October 4, 2001

Dr. John Bernard, Director
of Reactor Operations
Nuclear Reactor Laboratory
Massachusetts Institute of Technology
138 Albany Street
Cambridge, MA 02139

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-020/OL-01-01

Dear Dr. Bernard:

During the week of September 3, 2001, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your Massachusetts Institute of Technology Reactor. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1. At the conclusion of the examination, the examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/index.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 Patrick Isaac at 301-415-1019 or pxi@nrc.gov.

Sincerely,
/RA by Patrick M. Madden Acting for/

Eugene V. Imbro, Acting Chief
Operational Experience and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-020

Enclosures: 1. Initial Examination Report No. 50-020/OL-01-01
2. Examination and answer key (RO/SRO)

cc w/enclosures:
Please see next page

Massachusetts Institute of
Technology

Docket No. 50-20

cc:

City Manager
City Hall
Cambridge, MA 02139

Department of Environmental
Quality Engineering
100 Cambridge Street
Boston, MA 02202

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

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Please see next page

DISTRIBUTION w/ encls.:
PUBLIC REXB R/F EImbro PMadden
AAdams PIsaac
Facility File (EBarnhill) O-6 D-17

ADAMS ACCESSION #: ML012710075 **TEMPLATE #:NRR-074**

OFFICE	REXB:CE	E	IOLB	E	REXB:SC		REXB:ABC	
NAME	PIsaac		EBarnhill		PMadden		EImbro	
DATE	09/ 28 /2001		10/ 01 /2001		10/ 01 /2001		10/ 01 /2001	

C = COVER E = COVER & ENCLOSURE N = NO COPY
OFFICIAL RECORD COPY

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

REPORT NO.:	50-020/OL-01-01
FACILITY DOCKET NO.:	50-020
FACILITY LICENSE NO.:	R-37
FACILITY:	Massachusetts Institute of Technology
EXAMINATION DATES:	September 4 - 6, 2001
EXAMINER:	Patrick Isaac, Chief Examiner

SUBMITTED BY: ***/RA/*** 09/21/01
Patrick Isaac, Chief Examiner Date

SUMMARY:

During the week of September 3, 2001, the NRC administered Operator Licensing Examinations to one Senior Reactor Operator Instant (SROI), one Senior Reactor Operator Upgrade (SROU), and three Reactor Operator (RO) candidates. All the candidates passed their respective portions of 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**	**1/0**	**4/0**
Operating Tests	**3/0**	**2/0**	**5/0**
Overall	**3/0**	**2/0**	**5/0**

3. Exit Meeting:

   Personnel attending:

   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. The Chief Examiner agreed with Mr. Warmsley to delete question B. 10 from the written examination due to the lack of a correct answer.

All work do[illegible]

NON-POWER INITIAL

U. S. NUCLEAR RE

Candidate's Signature

ENCLOSURE 2

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

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12. There is

EQUATION SHEET

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

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

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

$SCR = S/(1\text{-}Keff)$

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

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

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

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

$SUR = 26.06/\tau$

$M = 1/(1\text{-}Keff) = CR_1/CR_0$

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

$SDM = (1\text{-}Keff)/Keff$

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

$Pwr = W_f \dot{m}$

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

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

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

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

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

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

$\rho = \Delta Keff/Keff$

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

$\bar{\beta} = 0.0070$

$DR_1 D_1^{\,2} = DR_2 D_2^{\,2}$

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

$DR = \dfrac{6CiE(n)}{R^2}$ DR ≡ R/hr, Ci ≡ Curies, E ≡ Mev, R ≡ feet

---

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 hp = 2.54×10^{3} BTU/hr

1 Mw = 3.41×10^{6} BTU/hr

1 BTU = 778 ft-lbf

°F = 9/5°C + 32

1 gal H_2O ≈ 8 lbm

°C = 5/9 (°F - 32)

QUESTION: 001 (1.00)

The void coefficient for the MIT reactor (core center) is?

a. 0.02 mbeta/cm3

b. 0.2 mbeta/cm3

c. 2 mbeta/cm3

d. 20 mbeta/cm3

QUESTION: 002 (1.00)

Which ONE of the following describe the reactivity effect(s) that would occur if heavy water leaks from the reflector into the core periphery and into the core proper?

a. Only negative reactivity is added.

b. Only positive reactivity is added.

c. First negative then strongly positive reactivity is added.

d. First positive then strongly negative reactivity is added.

