October 26, 2007

Dr. Gunter Kegel, Director
Nuclear Radiation Laboratory
University of Massachusetts – Lowell
One University Avenue
Lowell, MA 01854

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-223/OL-07-01, UNIVERSITY
             OF MASSACHUSETTS – LOWELL

Dear Dr. Kegel:

During the week of September 24, 2007, the NRC administered an operator licensing
examination at your University of Massachusetts – Lowell Reactor. The examination
was conducted according to NUREG-1478, "Non-Power Reactor Operator Licensing
Examiner Standards," Revision 2. Examination questions and preliminary findings were
discussed with those members of your staff identified in the enclosed report at the
conclusion of the examination.

In accordance with 10 CFR 2.390 of the Commission's regulations, a copy of this letter
and the enclosures will be available electronically for public inspection in the NRC Public
Document Room or from the Publicly Available Records (PARS) component of NRC's
Agencywide Documents Access and Management System (ADAMS). ADAMS is
accessible from the NRC Web site at (the Public Electronic Reading Room)
http://www.nrc.gov/reading-rm/adams.html. The NRC is forwarding the individual grades
to you in a separate letter which will not be released publicly. Should you have any
questions concerning this examination, please contact Mr. Phillip T. Young at
301-415-4094 or via internet e-mail pty@nrc.gov.

                                        Sincerely,

                                        /RA/

                                        Johnny Eads, Chief
                                        Research and Test Reactors Branch B
                                        Division of Policy and Rulemaking
                                        Office of Nuclear Reactor Regulation

Docket No. 50-223

Enclosures: 1. Initial Examination Report No. 50-223/OL-07-01
              2. Examination with Facility Comments Incorporated

cc: Please see next page

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cc w/encls: Please see next page

University of Massachusetts - Lowell   Docket No. 50-223

cc:

Mayor of Lowell
City Hall
Lowell, MA 01852

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Reactor Supervisor
University of Massachusetts - Lowell
One University Avenue
Lowell, MA 01854

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One Winter Street
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Director
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Massachusetts Emergency Management Agency
40 Worcester Road
Framingham, MA 01702-5399

Test, Research, and Training
  Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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

REPORT NO.:   50-223/OL-07-01

FACILITY DOCKET NO.: 50-223

FACILITY LICENSE NO.: R-125

FACILITY: University of Massachusetts – Lowell

EXAMINATION DATES: September 24, 2007

SUBMITTED BY: _____/RA/_____   10/23/2007
                    Phillip T. Young, Chief Examiner   Date

SUMMARY:

During the week of September 24, 2007, the NRC administered operator licensing
examinations to one Reactor Operator candidate. The RO passed the examination.

REPORT DETAILS

1. Examiners:
      Phillip T. Young, Chief Examiner

2. Results:

	RO PASS/FAIL	**SRO PASS/FAIL**	**TOTAL PASS/FAIL**
Written	1/0	0/0	1/0
Operating Tests	1/0	0/0	1/0
Overall	1/0	0/0	1/0

3. Exit Meeting:
      Phillip T. Young, NRC, Examiner
      Leo Bobek, Reactor Manager, University of Massachusetts-Lowell Reactor

The examiner thanked Mr. Bobek for his support of the examination. The examiner did
not note any generic weaknesses on the part of the license candidates.

University of Massachusetts- Lowell

WRITTEN EXAM W/Answer Key

UNITED STATES NUCLEAR REGULATORY COMMISSION

OPERATOR LICENSING EXAMINATION
September 27, 2007

Question   A.001   [1.0 point]   (1.0)

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 source neutrons.

b. The half-life to 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.

Answer   A.001 b.
Reference   Burn, R., Introduction to Nuclear Reactor Operations, © 1988, §

Question   A.002   [1.0 point]   (2.0)

WHICH ONE of the following is the MAJOR source of energy released during fission?

a. Kinetic energy of the fission neutrons.

b. Kinetic energy of the fission fragments.

c. Decay of the fission fragments.

d. Prompt gamma rays.

