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

REPORT NO.:	50-020/OL-99-01
FACILITY DOCKET NO.:	50-020
FACILITY LICENSE NO.:	R-37
FACILITY:	Massachusetts Institute of Technology
EXAMINATION DATES:	September 30 - October 1, 1999
EXAMINER:	Patrick Isaac, Chief Examiner
SUBMITTED BY:	Patrick Isaac, Chief Examiner — 10/28/99 Date

SUMMARY:

During the week of September 27, 1999, the NRC administered Operator Licensing Examinations to one Senior Reactor Operator Upgrade (SROU), and three Reactor Operator (RO) candidates. All the candidates passed the examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiners:

   Patrick Isaac, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**3/0**	**N/A**	**4/0**
Operating Tests	**3/0**	**1/0**	**4/0**
Overall	**3/0**	**1/0**	**4/0**

3. Exit Meeting:

   Personnel attending:

   John A. Bernard, Director of Reactor Operations, NRL
   Edward S. Lau, Asst. Superintendent for Reactor Operations, NRL
   Frank Warmsley, Operations and Training Coordinator, NRL
   Patrick Isaac, NRC, Chief Examiner

   There were no generic concerns raised by the Chief Examiner.

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

FACILITY: MIT

REACTOR TYPE: MITR-II

DATE ADMINISTERED: 1999/09/07

REGION: I

CANDIDATE: ______________________

INSTRUCTIONS TO CANDIDATE:
Answers are to be written on the answer sheet provided. Attach all answer sheets to the examination. Point values are indicated in parentheses for each question. A 70% in each category is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
20.00	33.3	________	____	A.	REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	33.3	________	____	B.	NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.3	________	____	C.	FACILITY 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

ENCLOSURE 2

A. RX THEORY, THERMO & FAC OP CHARS

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 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

020 a b c d ___

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

ANSWER SHEET

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

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 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 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 neither received nor 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 and each answer sheet.

6. Mark your answers on the answer sheet provided. USE ONLY THE PAPER PROVIDED AND DO NOT WRITE ON THE BACK SIDE OF THE PAGE.

7. The point value for each question is indicated in [brackets] after the question.

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. Ensure all information you wish to have evaluated as part of your answer is on your answer sheet. Scrap paper will be disposed of immediately following the examination.

11. To pass the examination you must achieve a grade of 70 percent or greater in each category.

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

13. When you have completed and turned in you examination, leave the examination area. If you are observed in this area while the examination is still in progress, your license may be denied or revoked.

EQUATION SHEET

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

$$P_{max} = \frac{(\rho-\beta)^2}{2\alpha(k)\ell}$$

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

$$SCR = \frac{S}{-\rho} \approx \frac{S}{1-K_{eff}}$$

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

$$CR_1(1-K_{eff_1}) = CR_2(1-K_{eff_2})$$
$$CR_1(-\rho_1) = CR_2(-\rho_2)$$

$$SUR = 26.06\left[\frac{\lambda_{eff}\rho}{\beta-\rho}\right]$$

$$M = \frac{1-K_{eff_0}}{1-K_{eff_1}}$$

$$M = \frac{1}{1-K_{eff}} = \frac{CR_1}{CR_2}$$

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

$$SDM = \frac{(1-K_{eff})}{K_{eff}}$$

$$P = P_0\ e^{\frac{t}{T}}$$

$$T = \frac{\ell^*}{\rho - \bar{\beta}}$$

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

$$\Delta\rho = \frac{K_{eff_2}-K_{eff_1}}{k_{eff_1}\times K_{eff_2}}$$

$$T = \frac{\ell^*}{\rho} + \left[\frac{\bar{\beta}-\rho}{\lambda_{eff}\rho}\right]$$

