ENCLOSURE 1

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

REPORT NO.: 50-223-OL-92-01

FACILITY DOCKET NO.: 50-223

FACILITY LICENSE NO.: R-125

FACILITY: University of Massachusetts - Lowell

EXAMINATION DATES: April 27-28, 1992

EXAMINER: Paul Doyle, Chief Examiner

SUBMITTED BY: Paul V Doyle — 6-1-92
Paul Doyle, Chief Examiner — Date

APPROVED BY: James L. Caldwell — 6/1/92
James L. Caldwell, Chief — Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation, NRR

SUMMARY:

The NRC administered a written examination to one Senior Reactor Operator Instant (SROI) candidate and operating tests to one SROI candidate and one Senior Reactor Operator Upgrade (SROU) candidate. Both candidates passed the operating portion of the operator licensing examination, and the SROI candidate passed the written portion of the examination.

REPORT DETAILS

1. Examiner:

   Paul V. Doyle, Jr., Chief Examiner

2. Results:

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

3. Written Examination:

   The written examination was administered on April 27, 1992 to one SROI candidate. The SROI candidate passed the written examination.

4. Operating Examinations:

   Operating examinations were administered on April 28, 1992. Both candidates passed this portion of the examination.

5. Exit Meeting:

   Personnel attending: Thomas Wallace
   Reactor Supervisor
   University of Massachusetts - Lowell
   Reactor Facility
   Paul V. Doyle, Jr., Chief Examiner

   Mr. Wallace provided the chief examiner with comments on the written examination. See Enclosure 2 for a listing of facility comments along with NRC resolutions to the comments.

ENCLOSURE 2

Facility Comments on Written Examination

Section A

Question 2
Which ONE of the following actions will cause K_{eff} to decrease?

a. Placing a large steel canister (filled with air) next to the core.
b. Irradiating an Argon gas sample via the rabbit system.
c. Removing a graphite reflector element from the core.
d. Flooding a beamport with water.

Facility Comment:
This question has two correct answers a & c.

NRC Resolution:
Agree with comment. The answer key has been modified to recognize either a or c as the correct answer. The answer will be modified to ask "Which ONE of the following actions will cause K_{eff} to increase?" to correct the problem.

Section C

Question 3
MATCH the correct plant response from column B to the plant conditions listed in column A. (0.2 points each).

COLUMN A		COLUMN B	
1.	Neutron flux (110%)	a.	Alarm Only
2.	Pool level 2'6" below the gutters		
3.	Primary Coolant flow 1450 gpm	b.	Scram Only
4.	Core Inlet temperature 104°F		
5.	Bulk pool temperature, 102°F	c.	Alarm and Scram
6.	Holdup Tank High conductivity		
7.	Reactor Period of 6 seconds	d.	Neither alarm nor Scram
8.	Fully withdrawn Regulating Rod		
9.	Both containment doors fully open		
10.	Opening the Thermal column door		

Facility Comment:
Pool level 2' 6" in. below the gutters will cause a scram and an alarm (choice 'c').

NRC Resolution:
Agree with comment. The answer key for this question has been modified to recognize choice 'c' as being correct for a pool level of 2' 6".

ENCLOSURE 2

Facility Comments on Written Examination

Section C
Question 6

The reactor has been shutdown over the weekend. You commence a reactor startup at 07:00 Monday morning. By 09:00am you have the reactor at 1 Megawatt. Which ONE of the following choices correctly describes the changes you would see in control rod height, primary coolant flow and pool temperature if you maintain reactor power at 1 Megawatt until 14:00 (2:00pm) in the afternoon?

a. Control blade height – increase
Primary flow – decrease
Pool temperature – remain the same

b. Control blade height – increase
Primary flow – remain the same
Pool temperature – increase

c. Control blade height – decrease
Primary flow – decrease
Pool temperature – remain the same

d. Control blade height – decrease
Primary flow – remain the same
Pool temperature – increase

Facility Comment:
B is the only correct answer. Why would Pool temperature increase?

NRC Resolution:
Agree with comment. No change to the answer key is necessary. This question will be modified.