Answer   A.002 b.
Reference   Burn, R., Introduction to Nuclear Reactor Operations, © 1988, §

Question   A.003   [1.0 point]   (3.0)

K_{eff} is K_∞ times …

a. the total non-leakage probability ($_f \times$ $_{th}$)

b. the resonance escape probability (p)

c. the reproduction factor (η)

d. the fast fission factor (ε)

Answer   A.003 a.
Reference   Burn, R., Introduction to Nuclear Reactor Operations, © 1988, §

Question   A.004   [1.0 point]   (4.0)
With the reactor critical at 10 KW a blade is pulled to insert a positive reactivity of 0.00126 ΔK/K. Which one of the following will be the stable reactor period as a result of this reactivity insertion?

   a. 10 seconds

   b. 50 seconds

   c. 60 seconds

   d. 70 seconds

Answer   A.004 b.
Reference: $\tau = (\beta-\rho)/\lambda_{eff}\rho$ = $\underline{.0075 - .00126}$ = 49.5 seconds
                                          (.1) (.00126)

Question   A.005   [1.0 point]   (5.0)
An initial count rate of 100 is doubled five times during a startup. Assuming an initial Keff of 0.950, which one of the following is the new Keff?

   a. 0.957

   b. 0.979

   c. 0.985

   d. 0.998

Answer: A.005 d.
Reference: CR1 (1-Keff1) = CR2 (1 - Keff2) or M1 (1-Keff1) = M2 (1 - Keff2)
          CR2/CR1 = 32   →   CR1 (1-Keff1)/CR2 = 1 - Keff2)
       →   100 (1-0.950)/3200 = 1 - Keff2   Keff2 = 1 - .0015625 = .998

Question A.006   [1.0 point]   (6.0)
Consider two identical critical reactors, with the exception that one has a beta of 0.0072 and the other has a beta of 0.0060. Each reactor is operating a 10 watts.   Which one of the following compares the response of the reactors to a +0.1% delta k/k reactivity insertion?

   a. The resulting period will be shorter for the reactor with the 0.0072 beta fraction

   b. The resulting period will be shorter for the reactor with the 0.0060 beta fraction

   c. The resulting power level will be higher for the reactor with the 0.0072 beta

fraction

   d. The resulting power level will be higher for the reactor with the 0.0060 beta
fraction

Answer: A.006 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, §§ 3.2.2
                    — 3.2.3

Question   A.007   [1.0 point]   (7.0)
Which ONE of the following conditions would INCREASE the shutdown margin of a reactor?

a. Lowering moderator temperature if the moderator temperature coefficient is negative.

b. Inserting an experiment adding positive reactivity.

c. Depletion of a burnable poison.

d. Depletion of uranium fuel.

Answer: A.007 d.
Reference: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 6.2.3, p. 6-4.

Question   A.008   [1.0 point]   (8.0)
Which one of the following is the PRIMARY reason that delayed neutrons are so effective at controlling reactor power?

a. Delayed neutrons make up a very large fraction of the fission neutrons in the core.

b. Delayed neutrons have a much longer mean lifetime than prompt neutrons.

c. Delayed neutrons are born at lower energies than prompt neutrons.

d. Delayed neutrons are born at thermal energies.

Answer: A.008 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, §§ 3.2.2 — 3.2.3

Question   A.009   [1.0 point]   (9.0)
Which one of the following is the principal source of heat in the reactor after a shutdown from extended operation at 1 MW?

a. Gamma interactions

b. Spontaneous fission of U-238

c. Production of delayed neutrons

d. Kinetic energy of fission fragments

Answer: A.009 d.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 4.9, pp. 4-23 — 4-26.

Question   A.010   [1.0 point]   (10.0)

Which one of the following is a correct statement concerning the factors affecting control rod worth?

 a. As Rx power increases rod worth increases.

 b. Fuel burn up causes the rod worth for periphery rods to decrease.

 c. Fuel burn up causes the rod worth to increase in the center of the core.

 d. The withdrawal of a rod causes the rod worth of the remaining inserted rods to increase.

Answer: A.010 d.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 7.2 &
7.3,   pp. 7-1 — 7-10.