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

$$\rho = \frac{(K_{eff}-1)}{K_{eff}}$$

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

$$DR_1 d_1^2 = DR_2 d_2^2$$

$$DR = \frac{6CiE(n)}{R^2}$$

DR — Rem, Ci — curies,
E — Mev, R — feet

$$\frac{(\rho_2-\beta)^2}{Peak_2} = \frac{(\rho_1-\beta)^2}{Peak_1}$$

1 Curie = 3.7 x 10^{10} dis/sec

1 kg = 2.21 lbm

1 Horsepower = 2.54 x 10^3 BTU/hr

1 Mw = 3.41 x 10^6 BTU/hr

1 BTU = 778 ft-lbf

°F = 9/5 °C + 32

1 gal (H_2O) ≈ 8 lbm

°C = 5/9 (°F - 32)

c_p = 1.0 BTU/hr/lbm/°F

c_p = 1 cal/sec/gm/°C

QUESTION: 001 (1.00)

The MITR-II uses light water for a coolant and moderator and heavy water for a reflector because:

a. Light water has a much higher heat capacity and heavy water is a good neutron scatterer.

b. Light water is a good neutron scatterer and heavy water absorbs few neutrons.

c. Light water absorbs few neutrons and heavy water is a good neutron scatterer.

d. Light water has a much higher heat capacity and heavy water absorbs few neutrons.

QUESTION: 002 (1.00)

Which of the following would occur if an in-core sample that is a neutron absorber and which is initially at the bottom of the in-core sample tube with the reactor critical were pulled up through the core and out?

a. Positive reactivity is added.

b. Negative reactivity is added.

c. Positive then negative reactivity is added.

d. Negative then positive reactivity is added.

QUESTION: 003 (1.00)

The method for determining Calculated Thermal Power is described by:

a. Primary power plus reflector power plus shield power.

b. Primary power plus reflector power minus shield power.

c. Primary power plus shield power minus reflector power.

d. Primary power minus reflector power minus shield power.

QUESTION: 004 (1.00)

As primary coolant temperature increases, control rod worth:

a. decreases due to lower reflector efficiency.

b. decreases due to higher neutron absorption in the moderator.

c. increases due to the increase in thermal diffusion length.

d. remains the same due to constant poison cross-section of the control rods..

QUESTION: 005 (1.00)

The peak differential reactivity worth of the shim blades occurs at the midpoints of their calibration curves, but the peak differential reactivity worth of the regulating rod occurs at the bottom of its calibration curve because:

a. the regulating rod is made of cadmium and the shim blades of boron-impregnated stainless steel.

b. the regulating rod is shadowed by the shim bank when it is above the bank height.

c. the regulating rod is a cylinder, while the blades are paddle-shaped.

d. the `full-in' position of the regulating blade is six inches above that of the shim blades.

QUESTION: 006 (1.00)

Which ONE of the following factors in the six factor formula is altered upon changing the coolant temperature?

a. Fast fission factor.

b. Reproduction factor.

c. Non-leakage factor.

d. Resonance escape probability.

QUESTION: 007 (1.00)

The Doppler effect is described by the:

a. blue glow seen around the fuel elements.

b. broadening of resonance peaks as fuel temperature increases.

c. slower response time in comparison to moderator temperature feedback.

d. spectral shift of Uranium-235 as moderator temperature increases.

QUESTION: 008 (1.00)

For a doubling time of 25 seconds the corresponding reactor period is:

a. 25 seconds

b. 36 seconds

c. 50 seconds

d. 81 seconds

QUESTION: 009 (1.00)

The major source of neutrons used for routine startups of the MITR-II is from:

a. Alpha decay of Uranium-238.

b. Antimony-Beryllium (Sb-Be) source.

c. Plutonium-Beryllium (Pu-Be) source.

d. Photo-neutrons produced by interaction of gamma rays with heavy water.