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

FACILITY: Univ. of Lowell

REACTOR TYPE: ULR

DATE ADMINISTERED: 92/04/27

REGION: 1

CANDIDATE: _____

LICENSE APPLIED FOR: _____

INSTRUCTIONS TO CANDIDATE:
Answers are to be written on 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

ANSWER SHEET

Multiple Choice (Circle or X your choice)

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

MULTIPLE CHOICE

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

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

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your election 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 B *****)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

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

MULTIPLE CHOICE

001 a b c d ___

002 a b c d ___

003 MATCHING

1 ___ 6 ___

2 ___ 7 ___

3 ___ 8 ___

4 ___ 9 ___

5 ___ 10 ___

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 MATCHING

1 ___

2 ___

3 ___

4 ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 MATCHING

1 ___

2 ___

3 ___

4 ___

5 ___

6 ___

7 ___

8 ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 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. 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.

EQUATION SHEET

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

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

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

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

$SUR = 26.06/\tau$

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

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

$P = \dfrac{\beta(1-\rho)}{\beta-\rho} P_0$

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

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

$\rho = \Delta Keff/Keff$

$\bar{\beta} = 0.0077$

$DR_1 D_1^2 = DR_2 D_2^2$

$\Delta\rho = \dfrac{Keff_2 - Keff_1}{Keff_1 Keff_2}$

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

$SCR = S/(1-Keff)$

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

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

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

$SDM = (1-Keff)/Keff$

$Pwr = W_f \dot{m}$

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

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

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

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

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

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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)

QUESTION: 001 (1.00)

For U-235, the thermal fission cross-section is [illegible] 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. 0.15

b. 0.18

c. 0.81

d. 0.84

QUESTION: 002 (1.00)

Which ONE of the following actions will cause Keff to decrease?

a. Placing a large steel cannister (filled with air) next to the core.

b. Irradiating an Argon gas sample via the rabbit system.

c. Removing a graphite reflector element from the core periphery.

d. Flooding a beamport with [illegible]r.

QUESTION: 003 (1.00)

Every fission of Uranium-235 produces an average of:

a. 2.0 neutrons

b. 2.1 neutrons

c. 2.4 neutrons

d. 2.9 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 PAGE *****)

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)

The secondary side of a heat exchanger is designed to supply water at 80 degrees F and return it to the environment at 91.4 degrees F at a flow rate of 1500 gpm The heat removal rate in the heat exchanger is:

a. 0.14 Mwatt

b. 1.2 Mwatt

c. 2.4 Mwatt

d. 4.8 Mwatt

QUESTION: 010 (1.00)

In a subcritical reactor, Keff 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)

Graphite is used in the reactor because it is a better neutron reflector than water. Which one of the following reasons is the reason why graphite is a better reflector?

a. lower density

b. lower cross-section for neutron absorption

c. higher value for energy loss per collision

d. higher scattering cross-section

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)

The following count rates were obtained during fuel loading. All control rods were withdrawn.

No. of fuel elements loaded	Counts per Second
0 (Source only)	15
5	17
10	25
15	47
18	75
20	120

How many fuel elements are required for a critical loading?

a. 22

b. 24

c. 26

d. 28

QUESTION: 016 (1.00)

With all rods IN, the Startup Counter reads 30 CPS and the reactor is shutdown by 9% delta k/k. What will the Startup Counter read with the control blades at 12 inches and the regulating rod at 10 inches? (The reactor is subcritical.)

a. 15 CPS

b. 30 CPS

c. 60 CPS

d. 120 CPS

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

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

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

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

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)

Technical Specifications defines a process used to determine an instrument's accuracy by visually comparing that indication to other independent instrument channels which measure the same parameter. Which ONE of the following is the correct term for this Technical Specifications definition?

a. Channel Test

b. Channel Measurement

c. Channel Calibration

d. Channel Check

QUESTION: 002 (1.00)

You are preparing to dispose of radioactive liquid waste. You perform a gross radionuclide analysis on the liquid. Which ONE of the following values, is the value above which a gamma spectroscopy is required to identify major radionuclides?

a. 3 x 10-6 micorcuries/liter

b. 3 x 10-6 microcuries/cm3

c. 6 x 10-3 microcuries/liter

d. 6 x 10-3 microcuries/cm3

QUESTION: 003 (1.00)