Question   A.011   [1.0 point]   (11.0)

Pool temperature increases by $20°F$. Given αT moderator = -0.0005 $\Delta K/K/°F$ and an average regulating rod worth of 0.004 $\Delta K/K/inch$. By how much and in what direction did the regulating rod move to compensate for the temperature change?

 a. 0.25 inches in

 b. 0.25 inches out

 c. 2.5 inches in

 d. 2.5 inches out

Answer: A.011 d.
Reference: $+20°F \times$ -0.0005 $\Delta K/K/°F$ = - 0.01 $\Delta K/K$. To compensate the rod must
add   +0.01 $\Delta K/K$. +0.01$\Delta K/K \div$ +0.004 $\Delta K/K/inch$ = +2.5 inches

Question   A.012   [1.0 point]   (12.0)

A thin foil target of 10% copper atoms and 90% atoms aluminum is in a thermal neutron beam. Given σs Al = 3.79 barns, σs Cu = 0.23 barns, σa Al = 7.90 barns and σa Cu = 1.49 barns, which ONE of the following reactions has the highest probability of occurring? A neutron …

 a. scattering reaction with aluminum.

 b.   scattering reaction with copper.

 c.   absorption in aluminum.

 d.   absorption in copper.

Answer: A.012 c.
Reference: Glasstone, S. and Sesonske, A, Nuclear Reactor Engineering,
Kreiger   Publishing, Malabar,   Florida, 1991, § 2.108 – 2.114,
pp. 77 – 80.

Question   A.013   [1.0 point]   (13.0)
Which one of the following factors in the "six factor" formula is the most strongly affected by the Negative Temperature Coefficient ?

   a. The fast fission factor

   b. The thermal utilization factor

   c. The resonance escape probability

   d. The thermal non-leakage probability

Answer: A.013 b.
Reference: Glasstone, S. and Sesonske, A, Nuclear Reactor Engineering, 1991, § 5.98,   p. 264.

Question   A.014   [1.0 point]   (14.0)
Which ONE of the following describes the **MAJOR** processes contributing to the **PRODUCTION** and **DEPLETION** of Xenon respectively in a **STEADY-STATE OPERATING** reactor?

	Production	Depletion
a.	Radioactive decay of Iodine	Radioactive Decay
b.	Radioactive decay of Iodine	Neutron Absorption
c.	Directly from fission	Radioactive Decay
d.	Directly from fission	Neutron Absorption

Answer   A.014 b.
Reference   Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 8.1

Question   A.015   [1.0 point]   (15.0)
Which factor of the Six Factor formula is most easily varied by the reactor operator?

   a. Fast Fission Factor (ε)

   b. Reproduction Factor (η)

   c. Thermal Utilization Factor (f)

   d. Fast Non-Leakage Factor ($_f$)

Answer   A.015 c.
Reference   Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 6.4

Question   A.016   [1.0 point]   (16.0)
You perform two startups with exactly the same core characteristics. During the first startup you proceed straight to criticality. During the second startup you receive a phone call after starting to pull rods, but before reaching criticality. How will this increase in time before reaching criticality affect reactor critical conditions? For the second startup …

   a. rod height will be the same, reactor power will be the same.

   b. rod height will be the same, reactor power will be higher.

   c. rod height will be higher, reactor power will be higher.

   d. rod height will be lower, reactor power will be lower.

Answer   A.016 b.
Reference   Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 5.3

Question   A.017   [1.0 point]   (17.0)
The term "prompt jump" refers to:

   a. the instantaneous change in power due to raising a control rod.

   b. a reactor which has attained criticality on prompt neutrons alone.

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

   d. a negative reactivity insertion which is less than β_{eff}.

