drop, the regulating rod drives in, and the transient rod remains as is

QUESTION: 012 (2.00)

For the items labeled 'a' through 'h' on the figure below and listed in Column I, select the proper component from the item list in Column II. (Items in Column II are only used once. Only one answer may occupy a space in Column I.) (8 required at 0.25 each)

COLUMN I (Figure Label)	COLUMN II (Component Item List)
a. _____	1. CIC #1
b. _____	2. Log N CIC
c. _____	3. CIC #2
d. _____	4. Beam Port #3
e. _____	5. Beam Port #1
f. _____	6. Regulating Rod
g. _____	7. Fission Chamber
h. _____	8. Safety Blade #1

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


f
g
h
e
d
c
b
a

QUESTION: 013 (1.00) Page 28

Which ONE of the following methods is used to measure the flow rate through the primary coolant pump?

a. The change in pressure across a flow orifice is converted to a flow signal.

b. The change in pressure across a Venturi is converted to a flow signal.

c. An inline rotary paddle connected to a permanent magnet generator produces a signal proportional to flow.

d. The force of water through a transparent tube lifts a metal plug in the tube.

QUESTION: 014 (1.00)

Which properties of the water must be determined prior to pumping the Hold Tank into the sewer system?

a. pH and temperature

b. pH and activity

c. temperature and resistivity

d. activity and temperature

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

QUESTION: 015 (1.00)

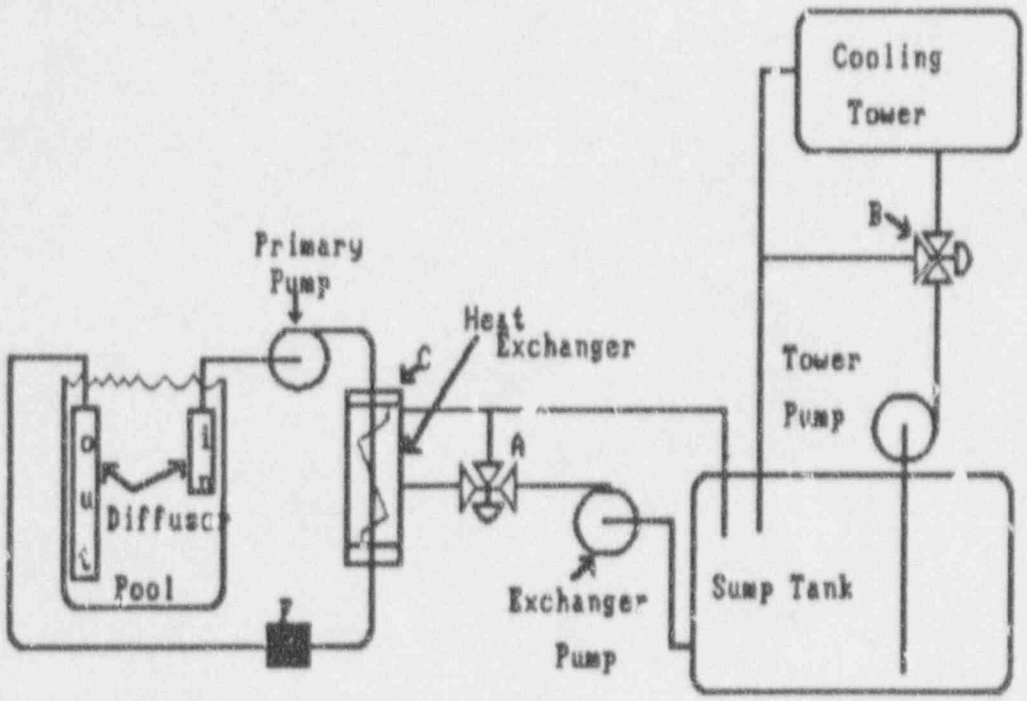
In the figure below, when air pressure to valve A is lost, the valve:

a. moves to full open, providing full flow to the heat exchanger

b. moves to full closed, with flow bypassing the heat exchanger

c. moves to full closed and the exchanger pump is tripped off

d. remains as is, with flow remaining the same



QUESTION: 016 (1.00) Page 30

Which ONE of the following conditions will result in a reactor scram?