Who must review and approve procedural changes before they are submitted to the Reactor Safety Subcommittee for final approval?

a. Reactor Operator

b. Chief Reactor Operator

c. Senior Operator

d. Reactor Supervisor

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

QUESTION: 004 (1.00)

In accordance with Reactor Operating Procedure R.O. -1, a minimum number of neutron flux instruments along with a minimum reading is required for fuel loading operations. Which ONE of the following choices represents the correct number of instruments on line and the minimum signal-to-noise ratio required for the monitor to be considered online?

a. 1, 2

b. 2, 3

c. 1, 3

d. 2, 2

QUESTION: 005 (1.00)

During a reactor startup in accordance with R.O. -5 "Routine Start-up" the minimum period allowed, is;

a. 20 seconds

b. 25 seconds

c. 30 seconds

d. 35 seconds

QUESTION: 006 (1.00)

Which ONE of the following is the MAXIMUM allowed dose rate at the pool surface, that would require suspension of irradiation fuel handling for foil mapping of the core?

a. 1000 mRem/Hr

b. 3000 Mrem/Hr

c. 5000 mRem/Hr

d. 7000 mRem/Hr

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

QUESTION: 007 (1.00)

While moving a Control Blade, no indication of movement on the position indicator was detected? Which ONE of the following is the correct action you should take?

a. Drive the problem control blade in.

b. Scram and secure the reactor.

c. Notify the Reactor Supervisor and wait for instructions.

d. Drive the other blades and the regulating rod fully in.

QUESTION: 008 (1.00)

Which ONE of the following conditions would require you to scram the reactor?

a. Pool level 6-1/2" below the pool gutters

b. Core Outlet Temperature 109 F

c. Coolant Flow 1375 gpm

d. Pool Temperature 102 F

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

QUESTION: 009 (1.00)

As defined by Technical Specifications, which ONE of the following statements is NOT part of the definition for a 'SHUTDOWN' reactor.

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

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

c. The minimum shutdown margin, with the most reactive of the operable control rod elements withdrawn shall be $1.00

d. No experiments in or near the reactor are being moved or serviced that have on movement a reactivity worth exceeding the maximum value allowed for a single experiment or one dollar whichever is smaller.

QUESTION: 010 (1.00)

In accordance with 10 CFR 20 (Standards for Protection Against Radiation), which ONE of the following is the radiation dose standard for individuals in restricted areas per calendar quarter? (Assume that NO NRC form 4 or equivalent 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: 011 (1.00)

Which ONE of the following choices is the MINIMUM amount of time a licensed operator must perform his/her licensed duties to maintain an active license?

a. Four hours per month

b. Four hours per calendar quarter

c. Six hours per month

d. Six hours per calendar quarter

QUESTION: 012 (1.00)

A Colbolt-60 source has been dropped in the reactor laboratory. Thirty (30) feet from the source a beta-gamma detector reads 100 mr/hr. What is the curie content of the source? (Assume a 1.2 and a 1.3 Mev gamma emmission.)

a. 90 curies

b. 30 curies

c. 6 curies

d. 2.5 curies

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

QUESTION: 013 (1.00)

Your pocket dosimeter suddenly goes off-scale (high). What immediate action would you take?

a. Reset the dosimeter back to zero.

b. Leave the radiation area and notify Health Physics or Reactor Operations.

c. No immediate action is required. Wait for routine processing of your TLD to see if the exposure was real.

d. Stay where you are until help arrives.