Answer   A.017 a.
Reference   Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 4.7

Question   A.018   [1.0 point]   (18.0)
An experimenter makes an error loading a rabbit sample. Injection of the sample results in a 100 millisecond period. If the scram which causes the reactor to shutdown is set at 1.25 MW and the scram delay time is 0.1 seconds, **WHICH ONE** of the following is the peak power of the reactor at shutdown.

   a. 1.25 MW

   b. 2.5 MW

   c. 3.4 MW

   d. 12.5 MW

Answer   A.018 c.
Reference $P = P_0\, e^{t/\tau}$, $P = 1.25 \text{ Mwatt} \times e^{0.1/0.1} = 1.25 \times e = 3.3979$

Question   A.019   [1.0 point]   (19.0)
All four control rods are worth 11.4% ΔK/K. Core excess is 4.2% ΔK/K. Regulating rod worth is 0.6% ΔK/K. If the regulating rod is stuck in the fully out position, calculate the actual (NOT TECHNICAL SPECIFICATION) Shutdown Margin. (Ignore temperature and poisons.)

    a. 2.5% ΔK/K

    b. 3.3% ΔK/K

    c. 6.6% ΔK/K

    d. 7.8% ΔK/K

Answer   A.019 c.
Reference   (11.4% - 4.2% - 0.6%)ΔK/K = 6.6% ΔK/K)

Question   A.020   [1.0 point]   (20.0)
Regarding the Am-Be neutron source: The decay of Americium produces _____ which are absorbed by the Beryllium producing the reaction _____

    a. Alphas; $_4Be^9$ (α,n) $_6C^{12}$

    b. Betas; $_4Be^9$ (β,n) $3Li^8$

    c. Gammas; $_4Be^9$ (γ,n) $2(_2He^4)$

    d. Neutrons (from Spontaneous fission); $_4Be^9$ (n,2n) $_4Be^8$

Answer   A.020 a.
Reference   Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 5.2,
also   Chart of the Nuclides.

Question   B.001   [1.00 point]   (1.0)
Following an irradiation of a specimen, the resulting radioisotope is expected to equal 12 curies. The radioisotope will decay by the emission of two gamma rays per disintegration with energies of 1.14 Mev and 1.36 Mev. Which one of the following is the radiation exposure rate (R/hr) at one 6 feet from the specimen with no shielding?

    a. 180 R/hr

    b.   30 R/hr

    c.   5 R/hr

    d.   2.72 R/hr

Answer: B.001 c.
Reference: $R = \dfrac{6\ C\ E\ n}{6^2} = \dfrac{6\ (12\ ci)\ (1.36 + 1.14\ Mev)}{36} = 5\ R/hr.$

Question   B.002   [1.00 point]   (2.0)
A small radioactive source is to be stored in the reactor bay with no shielding. The source reads 2 R/hr at 1 foot. A "Radiation Area" barrier would have to be erected approximately ___ from the source.

    a. 400 feet

    b.   40 feet

    c.   20 feet

    d.   10 feet

Answer: B.002 c.
Reference: Standard NRC Question

Question   B.003   [1.00 point]   (3.0)
A room contains a source which, when exposed, results in a general area dose rate of 175 millirem per hour. This source is scheduled to be exposed continuously for 35 days. Select an acceptable method for controlling radiation exposure from the source within this room.

    a. Lock the room to prevent inadvertent entry into the room.

    b. Post the area with the words "Danger-Radiation Area".

    c. Equip the room with a motion detector that will alarm in the control room.

    d. Equip the room with a device to visually display the current dose rate within the room.

Answer: B.003 a.
Reference: 10CFR20.1601(a)(3)

Question B.004 [1.00 point] (4.0)

Which one of the following statements describes the basis for the Safety Limit in the forced convection mode of operation?

a. The onset of nucleate boiling at the hot spot in the hot channel.

b. To prevent undesirable radiation levels on the surface of the pool.

c. The combination of reactor power and coolant flow rate will prevent the LSSS from being exceeded.

d. Excessive gas pressure between the fuel-moderator and cladding may result in loss of fuel element cladding integrity.

Answer: B.004 a.
Reference: Technical Specifications 2.1

Question B.005 [1.00 point] (5.0)

At 8:00 am, prior to the start of reactor operation, a checkout procedure is performed in accordance with RO-9. The reactor is started up, operated, and then shutdown at 1:00 PM. Which one of the following describes the checkout requirement for a subsequent startup at 4:00 PM ?

a. a new checkout procedure must be performed.

b. the checkout procedure does not need to be performed.

c. only the manual scram channel test must be performed.

d. only the power range monitor checks and tests, and fuel temperature 1 and 2 channel checks and tests must be performed.