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)

Given the following: Reactor operating at 5 MW, scram setpoint at 6 MW, scram delay time of 1 second, reactor period of 12.5 seconds

What will be the approximate reactor power at the time of the scram due to this reactivity excursion?

a. 6.1 MW

b. 6.5 MW

c. 7.2 MW

d. 12.5 MW

QUESTION: 012 (1.00)

As criticality is approached during a startup, blade withdrawal is made in smaller and smaller increments and with longer and longer intervals between withdrawals because:

a. as the reactor approaches criticality, the number of neutron generations required to attain equilibrium increases.

b. gamma rays begin to swamp the neutron signal in the nuclear detectors.

c. the fraction of delayed neutrons appraches zero as criticality is approached.

d. subcritical multiplication becomes less important.

QUESTION: 013 (1.00)

Delayed neutrons are essential to reactor safety because:

a. more delayed neutrons are produced than prompt neutrons.

b. delayed neutrons take longer to thermalize than do prompt neutrons, resulting in longer reactor periods during power changes.

c. delayed neutrons are born at different energies than prompt ones, thereby ensuring a broad neutron energy distribution.

d. delayed neutrons increase the average neutron lifetime, resulting in a longer reactor period during power changes.

QUESTION: 014 (1.00)

Coolant flows through a reactor core at a rate of 50 GPM, resulting in a coolant temperature increase of 6 degrees F. The power of the reactor is:

a. 5.3 kW.

b. 14.7 kW.

c. 44.0 kW.

d. 329.1 kW.

QUESTION: 015 (1.00)

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

a. gamma radiation.

b. kinetic energy of prompt and delayed neutrons.

c. kinetic energy of fission fragments.

d. alpha and beta radiation.

QUESTION: 016 (1.00)

The MITR-II is normally refueled when the xenon-equilibrium shim bank height is 16-17 inches, in order to:

a. avoid burnup of the upper portion of each element, thereby minimizing power peaking at the top of the core.

b. avoid blade withdrawal above the 18 inch height of the regulating rod.

c. avoid the possibility of being xenon-precluded should a restart following a scram be necessary.

d. maintain a uniform axial flux profile for the 3GV irradiation facilities.

QUESTION: 017 (1.00)

Which ONE of the following describes the behavior of xenon?

a. Xenon is produced from both fission and the decay of iodine.

b. Xenon peaks upon shutdown and remains at the peak until power operation resumes.

c. Xenon reactivity worth varies linearly with reactor power.

d. Equilibrium xenon is worth 1 Beta.

QUESTION: 018 (1.00)

Which ONE of the following is the reason why it requires 24 hours of constant power operation before thermal equilibrium is attained in the MITR-II reactor?

a. The time required for equilibrium Xenon and Samarium conditions to be established.

b. The time required for the large volume of the Deuterium tank to heat up.

c. The shield coolant system has a small flowrate to accomplish adequate mixing before temperature is uniformly stabilized.

d. The graphite reflector has a large heat capacity and is slow to reach equilibrium temperature distribution.

QUESTION: 019 (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.

QUESTION: 020 (1.00)

The fuel temperature coefficient of reactivity is -1.25E-4 delta k/k/deg.F. When a control rod with an average rod worth of 0.1% delta k/k/inch is withdrawn 10 inches, reactor power increases and becomes stable at a higher level. At this point, (ignoring any other temperature effects) the fuel temperature has:

a. increased by 80 deg.F.

b. decreased by 80 deg.F.

c. increased by 8 deg.F.

d. decreased by 8 deg.F.

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

QUESTION: 001 (1.00)

Which ONE of the following statements specifies a condition which satisfies Technical Specification Shutdown Margin requirements?

a. The reflector dump time must be at least twice the initial measured value.

b. No less than five shim blades are operable and the inoperable blade is at the operating position or higher.

c. With the most reactive blade and regulating rod fully withdrawn the reactor can be made at least 1% deltaK/K subcritical from the cold Xenon equilibrium critical condition.

d. Variable reactivity effects (samples) shall be in their most negative reactive state.

QUESTION: 002 (1.00)

Containment integrity is required whenever:

a. the H_2 concentration in the air space above the core exceeds 1.0 volume percent.

b. maintenance is being performed on the rod control system.

c. the reactor is not secured.

d. the emergency cooling system is not operable.