QUESTION: 003 (1.00)

The temperature coefficient of reactivity for the MITR-II encompasses two (2) distinct phenomena. Both insert negative reactivity with an increase in temperature. Which is correct?

a. An increase in the light water temperature will insert negative reactivity by hardening the neutron spectrum.

b. An increase in the heavy water reflector temperature will insert positive reactivity by allowing more neutron leakage.

c. A decrease in the heavy water reflector temperature will insert negative reactivity by allowing more neutron leakage.

d. A decrease in the light water temperature will insert negative reactivity by hardening the neutron spectrum.

QUESTION: 004 (1.00)

Which ONE of the following factors is the most significant in determining the differential worth of a control rod?

a. The rod speed.

b. Reactor power.

c. The flux shape.

d. The amount of fuel in the core.

QUESTION: 005 (1.00)

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

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: 006 (1.00)

Given a source strength of 100 neutrons per second (N/sec) and a multiplication factor of 0.8, the expected stable neutron count rate would be?

a. 125 N/sec

b. 250 N/sec

c. 400 N/sec

d. 500 N/sec

QUESTION: 007 (1.00)

With a 30 second period, power would double in approximately:

a. 15 seconds

b. 21 seconds

c. 30 seconds

d. 60 seconds

QUESTION: 008 (1.00)

Which ONE of the following describes how delayed neutrons affect control of the reactor?

a. More delayed neutrons are produced than prompt neutrons resulting in a longer time to reach a stable subcritical countrate.

b. Delayed neutrons are born at higher energies than prompt neutrons resulting in a shorter reactor period from increased leakage.

c. Delayed neutrons take longer to thermalize than prompt neutrons resulting in a longer reactor period.

d. Delayed neutrons increase the average neutron lifetime resulting in a longer reactor period.

QUESTION: 009 (1.00)

A source of delayed neutrons is from:

a. gamma interactions with structural materials.

b. decay of fission products.

c. alpha interactions with the reflector.

d. burnup of Xenon and Samarium.

QUESTION: 010 (1.00)

Which ONE of the following describes the reason for the constant rate of power change several minutes after a reactor scram from full power?

a. The decay of the longer-lived delayed neutron precursors.

b. The decay of the shorter-lived delayed neutron precursors.

c. The mean average decay of the delayed neutron precursors.

d. The decay of fission product gammas producing photoneutrons.

QUESTION: 011 (1.00)

After a week of full power operation, Xenon will reach its peak following shutdown in approximately:

a. 6 hours

b. 9 hours

c. 12 hours

d. 40 hours

QUESTION: 012 (1.00)

Which ONE of the following is the reason why it takes approximately 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: 013 (1.00)

Excess reactivity is the amount of reactivity:

a. associated with samples.

b. needed to achieve prompt criticality.

c. available above that which is required to make the reactor subcritical.

d. available above that which is required to keep the reactor critical.

QUESTION: 014 (1.00)

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 Beta-effective.

QUESTION: 015 (1.00)

A subcritical reactor is being started up. A control rod (shim blade) is raised in four equal steps (inches). Which statement most accurately describes the expected reactor response?

a. Power increases by the same amount for each withdrawal.

b. Each withdrawal will add the same amount of reactivity.

c. The time for power to stabilize after each successive withdrawal increases.

d. A lower critical rod height is attained by decreasing the time intervals between withdrawals.