Answer: B.005 c.
Reference: RO-6; Step 1.1.2

Question B.006 [1.00 point] (6.0)

An Emergency Action Level is:

a. a condition which calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.

b. a class of accidents for which predetermined emergency measures should be taken or considered.

c. a procedure that details the implementation actions and methods required to achieve the objectives of the Emergency Plan.

d. a specific instrument reading or observation which may be used as a threshold for initiating appropriate emergency measures.

Answer: B.006 d.
Reference: E-Plan Definitions

Section B Normal/Emergency Procedures and Radiological Controls

Question   B.007   [2.0 points, 0.5 each]   (8.0)
Match the type of radiation in column A with its associated Quality Factor (10CFR20) from column B.

Column A   Column B

a. alpha   1

b. beta   2

c. gamma   5

d. neutron (unknown energy)   10

                                         20

Answer: B.007 a. = 20;   b. = 1;   c. = 1;   d. = 10
Reference: 10CFR20.100x

Question   B.008   [1.0 point]   (9.0)
Which ONE of the following is the 10 CFR 20 definition of TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)?

a. The sum of the deep does equivalent and the committed effective dose
equivalent.

b. The dose to a specific organ or tissue resulting from an intake of radioactive
material.

c. The dose that your whole body receives from sources outside the body.

d. The sum of the external deep dose and the organ dose.

Answer: B.008 a
Reference: 10 CFR 20.1003 Definitions

Question   B.009   [1.0 point]   (10.0)
Two inches of shielding reduce the gamma exposure in a beam of radiation from 400 mR/hr to 200 mR/hr. If you add an additional four inches of shielding what will be the new radiation level? (Assume all readings are the same distance from the source.)

a. 25 mR/hr

b. 50 mR/hr

c. 75 mR/hr

d. 100 mR/hr

Answer: B.009 b.
Reference: Basic Radiological Controls knowledge: "Half-Thickness and Tenth-
                          Thickness".

Question B.010 [1.0 point] (11.0)
Match the 10CFR55 requirements for maintaining an active operator license in column A with the corresponding time period from column B.

Column A	Column B
a. Renew License	1 year
b. Medical Exam	2 years
c. Pass Requalification Written Examination	4 years
d. Pass Requalification Operating Test	6 years

Answer: B.010 a. = 6; b. = 2; c. = 2; d. = 1
Reference: 10CFR55.

Question B.011 [2.0 points, 0.5 each] (13.0)
Identify each of the following actions as either a channel **CHECK**, a channel **TEST**, or a channel **CAL**ibration.

a. Prior to startup you place a known radioactive source near a radiation detector, noting meter movement and alarm function operation.

b. During startup you compare all of your nuclear instrumentation channels ensuring they track together.

c. At power, you perform a heat balance (calorimetric) and determine you must adjust Nuclear Instrumentation readings.

d. During a reactor shutdown you note a -80 second period on Nuclear Instrumentation.

Answer: B.011 a. = Test; b. = Check; c. = Cal; d. = Check
Reference: Technical Specification 1.2.3-5.

Question B.012 [2.0 points, 0.5 each] (15.0)
Identify each of the following as either a Safety Limit (**SL**) a Limiting Safety System Setting (**LSSS**) or a Limiting Condition for Operation (**LCO**).

a. The minimum coolant flow rate shall be 1170 GPM (Forced Convection Mode).

b. Maximum excess reactivity shall be 4.7% Δk/k.

c. The True value of pool water level shall not be less than 24.25 feet above the centerline of the core. (Forced Convection Mode).

d. During steady-state operation a minimum of two Reactor Power Level (Linear N) Channels shall be operable.

Answer: B.012 a. = LSSS; b. = LCO; c. = SL; d. = LCO
Reference: Technical Specifications §§ 2.1, 2.2.3, 3.1.1 and 3.2.4 (table).