QUESTION: 003 (1.00)

In the event of an On-Site Evacuation, personnel should be directed to proceed to the:

a. Campus Police Headquarters (Bldg. W31.)

b. Operations Office (NW12-116).

c. NW13 Receiving Room.

d. NW13 Machine Shop.

QUESTION: 004 (1.00)

In order to ensure the health and safety of the public, 10CFR50 allows the operator to deviate from Technical Specifications. What is the minimum level of authorization needed to deviate from Tech. Specs?

a. USNRC

b. Reactor Supervisor

c. Licensed Senior Reactor Operator.

d. Licensed Reactor Operator.

QUESTION: 005 (1.00)

Safety Limits are ...

a. limits on variables associated with core thermal and hydraulic performance which are established to protect the integrity of the fuel clad.

b. settings for automatic protective devices related to those variable having significant safety functions.

c. settings for ANSI 15.8 suggested reactor scrams and/or alarms which form the protective system for the reactor or provide information which requires manual protective action to be initiated.

d. the lowest functional capability or performance levels of equipment required for safe operation of the reactor.

QUESTION: 006 (1.00)

What type of radiation hazard is associated with tritiated D_2O?

a. Alpha

b. Beta

c. Gamma

d. Neutron

QUESTION: 007 (1.00)

Select the MINIMUM amount of time that must be spent performing license activities in order to maintain an active license.

a. 4 hours per month

b. 8 hours per month

c. 4 hours per quarter

d. 8 hours per quarter

QUESTION: 008 (1.00)

While responding to a low pressure condition in the D_2O Helium System and while monitoring the recombiner, the gasholder level decreases rapidly. The primary concern associated with this condition is:

a. a buildup of Argon-41 in containment.

b. a release of Tritium to the equipment room.

c. an oil spill from a ruptured blow-out patch.

d. the loss of loop seal overpressure protection for the recombiner.

QUESTION: 009 (1.00)

What is the maximum power level allowed if the reactor top shield is NOT in place?

a. 100 W

b. 500 W

c. 100 kW

d. 250 kW

QUESTION: 010 (1.00)

Which ONE of the following is NOT a concern on loss of compressed air?

a. Operability of the pneumatic tube sample ejection system.

b. Position of the dump valve.

c. Containment integrity.

d. Capability to monitor dump tank level remotely.

QUESTION: 011 (1.00)

The maximum reactivity worth of a single non-secured experiment allowed by Technical Specifications is:

a. 0.2 % delta K/K

b. 0.5 % delta K/K

c. 1.0 % delta K/K

d. 1.8 % delta K/K

QUESTION: 012 (1.00)

A reactor startup is declared "non-routine" if:

a. a thermal power calibration has not been performed.

b. a significant shift has occurred in the radial power distribution.

c. the refueling sequence involved fuel flipping.

d. the startup is to be performed when xenon is peaking.

QUESTION: 013 (1.00)

Authorization for a temporary change to a checklist which does NOT change the intent of the original procedure, according to Technical Specifications, may be made by:

a. a licensed reactor operator.

b. the Director of Operations.

c. a licensed reactor operator and the Radiation Protection Officer.

d. a licensed senior reactor operator and another member of the facility staff.

QUESTION: 014 (1.00)

While responding to a safety system scram alarm, you are required to perform a MAJOR scram of the reactor if:

a. any building area monitor is above the alarm point.

b. a low level in the primary core tank is verifed.

c. any effluent monitor is above the alarm point.

d. a safety limit was exceeded.

QUESTION: 015 (1.00)

When maintenance is to be performed on an electrical system, the key that is used to lock out the appropriate circuit breaker is retained by the:

a. console operator.

b. shift supervisor.

c. person performing the work.

d. superintendent.

QUESTION: 016 (1.00)

During a normal reactor startup the reactor attains criticality before reaching the 0.5" below ECP position. The required action is to:

a. continue with the power increase to the desired operating power.

b. establish/maintain an infinite period and recalculate the ECP.

c. lower the shim bank at least 1.0" and determine the cause.

d. drive all rods in and recalculate the ECP.