QUESTION: 016 (1.00)

Which is the correct definition of shutdown margin?

a. The reactor is in a cold xenon-free condition, with the most reactive blade and the regulating rod full out, the reflector dumped, and all samples in their most reactive positions.

b. The reactor is in a cold xenon-free condition, with the most reactive blade and the regulating rod full in, the reflector dumped, and all samples in their most reactive positions.

c. The reactor can be made subcritical by at least 1% delta K/K in a cold xenon-free condition, with the most reactive blade and the regulating rod full out, and all samples in their most reactive positions.

d. The reactor is in a cold xenon loaded condition, with the most reactive blade and the regulating rod full out, the reflector dumped, and all samples in their least reactive positions.

QUESTION: 017 (1.00)

Which ONE of the following describe the difference between a moderator and reflector?

a. A reflector increases the fast non-leakage factor and a moderator increases the thermal utilization factor.

b. A reflector increases the neutron production factor and a moderator increases the fast fission factor.

c. A reflector decreases the thermal utilization factor and a moderator increases the fast fission factor.

d. A reflector decreases the neutron production factor and a moderator decreases the fast non-leakage factor.

QUESTION: 018 (1.00)

During the neutron cycle from one generation to the next, several processes occur that may increase or decrease the available number of neutrons.

SELECT from the following the six-factor formula term that describes an INCREASE in the number of neutrons during the cycle.

a. Thermal utilization factor.

b. Resonance escape probability.

c. Thermal non-leakage probability.

d. Fast fission factor.

QUESTION: 019 (1.00)

The reactor has just been started up, power raised to 5 megawatts and is in auto control. Which ONE of the following is the expected response of the regulating rod for the next half hour?

a. Drive in

b. Drive out

c. Not move

d. Drive out then back in

QUESTION: 020 (1.00)

A control rod is withdrawn until 100 millibeta is added to a critical reactor.

Which ONE of the following will be the expected reactor period immediately after rod motion stops? (Assume delayed neutron decay constant is 0.1 s-1)

a. 30 second

b. 45 second

c. 90 second

d. 110 second

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

QUESTION: 001 (1.00)

The maximum reactivity worth of a single movable experiment allowed by Tech. Specs 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: 002 (1.00)

In accordance with 10 CFR Part 50.54(x), under what conditions can an operator take reasonable action that departs from a license condition or a Technical Specification?

a. In any emergency.

b. In an emergency, when the action is needed to protect health and safety and no other action is immediately apparent.

c. In an emergency declared by the Emergency Director.

d. In an emergency declared by the Emergency Director along with the approval of the Senior Reactor Operator on site.

QUESTION: 003 (1.00)

Per Technical Specifications, who may authorize the use of a temporary change to a checklist provided it does not change the intent of the original approved procedure?

a. The SRO on duty and the Reactor Operator.

b. A licensed SRO and another member of the facility staff.

c. The Director of Reactor Operations.

d. A licensed Reactor Operator and the Reactor Radiation Protection Officer.

QUESTION: 004 (1.00)

The basis for the D_2 concentration limit in the Helium gas cover blanket for the D_2O reflector system is to:

a. minimize personnel radiation exposure.

b. limit the disassociation of D_20 in the reflector.

c. minimize the contamination of the Helium cover gas.

d. prevent a flammable concentration of D_2 gas in the Helium blanket.

QUESTION: 005 (1.00)

Which one of the followings describes requirements which must be observed when "locking out" facility equipment after permission is granted?

a. SRO witness lockout, SRO will verify safe system condition, Superintendent must be notified, the system must be tagged out, a notation as to the system being locked out shall be made on the status board.

b. SRO will witness lockout, RO will verify safe system condition, Superintendent must be notified, the system must be tagged out, a notation as to the system being locked out shall

be made on the status board.

c. SRO will witness lockout, person performing work will perform lockout, person performing work will retain the key on their person, the system must be tagged out, a notation as to the system being locked out shall be made on the status board.

d. SRO will verify safe system condition, any member of the NRL/RRPO Staff will witness lockout, person performing work will perform lockout, person performing work will retain the key on their person, the system must be tagged out.