QUESTION B.013 [1.0 point] (15.0)
While working in a radiation area, you note that your pocket dosimeter reads off-scale and immediately leave the area. You had been working for 2 hours at 8 feet from a source reading 2400 mr/hr at a foot. Which one of the following is the estimated dose you received?

a. 600 mr

b. 300 mr

c. 75 mr

d. 37½ mr

Answer: B.013 c.
Reference: $D_1 d_1^2 = D_2 d_2^2$ (D is Dose rate, d is distance) $D_1 (8^2) = 2400 (1^2)$
$D_1 = 2400/64 = 37½$ mr/hr   DOSE = Dose Rate x time
37½ mr/hr x 2 hr = 75 mr

Question B.014 [1.0 point] (16.0)
During an emergency responsibility for authorizing re-entry into the reactor building or portions thereof belongs to the …

a. Console Operator

b. Senior Reactor Operator

c. Emergency Director

d. Radiation Safety Officer

Answer: B.014 c.
Reference: Emergency Plan § 3.4

Question B.015 [1.0 point] (17.0)
Following work in a drained pool, whose permission (minimum) is required to use the primary system for refill?

a. None, this is the normal method for refill.

b. The Chief Reactor Operator.

c. The Reactor Supervisor.

d. The Reactor Director.

Answer: B.015 c.
Reference: Special Procedure 18, Draining the Pool, § 4.8 Refilling the pool.

Question   B.016   [1.0 point]   (18.0)
During a normal reactor startup, the neutron source is normally removed at …

   a. 500 milliwatts

   b.   5 watts

   c.   50 watts

   d. 500 watts

Answer: B.016 d.
Reference: RO-5 *Routine Startup*, § 5.1.5.i, page RO5-3.

Question   B.017   [1.0 point]   (19.0)
During a reactor start-up the console operator is withdrawing a control blade and notices that the position indicator for the control blade is not changing. Select the operator action for these conditions.

   a. Attempt to insert the control blade whose position indicator was not changing during blade withdrawal.

   b. Continue the reactor start-up. Level power at 1 watt and investigate the cause.

   c. Verify that source range counts are not changing.

   d. Run the other unstuck blades and the Regulating Rod fully in.

Answer: B.017 d.
Reference: EO-7, "Stuck Rod or Safety Blade," step 1

Question   B.018   [1.0 point]   (20.0)
When removing a sample from the pneumatic tube receiver, Health Physics coverage is required if the sample reads greater than …

a. 0.001 Rem/hr.

b.   0.01 Rem/hr.

c.   0.1 Rem/hr.

d.   1 Rem/hr.

Answer: B.018 d.
Reference: U. Mass.-Lowell, RO-4 § 4.1.7, p. 4-2.

Section C Facility and Radiation Monitoring Systems

Question C.001 [1.0 point] (1.0)
Which one of the following valves does NOT receive a signal in response to a ventilation freeze alarm?

a. "B" Fan EF-12 Exhaust Isolation

b. "D" Fan EF-14 Exhaust Isolation

c. "F" Fan AC-2 Exhaust Isolation

d. "H" Acid Vent Isolation

Answer: C.001 b.
Reference: UFSAR, §3.4.2.3 pp. 3-24, 3-25

Question C.002 [1.0 point] (2.0)
With the MASTER SWITCH in the TEST position, and the BLADE 1 OUT light ENERGIZED, what it the position of BLADE 1 control rod?

a. The rod is fully out, the lead screw is fully inserted.

b. The rod is fully inserted ,the lead screw is fully out.

c. Both the rod and the lead screw are fully out.

d. Both the rod and the lead screw are fully inserted.

Answer: C.002 b.
Reference: UFSAR, § 4,4,3, Table 4.3 p. 4-49

Question C.003 [1.0 point] (3.0)
Which one of the following radiation detectors does NOT supply a signal for initiation of either GREA or LREA?

a. Stack Particulate "A"

b. CAM 2 "C"

c. FPM "E"

d. Rabbit Filters "G"

Answer: C.003 d.
Reference: UMLR Study Guide Section covering Radiation Monitors.

Section C Facility and Radiation Monitoring Systems

Question   C.004   [1.0 point]   (4.0)
The console operator is maintaining reactor power at 100 kilowatts with reactor control in automatic at the 50% withdrawn position. The operator notes an unexplained power excursion and scrams the reactor. All four of the control blades fully insert into the core. Which one of the following describes the position of the regulating rod?

    a. fully inserted.

    b. 50% withdrawn in AUTO control.

    c. 50% withdrawn in MANUAL control

    d. 100% withdrawn in AUTO control.