QUESTION: 017 (1.00)

Shim blade withdrawal motion is limited to four inches by the "subcritical position" interlock circuit. Which ONE of the following is NOT a reason for incorporating the subcritical interlock into the shim blade circuit?

a. To maintain the shim blade bank at a uniform height during final approach to criticality.

b. To establish a level, below the critical position, to which the shim blades may be individually withdrawn in one step.

c. To provide a convenient reference point at which the operator can pause to make a complete instrument check before bringing the reactor to criticality.

d. To maintain the shim blade bank at a uniform height sufficient to maintain subcritical multiplication on the startup channels.

QUESTION: 018 (1.00)

Which ONE of the following describes the effect of a loss of electrical power to the Scam System?

a. Reactor protection from the automatic scrams are still in effect.

b. Signal lights associated with the scrams are active but reactor protection from automatic scrams are lost.

c. The Scam System Power Failure alarm will actuate if all electrical power to the reactor building has occurred.

d. The reactor will experience a minor scram but no alarm functions or instrument indications are active.

QUESTION: 019 (1.00)

If the Technical Specification limit for Tritium in the secondary coolant system is exceeded, all of the following actions must be performed EXCEPT:

a. Shut down the cooling tower spray.

b. Secure the secondary system water discharge flow.

c. Isolate the reflector heat exchanger.

d. Stop the reactor building ventilation system.

QUESTION: 020 (1.00)

Which ONE of the following is the reason for the irradiation time limit associated with the use of rabbits?

a. prevent swelling of containers.

b. limit radiation exposure to personnel handling containers.

c. prevent embrittlement of the polyethelyene containers.

d. limit radioactive gas release in the event of a container failure.

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

QUESTION: 001 (1.00)

At what building pressure should the containment pressure relief system be placed on line?

a. 3 psi

b. 2 psi

c. 2.5 psi

d. 1 psi

QUESTION: 002 (1.00)

Which ONE of the following alarm conditions will result in an automatic scram?

a. High Pressure Reactor Inlet.

b. High Level Emergency Power Channel.

c. Low Level Dump Tank.

d. Low Flow Shield Coolant.

QUESTION: 003 (1.00)

A major concern when responding to any casualty that affects the reflector is:

a. possible tritium exposure.

b. toxicity of the heavy water.

c. corrosiveness of irradiated heavy water.

d. possible N-16 exposure.

QUESTION: 004 (1.00)

Which ONE of the following describes decay heat removal capability while on Emergency Power?

a. Primary coolant system auxiliary pump MM2 can be restarted after resetting the low-voltage protection.

b. Primary coolant system pump MM1 can be restarted after resetting the low-voltage protection.

c. Standby Transfer Pump DM-2 will automatically start on high temperature.

d. Natural circulation provides cooling since pumping power is not available.

QUESTION: 005 (1.00)

Which ONE of the following automatic actions will occur, if the on-line waste tank reaches a high level alarm condition?

a. City water inlet solenoid valve closes.

b. Waste tank vent valve closes.

c. On-line sewer pump trips.

d. Sump pumps trip.

QUESTION: 006 (1.00)

What action should always be taken to maximize effectiveness of the emergency plan for airborne releases?

a. Shut down the reactor; Isolate containment.

b. Shut down the reactor; Leave ventilation on.

c. Lower shim blades to subcritical; Isolate containment.

d. Minor scram..

QUESTION: 007 (1.00)

Which ONE of the following is NOT a purpose of the shield coolant system?

a. Remove heat deposited by gamma rays from the shield.

b. Cool 3GV facility samples.

c. Cool spectrometer magnets if spectrometers are operational.

d. Remove heat from the H_2O shutter tank.