QUESTION: 006 (1.00)

A radiation survey performed 30 minutes after shutdown from a week of full power operation indicated 1500 mR/hr on contact with the main heat exchangers. Which of the following is true?

a. This reading is normal, most likely caused by N-16.

b. This reading is normal, most likely caused by Na-24.

c. This reading is abnormal, most likely caused by tritium.

d. This reading is abnormal, most likely caused by fission products.

QUESTION: 007 (1.00)

A 15 ml sample of primary water is removed from the sample station. What is the dominant nuclide you would expect assuming routine (normal) operation?

a. Na-24

b. U-235

c. Co-60

d. Ar

QUESTION: 008 (1.00)

If the reactor core tank level can not be maintained at or above the low level scram (-4"), what class of emergency would be declared?

a. Unusual Event

b. Alert

c. Site Area

d. General

QUESTION: 009 (1.00)

Which one of the following most closely represent the exposure rate on top of the reactor (above the shielding) when the reactor is operating at 4.9 MW?

a. 1 mR/hr

b. 10 mR/hr

c. 20 mR/hr

d. 50 mR/hr

QUESTION: 010 (1.00) ***DELETED***

A small radioactive source is to be stored in the reactor building. The source is estimated to contain 2 curies and emit a 1.33 Mev gamma. Assuming no shielding was to be used, a Radiation Area barrier would have to be erected from the source at a distance of approximately:

a. 6 inches

b. 12 inches

c. 21 inches

d. 4 feet

QUESTION: 011 (1.00)

A sample reading 1 R/hour is placed behind a 2-centimeter lead shield. What will be the resulting exposure rate? Assume no buildup and a linear attenuation equal to 0.52 cm-1.

a. 0.63 R/hr

b. 3.60 R/hr

c. 0.36 R/hr

d. 36 R/hr

QUESTION: 012 (1.00)

The following measurements are made from a beta-gamma point source:
2 R/hr at six inches 0.5 mR/hr at ten feet.
What are the relative fractions of betas and gammas emitted?

a. (1800/200) = 9

b. (2000/200) = 10

c. (1800/20) = 90

d. (2200/200) = 11

QUESTION: 013 (1.00)

Which ONE of the following is the assembly area in the event of a NW12 fire alarm?

a. Reception Area.

b. NW13 Machine Shop.

c. Far side of Albany Street.

d. Campus Police Headquarters.

QUESTION: 014 (1.00)

What must be assumed if the high radiation set-up area vault alarm has actuated?

a. Person went by with hot source.

b. Vault monitor failed.

c. Inadvertent criticality has occurred.

d. Electrical short in instrument.

QUESTION: 015 (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: 016 (1.00)

Before any change is made in the core configuration (refueling), the proposed change must be reviewed and approved by:

a. the Operator-in-charge and a Senior Reactor Operator.

b. a Senior Reactor Operator and the Reactor Superintendent.

c. the MIT Reactor Safeguards Committee and the Reactor Superintendent.

d. the MIT Reactor Safeguards Committee and the Director of Reactor Operations.

QUESTION: 017 (1.00)

During continuous power operation with the automatic control system it may be necessary for the operator to reshim the control blades to maintain the regulating rod within its useful range. Which ONE of the following describes the requirements associated with this reshim of control blades?

a. Reactor power is to be maintained within 2.5% of the desired level while reshimming.

b. All shim blades must be maintained within 2.5 inches of each other during the reshim and within 1.0 inch following the reshim.

c. The first motion of any control absorber during a reshim should be inward so as to lower reactor power.

d. The duty supervisor must approve all reshims prior to performance.

QUESTION: 018 (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: 019 (1.00)

What must be done in order to continue operation if a single plenum radiation monitor becomes inoperative due to a plugged flow line and the containment isolates?

a. Bypass affected channel using key switch and restart ventilation.

b. Bypass by selecting a different plenum channel and restart ventilation.

c. Replace plugged flow line and restart ventilation.

d. Operation is not allowed.