a. Reactor period = 6 seconds

b. Bridge radiation = 60 mR/hr

c. Fuel temperature = 400 deg Fahrenheit

d. Power = 125%

QUESTION: 017 (1.00)

The poison section of the UWNR Safety blades consists of:

a. Boron Carbide and Aluminum

b. powdered borated graphite

c. Boron Carbide mixed with Zirconium Hydride

d. compacted and sintered Coron Carbide

QUESTION: 018 (1.00)

The reason for the high temperature alarm for the water inlet to the demineralizer is that:

a. resins expand and restrict flow through the demineralizer

b. the demineralizer decontamination factor is significantly increased

c. resins are organic compounds which will decompose

d. decreased water density will result in increased flow

QUESTION: 019 (1.00) Page 31

Which ONE of the following conditions describe the onset of reactor criticality during a reactor startup?

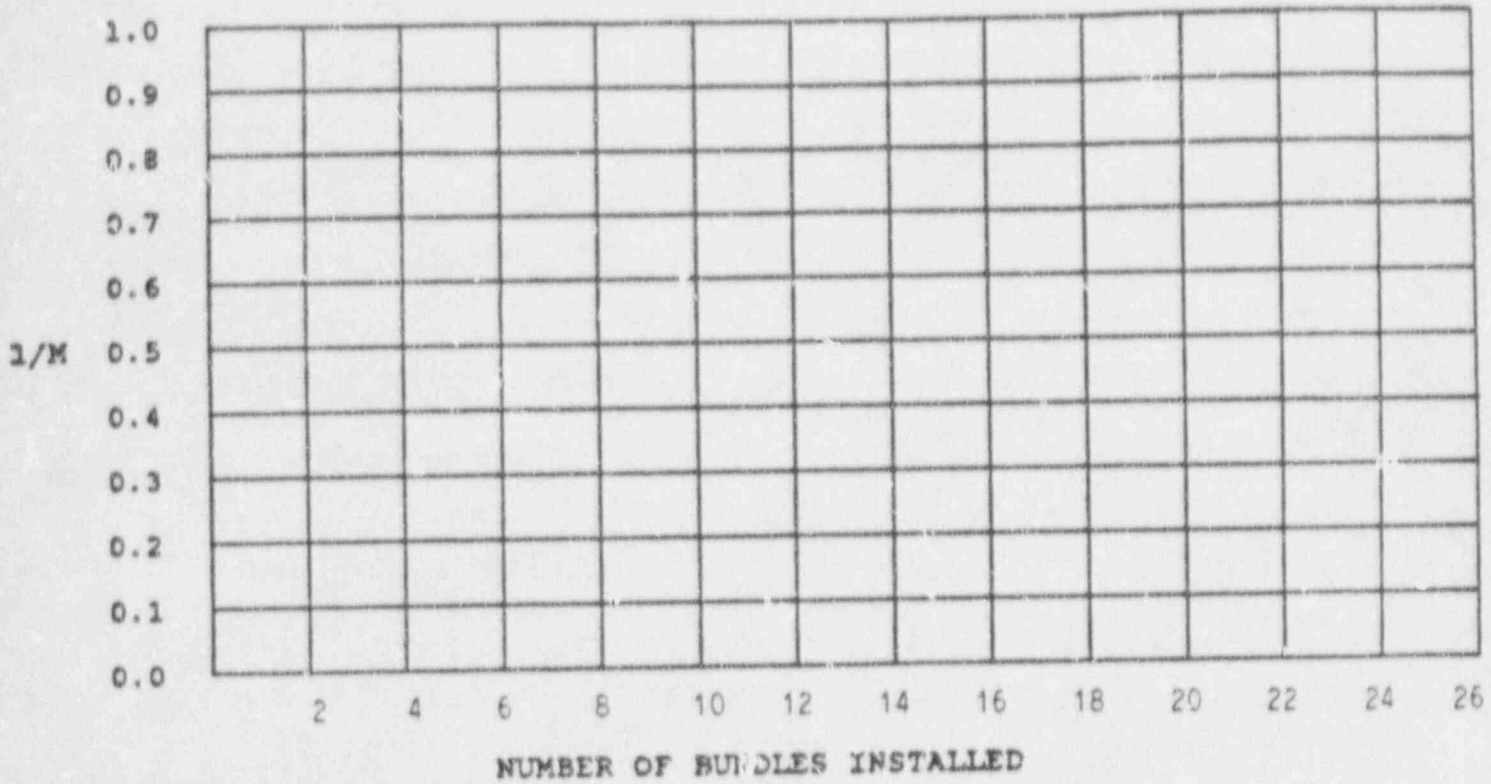
a. No rod motion, positive period, increasing count rate