QUESTION: 008 (1.00)

Which ONE of the following statements describes the operation of the ventilation system?

a. If the main intake damper fails to close within ten seconds of a trip signal, the auxiliary damper will close.

b. If temperature of the outside air drops below freezing the main intake damper will close, but the intake fan continues to run.

c. If the main intake damper fails to close, it can be operated manually by using a lanyard inside containment near the damper.

d. In the "weekend-open" position, if activity is detected the plenum monitors will trip the inlet dampers and intake fan.

QUESTION: 009 (1.00)

If the reactor hold-down grid latch is open, then the interlock associated with the grid latch will:

a. trip the primary pumps.

b. dump the reflector.

c. trip the D_2O pumps.

d. initiate emergency core cooling.

QUESTION: 010 (1.00)

Which ONE of the following indications is not indicative of a fission product release from a fuel element?

a. Increasing readings on core purge monitor.

b. Increasing readings on plenum air monitor.

c. Increasing readings on N-16 monitor.

d. Increasing readings on NW12 gamma monitor.

QUESTION: 011 (1.00)

The operator in the control room would be required to notify personnel on the reactor top, if during refueling:

a. a positive steady-state period is observed when no fuel or dummies are being moved.

b. subcritical multiplication levels decrease by a factor of 2 or more.

c. a negative steady-state period is observed while fuel or dummies are being moved.

d. radiation levels decrease by a factor of 2 or more.

QUESTION: 012 (1.00)

Which ONE of the following indications will be automatically actuated outside of the control room when the 'trouble NW-12 gamma monitor' scam alarm actuates?

a. A red light and a warning horn in operations office.

b. A blue light and a bell at the reception area.

c. A siren and backlighted signs in the containment building.

d. A horn in building NW12 and backlighted signs at entrances.

QUESTION: 013 (1.00)

At what core tank level would city water be utilized for emergency core cooling?

a. -48 inches

b. -52 inches

c. -36 inches

d. -72 inches.

QUESTION: 014 (1.00)

Which ONE of the following conditions will result in a Spent Fuel Storage Pool (SFSP) Alarm?

a. Leak

b. SFSP Pump trip on thermal overload

c. Securing pump from the SFSP control panel

d. High temperature ion column inlet

QUESTION: 015 (1.00)

Which ONE of the following describes the design feature that provides for containment overpressure protection?

a. A pressure relief blower automatically starts.

b. A containment relief valve automatically opens.

c. A containment relief valve can be manually opened.

d. The stack exhaust control damper will automatically open on differential pressure.

QUESTION: 016 (1.00)

The reason for limiting cleanup system temperature to less than 50 degrees-C is to:

a. minimize gaseous release when sampling the primary.

b. prevent damage to the mixed-bed ion exchanger resin.

c. prevent coolant flashing when passing through filters.

d. limit the inaccuracy of the conductance probes, which are not temperature compensated.

QUESTION: 017 (1.00)

The automatic action associated with the Sewer radiation monitor high alarm during NORMAL system operation is:

a. the Sump pumps trip.

b. the Sewer pump trips.

c. the inlet City Water solenoid valve closes.

d. the isolation valve closes to secure flow to the sewer.

QUESTION: 018 (1.00)

Which ONE of the following actions should the console operator perform immediately, if during rabbit irradiation the rabbit station radiation monitor alarms?

a. Eject the sample into the hot cell using the "Abort Auto Transfer" pushbutton.

b. Shutdown the reactor and when radiation levels are less than the permissible limit, use the 1PH1 "Eject" pushbutton to remove the sample.

c. Commence a normal reactor shutdown and dump the reflector.

d. Depress and hold the radiation alarm reset pushbutton to allow for the automatic transfer of the sample.

QUESTION: 019 (1.00)

Which ONE of the following is the reason for shutting down the reactor if the compressed air system pressure is less than 40 psig?

a. Personnel airlock cannot be operated.

b. Eventual loss of containment integrity.

c. Loss of ability to dump the reflector.

d. Prevent trip on low secondary flow indication.