QUESTION: 020 (1.00)

In accordance with Standard Operating Procedure PM 2.3.1, Normal Reactor Startup, what should be your immediate response if the reactor goes critical at a position more than 0.5 inches below the ECP?

a. Lower shim bank to subcritical interlock.

b. Lower the shim bank at least one inch.

c. Hold and recalculate ECP.

d. Shut down.

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

QUESTION: 001 (1.00)

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

a. High Level Emergency Power Channel.

b. High Temperature Reflector Outlet.

c. Low Level Shield Coolant Storage Tank.

d. Low Voltage Chamber Power Supply.

QUESTION: 002 (1.00)

MP-6 and MP-6A measure inlet pressure to the reactor core. What flowrate corresponds to a minimum flow rate required by the technical specifications?

a. 1000 gpm

b. 1500 gpm

c. 1800 gpm

d. 2000 gpm

QUESTION: 003 (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: 004 (1.00)

Which ONE of the following automatic actions will occur, if the on-line liquid waste storage 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 pump trips.

QUESTION: 005 (1.00)

Blowdown of the cooling tower basins is secured when the reactor is shutdown because:

a. secondary water monitors can no longer detect in-leakage.

b. the automatic makeup system is secured on reactor shutdown.

c. the efficiency of blowdown decreases without secondary flow.

d. it is no longer required when cooling tower spray is secured.

QUESTION: 006 (1.00)

Which of the following sensors does NOT use a flow orifice?

a. Primary flow MF-1.

b. Reflector flow DF-1.

c. Shield flow PF-1.

d. Secondary flow HF-1A.

QUESTION: 007 (1.00)

Which ONE of the following describes the purpose for the subcritical interlock?

a. To prevent withdrawing more than one shim blade at a time.

b. To allow for performance of individual shim blade drop time testing.

e. To aid in maintaining the shim blade bank at a uniform height during the final approach to criticality.

d. To ensure the nuclear instruments are on scale prior to allowing shim blade withdrawal.

QUESTION: 008 (1.00)

Which ONE of the following describes an automatic response of the ventilation system?

a. If temperature of the outside air drops below freezing the intake fan will trip.

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

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

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

QUESTION: 009 (1.00)

Of what material are the fuel dummies constructed?

a. Titanium

b. Stainless steel

c. Aluminum

d. Spent uranium.

QUESTION: 010 (1.00)

During refueling of the core the indicated neutron level has increased by a factor of 2.5. Which ONE of the following operator actions is required to be taken?

a. Evacuate personnel from the reactor top.

b. Dump the reflector, if not already dumped.

c. Notify Radiation Protection to perform a radiation survey of the reactor top area.

d. Notify personnel on the reactor top to insert a dummy element in place of the fuel element just removed.

QUESTION: 011 (1.00)

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

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 backlit signs in the containment building.

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

QUESTION: 012 (1.00)

A CO_2 purge is maintained to the Vertical Thimbles during reactor operation. Which ONE of the following is the reason for maintaining this purge?

a. To maintain a positive pressure in the thimbles to prevent filling with water in the event of a seal leak.

b. To limit the amount of tritium produced during reactor operation.

c. To provide cooling to the samples during irradiation.

d. To reduce the production of Argon-41 and prevent formation of Nitric acid.

QUESTION: 013 (1.00)

If the radiation monitor in the off-gas system detects abnormal radiation levels, the pool ventilation will be automatically secured. Protection from overpressure of the coolant system in this condition is provided by:

a. a Vacuum breaker on suction side of the off-gas blower.

b. a Blowout patch on the coolant storage tank.

c. the sample line connections between the isolation valves.

d. a relief valve on the off-gas discharge piping which relieves to the main ventilation exhaust plenum.