QUESTION: 014 (1.00)

An experiment has been removed from the reactor. A radiation reading of 1 r/hr was recorded at 3 feet when the experiment was removed. Fifteen minutes later a reading of 750 mr/hr was recorded at the same distance. What is the approximate length of time required (measured from the time of removal) for the radiation level to decrease to 10 mr/hr at 1 foot?

a. 3 hours

b. 6 hours

c. 9 hours

d. 12 hours

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

QUESTION: 015 (1.00)

Which ONE of the following facility documents does NOT require NRC approval for changes?

a. Facility License

b. Facility Requalification Plan

c. Facility Emergency Implementation Procedures

d. Facility Emergency Plan

QUESTION: 016 (1.00)

According to Technical specifications what is the MAXIMUM allowable worth of a SINGLE MOVABLE experiment?

a. 5.0 % Delta K/K

b. 1.0 % Delta K/K

c. 0.5 % Delta K/K

d. 0.1 % Delta K/K

QUESTION: 017 (1.00)

Assume you have a core designated as C-5-3. In accordance with Standing Order #3, which of the following changes to the core will result in a change to the C?

a. Two fuel elements are exchanged.

b. The fuel configuration is changed.

c. A new graphite element is added in place of a radiation basket.

d. A fuel element is replaced by a new element.

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

QUESTION: 018 (1.00)

Which of the following isotopes is the greatest source of gamma radiation from the primary coolant during operation?

a. N-16

b. Ar-41

c. Na-24

d. Rb-88

QUESTION: 019 (1.00)

Why is the core end of a typical beamport plugged with a nitrogen filled canister?

a. To reduce the production of N-16

b. To reduce the production of Ar-41

c. To reduce the production of Cs-188

d. To reduce the production of Rb-88

QUESTION: 020 (1.00)

In accordance with Technical Specifications, who of the following is the lowest level of facility management authorized to implement a TEMPORARY change to a facility procedure which does not change the intent of the procedure?

a. The on-duty Senior Reactor Operator

b. The Chief Reactor Operator

c. The Reactor Supervisor

d. The Reactor Safety Subcommittee

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

QUESTION: 001 (1.00)

Which one of the following is a valid purpose for one of the Limit Switches on the Control Blade Drives?

a. To provide control blade position during all point of travel

b. To shut off the control blade motor when the blade has reached the end of travel limit.

c. To actuate the rundown circuit

d. To provide input to the servo-controlled regulating element drive system.

QUESTION: 002 (1.00)

Which ONE of the following is a purpose for the friction-disc type clutch on each control blade drive motor output shaft?

a. Ensure adequate transmission of torque to raise and lower the control blades.

b. Allow continuous motor operation during periods of frequent blade movement so that motor wear is reduced.

c. Limit the amount of torque that is applied to the lead screw.

d. Reduce the shaft speed sufficiently so that insertion or movement of the control blade does not exceed the reactivity addition rate limit in the Technical specifications.

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

QUESTION: 003 (2.00)

MATCH the correct plant response from column B to the plant conditions listed in column A. (0.2 points each)

COLUMN A	COLUMN B
1. Neutron Flux (110%)	a. Alarm Only
2. Pool level 2'6" below gutters	
3. Primary Coolant flow 1450 gpm	b. Scram Only
4. Core Inlet temperature, 104 F	
5. Bulk pool temperature, 102 F	c. Alarm & Scram
6. Holdup Tank High Conductivity	
7. Reactor Period of 6 seconds	d. Neither Alarm nor Scram
8. Fully withdrawn Regulating Rod	
9. Both Containment doors fully open	
10. Opening the Thermal Column door	

QUESTION: 004 (1.00)

Which ONE of the following choices is NOT an input to or a component of the Automatic Power Level Channel?

a. Period Signal

b. Power Schedule Switch

c. Regulating Rod Limit Switches

d. Log-N recorder

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

QUESTION: 005 (1.00)

An experimental sample has been inserted into the reactor via the pneumatic system. In accordance with ULR R.O.-4, "Adding or Removal of Samples to the Core," which ONE of the following choices lists the correct information the operator needs in order to calculate the actual worth of the experimental sample?

a. Moderator temperature coefficient along with the reactor inlet temperatures before and after the insertion

b. The regulating rod worth curve along with rod positions for the same power level before and after the insertion

c. Reactor Period meter indication just before and just after the insertion

d. Coolant Flow rate just before and just after the insertion.