QUESTION: 020 (1.00)

The primary concern associated with the pressure relief system charcoal filters becoming submersed during a large leak of primary coolant is:

a. loss of efficiency in removing particulates.

b. possible spontaneous combustion during dryout.

c. reduction in relief flow capability to relieve pressure.

d. possible spread of contamination from leaks in the filter housing.

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

(***** END OF EXAMINATION *****)

ANSWER: 001 (1.00)
B
REFERENCE:
MIT RSM 10.9

ANSWER: 002 (1.00)
D
REFERENCE:
MIT RSM 10.1 on Axial flux profile and MIT Notes on Nuclear Instrumentation, p. 23

ANSWER: 003 (1.00)
A
REFERENCE:
PM 2.4, p 5.

ANSWER: 004 (1.00)
C
REFERENCE:
MIT Reactor Physics Notes, Reactivity Feedback, Section 5.

ANSWER: 005 (1.00)
D
REFERENCE:
MIT RSM 1.6.2

ANSWER: 006 (1.00)
C
REFERENCE:
MIT Reactor Physics Notes on Reactivity Feedback, pg. 18

ANSWER: 007 (1.00)
B
REFERENCE:
MIT Reactor Physics Notes, Reactivity Feedback and Fig 4.2b.

ANSWER: 008 (1.00)
B
REFERENCE:
MIT Reactor Physics Notes on Reactor Kinetics, pg. 18
Doubling Time = 0.693 x Period = 25 seconds, Period = 36 seconds

ANSWER: 009 (1.00)
D
REFERENCE:
MIT Reactor Physics Notes, Reactor Startup, p 7.

ANSWER: 010 (1.00)
B
REFERENCE:
MIT Reactor Physics Notes on Reactor Kinetics, pg. 2
$\rho_1 = (0.861 - 1)/0.861 = -0.161\Delta k/k$; $\rho_2 = (0.946 - 1)/0.946 = -0.057\Delta k/k$
$\Delta\rho = \rho_2 - \rho_1 = -0.057 - (-0.161) = +0.104$ delta k/k

ANSWER: 011 (1.00)
B
REFERENCE:
MIT Exam Bank # 19

ANSWER: 012 (1.00)
A
REFERENCE:
MIT Reactor Physics Notes on Subcritical Multiplication, pg. 10

ANSWER: 013 (1.00)
D
REFERENCE:
MIT Reactor Physics Notes on Reactor Kinetics, pp 8-10

ANSWER: 014 (1.00)
C
REFERENCE:
MIT PM 2.4.2 Power = (Mass flow rate)(Specific heat)(temperature increase)
Power = (50 GPM)(8.34 lbs/gallon)(1 Btu/lb-deg F)(6 deg F)(60 min/hour)
Power = (150,120 Btu/hour)(1 kW/3413 Btu/hour) = 44.0 kW

ANSWER: 015 (1.00)
C
REFERENCE:
Glasstone, Section 1.52

ANSWER: 016 (1.00)
C
REFERENCE:
Examination of MITR-II Shim Bank and Xenon Reactivity Worth Curves

ANSWER: 017 (1.00)
A
REFERENCE:
MIT Reactor Physics Notes on Reactivity Feedback, pg. 21

ANSWER: 018 (1.00)
D
REFERENCE:
Glasstone and Sesonske, Nuclear Reactor Engineering, Chapter 5, Section 5.114, p 272; MIT Exam Bank #48.

ANSWER: 019 (1.00)
B
REFERENCE:
Glasstone, Section 5.51

ANSWER: 020 (1.00)
A
REFERENCE:
Glasstone, Section 5.96
Reactivity added by control rod = +(0.001 Δk/k/inch)((10 inches) = 0.01 delta k/k
Fuel temperature change = - reactivity of rod/fuel temp. coeff. = (- 0.01 delta k/k)/(- 1.25E-4 delta k/k/deg. F) = 80 deg. F

ANSWER: 001 (1.00)
B
REFERENCE:
TS 3.9

ANSWER: 002 (1.00)
C
REFERENCE:
TS 3.5.1

ANSWER: 003 (1.00)
D
REFERENCE:
PM 5.3.1 - 5.3.4

ANSWER: 004 (1.00)
C
REFERENCE
10CFR50.54(y)

ANSWER: 005 (1.00)
A
REFERENCE
TS 2.1

ANSWER: 006 (1.00)
B
REFERENCE:
Nuclear Reactor Engineering, Glasstone & Sesonske, Section 2.85, p 60; MIT Exam Bank, Catagory C, #4.