QUESTION: 014 (1.00)

Which one of the following is the alarm setting on the core outlet temperature recorder?

a. 50 °C

b. 53 °C

c. 55 °C

d. 60 °C

QUESTION: 015 (1.00)

Which ONE of the following Nuclear Instrumentation Channels provides input to the automatic reactor control system?

a. Channel 3

b. Channel 5

c. Channel 7

d. Channel 9

QUESTION: 016 (1.00)

Which ONE of the following radiation monitors can be used for estimating reactor power?

a. Argon-41

b. Reactor Top

c. Medical Room

d. Linear N-16

QUESTION: 017 (1.00)

Which ONE of the following describes the expected response in the event both door gaskets are deflated simultaneously on the Basement Air Lock?

a. Campus Patrol receives an "INTRUSION" alarm.

b. The reactor will automatically scram.

c. A "LOW PRESSURE AIR" alarm is received in the control room and reception area.

d. The Backup bottle of compressed air automatically supplies the door gaskets.

QUESTION: 018 (1.00)

If the normal heat removal path is NOT available for the Shutdown Cooling System, alternative cooling can be obtained from the:

a. fire protection system.

b. secondary cooling system.

c. city water supply to HE-2.

d. H2O medical shutter cooling system.

QUESTION: 019 (1.00)

Which ONE of the following describes the operator action(s) required to determine the location of a leak in the D_2O Leak Detection System?

a. TV camera displays are viewed to check areas for leaks on receipt of a sump level detector alarm.

b. The neon lamp that is illuminated on the leak alarm console is compared to the leak tape location list.

c. The neon lamp that is illuminated on the leak alarm console is extinguished by depressing the pushbuttons above the light one at a time, then referring to the leak tape location list.

d. With more than one leak tape in the same channel shorted then an operator must be dispatched to the affected areas, since the alarm can not be cleared until the leak tapes are replaced.

QUESTION: 020 (1.00)

Which ONE of the following actions should be performed to determine if the ion column resin is exhausted?

a. Measure the differential pressure drop across the ion column, if normal then the ion column resin is not exhausted.

b. Bypass the ion column flow and if the primary coolant conductance increases then the ion column is not exhausted.

c. Measure the inlet and outlet ion column conductivities, if both are increasing then the ion column is exhausted.

d. Determine if the temperature of the ion column has reached 53 degrees-C, if so then the ion column is exhausted.

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

ANSWER: 001 (1.00)
C
REFERENCE:
RSM 10.8

ANSWER: 002 (1.00)
D
REFERENCE:
RSM 10.9.2

ANSWER: 003 (1.00)
A
REFERENCE:
RSM

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

ANSWER: 005 (1.00)
D
REFERENCE:
MIT Reactor Physics Notes, Reactor Startup

ANSWER: 006 (1.00)
D
REFERENCE:
MIT Reactor Physics Notes, Reactor Startup; CR=S/(1-K)

ANSWER: 007 (1.00)
B
REFERENCE:
Glasstone, Nuclear Reactor Engineering, Chapter 5, Section 5.18; MIT Reactor Physics Notes, Reactor Kinetics, Section 6 a Calculations.

P=PoE*t/T P=2Po 2=E*t/30 Ln2=t/30 0.693=t/30 t=20.8

ANSWER: 008 (1.00)
D
REFERENCE:
MIT Reactor Physics Notes, Reactor Kinetics

ANSWER: 009 (1.00)
B
REFERENCE:
MIT Reactor Physics Notes, Reactor Kinetics

ANSWER: 010 (1.00)
A

REFERENCE:
Glasstone and Sesonske, Nuclear Reactor Engineering, Chapter 5, Section 5.47

ANSWER: 011 (1.00)
A
REFERENCE:
MIT Reactor Physics Notes, Reactivity Feedback and measurement of a Xenon Transient; RSM 10.6

ANSWER: 012 (1.00)
D
REFERENCE:
RSM 6.4

ANSWER: 013 (1.00)
D
REFERENCE:
Glasstone and Sesonske, Nuclear Reactor Engineering, Chapter 5, Section 5.114

ANSWER: 014 (1.00)
A
REFERENCE:
MIT Reactor Physics Notes, Reactivity Feedback

ANSWER: 015 (1.00)
C
REFERENCE:
MIT Reactor Physics Notes, Reactor Startup and Subcritical Multiplication

ANSWER: 016 (1.00)
C
REFERENCE:
T.S. 3.9

ANSWER: 017 (1.00)
A
REFERENCE:
Glasstone & Sesonke, Nuclear Reactor Engineering, Chapter 1, Section 1.51 & 1.52

ANSWER: 018 (1.00)
D
REFERENCE:
MIT Reactor Physics Notes, Reactor Startup and Subcritical Multiplication.