b. No rod motion, infinite period, stable count rate

c. No rod motion, infinite period, increasing count rate

d. Rod withdrawing, positive period, increasing counts

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


1.0
0.9
0.8
0.7
0.6
1/M 0.5
0.4
0.3
0.2
0.1
0.0
2
4
6
8
10
12
14
16
18
20
22
24
26
NUMBER OF BUNDLES INSTALLED

EQUATION SHEET

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

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

$\rho = \Delta Keff/Keff$

$DR_1D_1^2 = DR_2D_2^2$

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

$SCR = S/(1-Keff)$

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

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

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

$SDM = (1-Keff)/Keff$

$Pwr = W_f\, \dot{m}$

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

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

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

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

$DR = DR_oe^{-\lambda t}$

---

1 Curie = 3.7×10^{10} dps

1 hp = 2.54×10^3 BTU/hr

1 BTU = 778 ft-lbf

1 kg = 2.21 lbm

1 Mw = 3.41×10^6 BTU/hr

°F = 9/5°C + 32

°C = 5/9 (°F - 32)

A. RX THEORY, THERMO & FAC OP CHARS

ANSWER: 001 (1.00)

C. Fission reaction rate = (flux)(macroscopic cross-section)

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, PHYSICS I, Page 2

ANSWER: 002 (1.00)

B.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS II, Pages 1-2

ANSWER: 003 (1.00)

B. reactivity($) = reactivity(delta k/k)/0.0070

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS II, Page 3

ANSWER: 004 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS I, Page 2

ANSWER: 005 (1.00)

C.

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

A. RX THEORY, THERMO & FAC OP CHARS

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS I, Page 2

ANSWER: 006 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS I, Page 3

ANSWER: 007 (1.00)

B.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS II, Page 4

ANSWER: 008 (1.00)

C.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS I, Page 1

ANSWER: 009 (1.00)

D.

REFERENCE:

OPERATOR TRAINING MANUAL, REACTOR PHYSICS III, CONTROL ROD CALIBRATION, Page 1

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

A. RX THEORY, THERMO & FAC OP CHARS

ANSWER: 010 (1.00)

B.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS II, Page 2

ANSWER: 011 (1.00)

B. $P(t)=P(0)\exp(t/T)$

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, MATH AND PHYSICS, Page 2

ANSWER: 012 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, MATH AND PHYSICS, Page 2

ANSWER: 013 (1.00)

B.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, MISCELLANEOUS, Page 2

ANSWER: 014 (1.00)

D.

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

A. RX THEORY, THERMO & FAC OP CHARS

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS I, Page 11

ANSWER: 015 (2.00)

B.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS II, CRITICAL EXPERIMENT

ANSWER: 016 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS, Page 6

ANSWER: 017 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS II, Page 5

ANSWER: 018 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR PHYSICS I

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

A. RX THEORY, THERMO & FAC OP CHARS

ANSWER: 019 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, PHYSICS I, Page 4

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

B. NORMAL/EMERG PROCEDURES & RAD CON

ANSWER: 001 (1.00)

B.