Answer: C.004 c.
Reference: UFSAR §§ 4.6 and 4.7.

Question   C.005   [1.0 point]   (5.0)
Which ONE of the following conditions will result in a control blade withdrawal inhibit?

    a. Positive 20 second Log N period.

    b. Movement of the startup detector.

    c. Startup detector indication of 5 CPS.

    d. Picoammeter range switch in the most sensitive position.

Answer: C.005 b.
Reference: ULR RO-9, Rev 8, p RO-9-6, Standing Order #11, p 2.

Question   C.006   [1.0 point]   (6.0)
You are operating the reactor at 1 Megawatt. Personnel are performing maintenance on the airlock doors and the truck door when a reactor scram occurs. Select the cause for the reactor scram.

    a. The outer airlock door was opened and the inner airlock door was shut.

    b. The outer airlock door was shut and the inner airlock door was open.

    c. The outer airlock door has lost its pneumatic seal.

    d. The truck door has lost its pneumatic seal.

Answer: C.006 d.
Reference: SAR, Section 3.1.2.1, last paragraph.

Question   C.007   [1.0 point]   (7.0)

You are operating the reactor power at 1 Megawatt. A severe storm warning has been announced by the National Weather Service. A loss of electrical power has occurred (the emergency generator has NOT started). Select the condition of the ventilation system.

a. The ventilation fans have stopped and the ventilation valves, except valve F, have closed.

b. The ventilation fans continue to run and the ventilation valves, except valve F, have closed.

c. The ventilation fans have stopped and valve F has closed, the other ventilation valves remain open.

d. The ventilation fans continue to run and valve F has closed, the other ventilation valves remain open.

Answer: C.007 a.
Reference: SAR, Section 3.4.2.1, "System Closure," and 3.4.2.2, "Response to Initiation of System Closure."

Question   C.008   [1.0 point]   (8.0)

The reactor is operating at 100 kilowatts steady state power, when one of the beam tubes develops a small leak. Select the indication which alerts the console operator to the beam tube leak.

a. The stack monitor

b. Bubbling in the pool

c. The water line in the beam tube

d. The conduit lines connected to the beam tube

Answer: C.008 a.
Reference: SAR, Paragraph 4.3.2, "Beam Ports."

Question   C.009   [1.0 point]   (9.0)

The "Rabbit" is inserted and withdrawn from the core using:

a. two exhausters.

b. a length of cable wire.

c. a blower and exhauster.

d. an exhauster and a wind gate cabinet.

Answer: C.009 d.
Reference: SAR, Paragraph 4.3.3.2 & 4.3.3.3, "Pneumatic Tube System." ¶

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Question   C.010   [1.0 point]   (10.0)
Given the following conditions:

- There is NO blade position indication.

- NO annunciators are in alarm.

- The picoammeters are in the tripped state.

- The scram magnets are de-energized.

Select the cause for the above conditions. A loss of the:

    a. high voltage dc power supplies

    b. unregulated control power supply

    c. regulated instrumentation power supply

    d. emergency generator

Answer: C.010 b.
Reference: SAR, Paragraphs 4.4.5, 4.4.6, and 4.4.7, (Power Supplies)

Question   C.011   [1.0 point]   (11.0)
Given the following conditions:

- Reactor power is 250 Kilowatts and increasing.

- Core inlet temperature is 104°F.

- Coolant flow is 1400 gpm.

- Reactor period is 15 seconds.

The Reactor scrams. Select the cause for the reactor scram.

a. High reactor flux

b. High core inlet temperature

c. Low coolant flow

d. Short period

Answer: C.011 b.
Reference: Standing Order #11 and SAR Table 4.4

Question   C.012   [1.0 point]   (12.0)

During reactor operation, the console operator has noticed the pool temperature channel failed low (on the low end scale peg). Select the cause for this reading.

    a. The thermocouple has shorted.

    b. The thermocouple has opened.

    c. The RTD has shorted.

    d. The RTD has opened.