QUESTION: 006 (1.00)

The reactor has been shutdown over the weekend. You commence a reactor startup at 07:00 Monday morning. By 09:00 am you have the reactor at 1 Megawatt. Which ONE of the following choices correctly describes the changes you would see in control rod height, primary coolant flow and pool temperature if you maintain reactor power at 1 Megawatt until 14:00 (2:00pm) in the afternoon?

a. Control blade height - increase
Primary flow - decrease
Pool temperature - remain the same

b. Control blade height - increase
Primary flow - remain the same
Pool temperature - increase

c. Control blade height - decrease
Primary flow - decrease
Pool temperature - remain the same

d. Control blade height - decrease
Primary flow - remain the same
Pool temperature - increase

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

QUESTION: 007 (1.00)

The "MASTER SWITCH" is in the "TEST" position and the "REGULATING BLADE OUT" light is energized. What is the actual position of the regulating rod.

a. fully in

b. fully out

c. indeterminate while in "TEST" position

d. at 0.5" withdrawn

QUESTION: 008 (1.00)

Which ONE of the Scrams listed is NOT disabled by placing the range switch (7S5) in the "0.10 MW" position?

a. Reactor low flow

b. Core inlet temperature

c. Primary low flow

d. Picoammeter switch set at > 100 Kilowatts

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

QUESTION: 009 (2.00)

Match the reactivity worth listed in column B, with the operation in column A.

COLUMN A	COLUMN B
1. Adding one fuel element to core	a. - 8.0 Delta K/K
2. Flooding one beam port	b. - 3.4 Delta K/K
3. Removing on graphite element	c. - 0.2 Delta K/K
4. Replacing the center fuel element with water	d + 0.06 Delta K/K
	e. + 2.0 Delta K/K

QUESTION: 010 (1.00)

Which ONE of the following conditions does NOT send an input into the rod withdrawal interlock circuit?

a. Low Source count - 3 cps

b. High reactor flux - 110%

c. High Source count - 1 x 10**6

d. Short reactor period - 15 seconds

QUESTION: 011 (1.00)

Which ONE of the following ventillation system valves fails in the OPEN position?

a. Sanitary system vent isolation valve (G)

b. Emergency exhaust isolation valve (D)

c. Ventilation supply cross-over valve (F)

d. Acid Vent (Basement) exhaust isolation valve (H)

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

QUESTION: 012 (1.00)

Which ONE of the following alarm conditions does NOT also cause a scram to occur?

a. bridge movement

b. a safety blade disengaging from it's magnet

c. the containment air lock doors open

d. a Nuclear Instruments High Voltage Failure

QUESTION: 013 (2.00)

MATCH the electrical load in column A with the correct power supply in column B.

1.	underwater lights	a.	PPL-R1
2.	primary pump	b.	motor control center 1
3.	main exhaust fan	c.	motor control center 2
4.	bridge crane	d.	ELPL-R1
5.	airlock doors		
6.	area radiation monitors		
7.	makeup pump		
8.	secondary pump		

QUESTION: 014 (1.00)

There are two types of forced cooling modes available. Which ONE of the following is the preferred mode and the reason why?

a. Downcomer mode because it produces less core vibration than the cross-stall mode.

b. Cross-stall mode because it produces less core vibration than the downcomer mode.

c. Downcomer mode, because it provides a more efficient flow and cooling for the core.

d. Cross-stall mode, because it provides a more efficient flow and cooling for the core.

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

QUESTION: 015 (1.00)

Which ONE of the following is the radiation level expected above the pool under the reactor bridge, during 1 Mwatt power operation?

a. 5 mR/Hr

b. 10 mR/Hr

c. 50 mR/Hr

d. 100 mR/Hr

QUESTION: 016 (1.00)

As a result of a reactor scram, you lose primary flow. Which ONE of the following is the approximate time it will take for flow to coast down and reverse due to natural convective effects?

a. 25 seconds

b. 45 seconds

c. 65 seconds

d. 85 seconds

QUESTION: 017 (1.00)

If the compensating voltage to the Compensated Ion Chamber (CIC) is lost, while reactor power is low in the intermediate range, indicated power will be:

a. unchanged

b. higher than actual

c. lower than actual

d. zero

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

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

ANSWER: 001 (1.00)

D

REFERENCE:

Introduction to Nuclear Reactor Operations, Page 3-2

ANSWER: 002 (1.00)

C

REFERENCE:

Exam Question Bank No. 0033934 and FSAR Page 4-67

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

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

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)

c

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

REFERENCE:

FSAR Section 4.2.2.2 and Equation Sheet

BTU/min = 1500 gpm(8 lbm/gal)(1 BTU/lbm degF)(91.4 degF- 80 degF)

= 136,800 BTU/min

136,800 BTU/min (0.00001758 Mwatt/BTU/min) = 2.40 Mwatt

ANSWER: 010 (1.00)

B
Reactivity Change = (K2 - K1)/(K2*K1)
= (0.946 - 0.861)/(0.946 * 0.861)
= .0085/0.8145
= .1044 delta K/K

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
P = Poe**(-t/T)
ln(P/Po) = -t/T, Given that for a constant period T is constant
P/Po for the four different choices are respectively . . .
6, 2, 1.33 and 1.5. Therefore the longest time t goes with the
greatest ratio (a).

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

REFERENCE:

Introduction to Nuclear Reactor Operations, Page 4-4

ANSWER: 013 (1.00)

b

REFERENCE:

Introduction to Nuclear Reactor Operations, Page 2-63

ANSWER: 014 (1.00)

B

REFERENCE:

Introduction to Nuclear Reactor Operations, Page 8-3

ANSWER: 015 (1.00)

B

REFERENCE:

Introduction to Nuclear Reactor Operations, Page 5-18
ROI 1.2.17 Page 5

ANSWER: 016 (1.00)

C

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

REFERENCE:

Introduction to Nuclear Reactor Operations, Section 5.3
Rod Worth curves for Core Configuration C-7-3

Moving the control rod from 0 to 12 inches adds 4.5% delta k/k.

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

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

REFERENCE:

Introduction to Nuclear Reactor Operations, Page 8-10

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

ANSWER: 001 (1.00)

d

REFERENCE:

Technical Specifications, Section 1.0

ANSWER: 002 (1.00)

b

REFERENCE:

S.P. 10 appe' ' 6,

ANSWER: 003

d

REFERENCE:

AP-2 Section 2.4

ANSWER: 004 (1.00)

b

REFERENCE:

RO-1, "Critical Experiments" Section 1.2.13

ANSWER: 005 (1.00)

c

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

REFERENCE:

RO-5 "Routine Startup" Section 5.1.5(k)

ANSWER: 006 (1.00)

c

REFERENCE:

RO-11 Section 4.2.4

ANSWER: 007 (1.00)

d

REFERENCE:

EO-7 "Stuck Rod or Safety Blade" Section 1

ANSWER: 008 (1.00)

b

REFERENCE:

Standing Order #11, "Setpoints for Various Scrams and Alarms"

ANSWER: 009 (1.00)

c

REFERENCE:

Technical Specifciations 1.18

ANSWER: 010 (1.00)

c

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

REFERENCE:

10 CFR 20.101

ANSWER: 011 (1.00)

b.

REFERENCE:

10 CFR 50.53(e)

ANSWER: 012 (1.00)

C

REFERENCE:

Equation Sheet. Note no material was provided by facility for Radiological procedures.

ANSWER: 013 (1.00)

b

REFERENCE:

Check at facility. This is standard practice however, no reference material received from facility.

ANSWER: 014 (1.00)

b

REFERENCE:

Technical Specification 6.1.5

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

ANSWER: 015 (1.00)

c

REFERENCE:

10 CFR 50.90, 10 CFR 55.59(a), 10 CFR 50.47

ANSWER: 016 (1.00)

d

REFERENCE:

Technical Specifications Section 3.1.(9)

ANSWER: 017 (1.00)

b

REFERENCE:

ULR standing order #3, "Core Loading Identification"

ANSWER: 018 (1.00)

a

REFERENCE:

USAR Section 8.1.2.

ANSWER: 019 (1.00)

b

REFERENCE:

USAR, Section 7.3.3.