ANSWER: 007 (1.00)
C
REFERENCE
10 CFR 55.53

ANSWER: 008 (1.00)
B
REFERENCE:
PM 5.5.13

ANSWER: 009 (1.00)
C
REFERENCE:
TS 3.11.2.d

ANSWER: 010 (1.00)
A
REFERENCE:
MIT Reactor Systems Manual, Section 8.6

ANSWER: 011 (1.00)
B
REFERENCE:
TS 6.1

ANSWER: 012 (1.00)
B
REFERENCE:
PM 2.3.2

ANSWER: 013 (1.00)
D
REFERENCE:
TS 7.8.3

ANSWER: 014 (1.00)
C
REFERENCE:
PM 5.1.3

ANSWER: 015 (1.00)
C
REFERENCE:
PM 1.14, p 9.

ANSWER: 016 (1.00)
C
REFERENCE:
PM 2.3, Step 11, p 2.

ANSWER: 017 (1.00)
D
REFERENCE:
RSM 4.2.

ANSWER: 018 (1.00)
A
REFERENCE:
PM 5.7.1

ANSWER: 019 (1.00)
D
REFERENCE:
TS 3.8.1

ANSWER: 020 (1.00)
C
REFERENCE:
PM 1.10, Step 9, p 10.

ANSWER: 001 (1.00)
B
REFERENCE:
Reactor Systems Manual 8.4, AOP PM 5.5.7

ANSWER: 002 (1.00)
D
REFERENCE:
Reactor Systems Manual, Pages 9.3 to 9.5

ANSWER: 003 (1.00)
A
REFERENCE:
Reactor Systems Manual, Page 8.31

ANSWER: 004 (1.00)
A
REFERENCE:
Reactor Systems Manual, Page 8.31

ANSWER: 005 (1.00)
A
REFERENCE:
Reactor Systems Manual, Page 8.19

ANSWER: 006 (1.00)
A
REREFENCE
Emergency Plan Section 4.3.1.2.1.

ANSWER: 007 (1.00)
D
REFERENCE:
RSM Section 3.5.1

ANSWER: 008 (1.00)
A
REFERENCE:
Reactor Systems Manual, Page 8.12

ANSWER: 009 (1.00)
A
REFERENCE:
PM 2.7, p 3.

ANSWER: 010 (1.00)
D
REFERENCE:
AOP PM 5.8.2

ANSWER: 011 (1.00)
A
REFERENCE:
PM 3.3.1, p 2.

ANSWER: 012 (1.00)
B
REFERENCE:
AOP PM 5.6.4, RSM 7.6

ANSWER: 013 (1.00)
B
REFERENCE:
Reactor Systems Manual, Section 3.2.7

ANSWER: 014 (1.00)
A
REFERENCE:
PM 5.7.12

ANSWER: 015 (1.00)
C
REFERENCE:
Reactor Systems Manual, Page 8.22

ANSWER: 016 (1.00)
B
REFERENCE:
Reactor Systems Manual, Page 3.3

ANSWER: 017 (1.00)
A
REFERENCE:
Reactor Systems Manual, Pages 7.7, 8.19; SAR Rev 36, Sec 12.2; SR#-0-88- 11, p 2.

ANSWER: 018 (1.00)
A
REFERENCE:
PM 1.10, Step 4.14B, p 14.

ANSWER: 019 (1.00)
D

REFERENCE:
RSM Section 8.6.2

ANSWER: 020 (1.00)
B
REFERENCE:
PM 5.2.14