Answer: C.012 c.
Reference: SAR, Paragraph 4.4.17.5

Question   C.013   [1.0 point]   (13.0)

Given the following conditions:

- An experiment requires the core flux to be as flat as possible both radially and axially.
- Core life is at MOL (Middle of Life)
- The experiment requires all fuel elements to be in the core.

Select the method for obtaining the required core flux.

a. Run with ALL control blades fully withdrawn.

b. Remove the graphite reflector elements.

c. Place the start-up source in the core during operation.

d. Invert or rotate the fuel elements to achieve the desired flux.

Answer: C.013 d.
Reference: SAR, Paragraph 4.1.1 & 4.1.2 and reactor theory.

Question C.014 [1.0 point] (14.0)
Given the following conditions:

- Reactor power is 250 Kilowatts.

- Stack ventilation radiation monitor (gaseous/particulate) has indicated increasing counts over the past hour.

- A small leak has developed in the pneumatic tube.

Select a method to determine the LOCATION of the problem.

    a. Operate the ventilation system in the manual mode.

    b. Place a portable monitor in the area of the ventilation monitor.

    c. Use a portable air monitor taking suction from the stack.

    d. Shutdown the reactor and take a pool area air sample.

Answer: C.014 a.
Reference: SAR, ¶ 3.3.2, Facilities Exhaust, & 3.4.1, Normal Operation.

Question C.015 [1.0 point] (15.0)
Which of the following describes how the cleanup system functions to minimize corrosion of the reactor components? The cleanup system:

    a. maintains the coolant pH at a basic value.

    b. maintains the coolant pH at a acidic value.

    c. maintains primary coolant at a low conductivity.

    d. filters suspended particles from the coolant.

Answer: C.015 c.
Reference: Technical Specifications, 3.8, Coolant System, and SAR, ¶ 4.2.5, Cleanup System.

Question C.016 [1.0 point] (160)
Reactor power is 300 Kilowatts when the console operator selects "Rundown" on the console. Reactor power will:

    a. decrease because the regulating blade is inserted into the core.

    b. decrease because all four control blades are inserted into the core.

    c. decrease because the regulating blade is inserted to the 50% withdrawn position.

    d. decrease because all four control blades are inserted to the 50% withdrawn position.

Answer: C.016 b.
Reference: SAR, Table 4.2

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Question C.017 [1.0 point] (17.0)

Which ONE of the following contaminants is the Demineralizer most efficient at removing from pool water?

   a. oil

   b. Ar^{41}

   c. I^{135}

   d. mosquito larvae

Answer: C.017 c.
Reference: SAR § 4.2.5

Question C.018 [1.0 point] (18.0)

Which ONE of the following is the actual design feature which prevents siphoning of pool water on a failure of the primary/purification system?

   a. The suction and return line each contain a siphon break valve and stand-pipe.

   b. All primary system pipes end three feet below the water surface.

   c. ½ inch holes are located in each water pipe about a foot below the water surface.

   d. The suction and return line each contain a valve which will inject service air into the loop.

Answer: C.018 a.
Reference: SAR § 4.2.2 Primary Coolant System, 5th ¶.

Question C.019 [1.0 point] (19.0)

Which ONE of the following methods is used to determine if there is a leak in the heat exchanger?

   a. Routine checks of the secondary coolant for Na^{24}.

   b. Pool level will decrease due to leakage into the secondary.

   c. Decrease in secondary makeup, due to water from primary.

   d. Routine checks of the secondary coolant for O^{19}.

Answer: C.019 a.
Reference: Study Guide for Key Access and Introduction to Operator Training "Secondary Cooling System" ¶ 8.

Question C.020 [1.0 point] (20.0)
Which ONE of the following safety system protective functions (Scrams) is NOT bypassed when the Power Level Selector Switch is in the 0.1 Mwatt position?

a. High temperature Primary Coolant leaving core

b. Primary coolant low flow rate

c. Bridge Low Power Position

d. Low Pool Water Level

Answer: C.020 d.
Reference: U. Mass — Lowell Technical Specifications § 3.3. R.0.9 "Reactor and Control System Checkout Procedures", 9.2.2.(d).