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

ANSWER: 020 (1.00)

c

REFERENCE:

ULR Technical Specifications 6.3.(10) pp.TS-46

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

ANSWER: 001 (1.00)

b

REFERENCE:

USAR, Section 4.1.7 pg. 4-10

ANSWER: 002 (1.00)

c

REFERENCE:

USAR, Section 4.1.7 pg. 10

ANSWER: 003 (2.00)

1.	a	6.	a
2.	a	7.	c
3.	d	8.	a
4.	c	9.	c
5.	a	10.	c

REFERENCE:

USAR, Table 4.4 Present Reactor Safety System Setpoints
Standing Order #11

ANSWER: 004 (1.00)

d

REFERENCE:

USAR, Section 4.4.12

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

ANSWER: 005 (1.00)

b.

REFERENCE:

RO-4, Section
Intro to Nuclear Operations, Chapt. 7.3

ANSWER: 006 (1.00)

b

REFERENCE:

USAR, Section 4
RO-6, "Operation at Power and Adjustments in power level"
Step 6.2

ANSWER: 007 (1.00)

b

REFERENCE:

USAR tables 4.2 & 4.3

ANSWER: 008 (1.00)

d

REFERENCE:

RO-9, Section 9.2.2.(d) Technical Specifications 3.3

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

ANSWER: 009 (2.00)

1. 5
2. 4
3. 3
4. 2

REFERENCE:

USAR Section 4.5.8

ANSWER: 010 (1.00)

c

REFERENCE:

USAR Section 4.4.9 and table 4.4.

ANSWER: 011 (1.00)

c

REFERENCE:

USAR, Section 3.4.2.2

ANSWER: 012 (1.00)

b

REFERENCE:

Technical Specifications, pp. IV-18 and IV-19.
USAR, 4-75

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

ANSWER: 013 (2.00)

1. a
2. b
3. c

REFERENCE:

SAR, p 5-5

ANSWER: 014 (1.00)

b

REFERENCE:

USAR, Section 4.4.4

ANSWER: 015 (1.00)

b

REFERENCE:

USAR, Section 8,1,1-2, page 8.1

ANSWER: 016 ~~(1)~~.00)

d

REFERENCE:

USAR, Section 9.1.3, page 9.20

ANSWER: 017 (1.00)

b

REFERENCE:

USAR 4.4.13 discusses the intermediate channel, however it does NOT go into specifics on the operation of a CIC tube. This however is knowledge a Reactor Operator should have.

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)
(********** END OF EXAMINATION **********)

ANSWER KEY

MULTIPLE CHOICE

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

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

ANSWER KEY

MULTIPLE CHOICE

001 d

002 b

003 d

004 b

005 c

006 c

007 d

008 b

009 c

010 c

011 b

012 C

013 b

014 b

015 c

016 d

017 b

018 a

019 b

020 c

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

ANSWER KEY

MULTIPLE CHOICE

001 b

002 c

003 MATCHING

1	a	6	a
2	a	7	c
3	d	8	a
4	c	9	c
5	a	10	c

004 d

005 b

006 b

007 b

008 d

009 MATCHING

1	5
2	4
3	3
4	2

MULTIPLE CHOICE

010 c

011 c

012 b

013 MATCHING

1	a
2	b
3	c
4	c
5	d
6	d
7	b
8	c

014 b

015 b

016 d

017 b

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

S R O E x a m

Organized by Question Number

QUESTION	VALUE	REFERENCE
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005	1.00	9000042
006	1.00	9000043
007	1.00	9000044
008	1.00	9000045
009	1.00	9000046
010	1.00	9000047
011	1.00	9000048
012	1.00	9000049
013	1.00	9000050
014	1.00	9000051
015	1.00	9000052
016	1.00	9000053
017	1.00	9000054
018	1.00	9000055
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020	1.00	9000057
	20.00	

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003	1.00	9000003
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005	1.00	9000005
006	1.00	9000006
007	1.00	9000007
008	1.00	9000008
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010	1.00	9000010
011	1.00	9000011
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017	1.00	9000017
018	1.00	9000018
019	1.00	9000019
020	1.00	9000020
	20.00	

SRO Exam

Organized by Question Number

QUESTION	VALUE	REFERENCE
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007	1.00	9000027
008	1.00	9000028
009	2.00	9000029
010	1.00	9000030
011	1.00	9000031
012	1.00	9000032
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017	1.00	9000037
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