REFERENCE:

UWNR 001, Standard Operating Instructions

ANSWER: 002 (1.00)

B.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 3.6.b

ANSWER: 003 (1.00)

C.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 1.31

ANSWER: 004 (1.00)

C.

REFERENCE:

UWNR Procedure 150

ANSWER: 005 (1.00)

C.

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

B. NORMAL/EMERG PROCEDURES & RAD CON

REFERENCE:

UWNR 001, Standard Operating Instructions

ANSWER: 006 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, HEALTH PHYSICS, Page 3

ANSWER: 007 (1.00)

B.

REFERENCE:

UWNR Procedure 006

ANSWER: 008 (1.00)

A.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 2.1

ANSWER: 009 (1.00)

A. Dose Rate proportional to 1/distance squared

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, PHYSICS I, Page 5

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

B. NORMAL/EMERG PROCEDURES & RAD CON

ANSWER: 010 (1.00)

D.

REFERENCE:

UWNR Procedure 132

ANSWER: 011 (1.00)

B.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS, Section 6.5

ANSWER: 012 (1.00)

B.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 3.1

ANSWER: 013 (1.00)

A.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 6.3

ANSWER: 014 (1.00)

D.

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

B. NORMAL/EMERG PROCEDURES & RAD CON

REFERENCE:

UWNR Procedure 150

ANSWER: 015 (1.00)

C.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 3.3.1

ANSWER: 016 (1.00)

C.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, HEALTH PHYSICS, Page 5

ANSWER: 017 (1.00)

C.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 1.22

ANSWER: 018 (1.00)

A.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS Section 2.1

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

B. NORMAL/EMERG PROCEDURES & RAD CON

ANSWER: 019 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, PHYSICS I

ANSWER: 020 (1.00)

A.

REFERENCE:

UWNR Procedure 002

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

C. PLANT AND RAD MONITORING SYSTEMS

ANSWER: 001 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 002 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 003 (1.00)

D.

REFERENCE:

UWNR SAR, Section 2.1.3

ANSWER: 004 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 005 (1.00)

A.

C. PLANT AND PAD MONITORING SYSTEMS

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 006 (1.00)

D.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 007 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 008 (1.00)

C.

REFERENCE:

UWNR SAR, Section 2.4.4

ANSWER: 009 (1.00)

A.

REFERENCE:

UWNR Procedure 152

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

C. PLANT AND RAD MONITORING SYSTEMS

ANSWER: 010 (1.00)

A.

REFERENCE.

UWNR OPERATOR TRAINING MANUAL, CONTROLS AND INSTRUMENTATION I & II

ANSWER: 011 (1.00)

C.

REFERENCE:

UWNR SAR, Section 2.1

ANSWER: 012 (2.00)

a,5; b,8; c,4; d,6; e,7; f,1; g,2; h,3

REFERENCE:

UWNR QUESTION BANK, #108

ANSWER: 013 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, WATER SYSTEMS

ANSWER: 014 (1.00)

B.

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

C. PLANT AND RAD MONITORING SYSTEMS

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, HEALTH PHYSICS III

ANSWER: 015 (1.00)

B.

REFERENCE:

UWNR QUESTION BANK #144

ANSWER: 016 (1.00)

D.

REFERENCE:

UWNR TECHNICAL SPECIFICATIONS, Section 3.3.3

ANSWER: 017 (1.00)

A.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR DESCRIPTION

ANSWER: 018 (1.00)

C.

REFERENCE:

UWNR OPERATOR TRAINING MANUAL, REACTOR WATER SYSTEMS III

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

C. PLANT AND RAD MONITORING SYSTEMS

ANSWER: 019 (1.00)

A.

REFERENCE:

UWNR QUESTION BANK, #85

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