ANSWER: 019 (1.00)
B
REFERENCE:
MIT Reactor Physics Notes, Reactivity Feedback and Measurement of a Xenon Transient

ANSWER: 020 (1.00)

A. RX TI

C

REFERENCE:

T = (B-p)/(lambda x p); T= (1-0.1)/(0.1x0.1); T=90s

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

ANSWER: 001 (1.00)
A
REFERENCE:
MIT TS 6.1.1

ANSWER: 002 (1.00)
B
REFERENCE:
10CFR50.54 (x)

ANSWER: 003 (1.00)
B
REFERENCE:
T.S. 7.8.3

ANSWER: 004 (1.00)
D
REFERENCE:
TS 3.3

ANSWER: 005 (1.00)
C
REFERENCE:
PM 1.14.3

ANSWER: 006 (1.00)
D
REFERENCE:
AOP 5.0

ANSWER: 007 (1.00)
A
REFERENCE:
RRPO surveys

ANSWER: 008 (1.00)
A
REFERENCE:
PM 4.4.4.15

ANSWER: 009 (1.00)
B
REFERENCE:
RRPO surveys

ANSWER: 010 (1.00) ***DELETED***
C
REFERENCE:
DR= 6CE/(f)(f) = 5 = 6(2)(1.33)/x2, x2 = 3.19, x = 1.79 feet = 21.48 in

ANSWER: 011 (1.00)
C
REFERENCE:
$I = I_o e^{-\mu x} \rightarrow I = 1 R/hr\ e^{(-0.52 \times 2)} = 0.36$ R/hr

ANSWER: 012 (1.00)
A
REFERENCE:
Assume beta will not travel 10 feet in air, therefore 0.5 mr is gamma. Gamma dose at ½ ft is:
$(DR_1)(R_1^2) = (DR_2)(R_2^2) \rightarrow DR_2 = (DR_1)(R_1^2) / R_2^2 = 0.5 \text{ mr} \times 10 \text{ ft}^2 / 0.5 \text{ ft}^2 = 200$ mr/hr
Therefore, beta contribution at ½ ft is 2000 - 200 = 1800 mr/hr.
Beta contribution/Gamma contribution = 1800/200 = 9

ANSWER: 013 (1.00)
C
REFERENCE:
PM 4.4.4.11 Appendix A

ANSWER: 014 (1.00)
C
REFERENCE:
AOP 5.6.1

ANSWER: 015 (1.00)
B
REFERENCE:
RSM 3.2.7

ANSWER: 016 (1.00)
B
REFERENCE:
PM 1.15, p 1.

ANSWER: 017 (1.00)
C
REFERENCE:
PM 2.4, Step 3(a), p 3.

ANSWER: 018 (1.00)
A
REFERENCE:
E-Plan Sect. 4.3.1.2.1

ANSWER: 019 (1.00)
A
REFERENCE:
AOP 5.6.3

ANSWER: 020 (1.00)
B

B. NORI

REFERENCE:
PM 2.3.1

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

ANSWER: 001 (1.00)
D
REFERENCE:
RSM-9.3 to 9.5

ANSWER: 002 (1.00)
C
REFERENCE:
PM 5.2.10

ANSWER: 003 (1.00)
A
REFERENCE:
RSM-8.37

ANSWER: 004 (1.00)
A
REFERENCE:
PM 3.6 SAR Rev #36, SAR Section 12.1.1.2.

ANSWER: 005 (1.00)
A
REFERENCE:
RSM-7.6, Section 7.4.1

ANSWER: 006 (1.00)
A
REFERENCE:
RSM-6.4.1 and 6.4.2

ANSWER: 007 (1.00)
C
REFERENCE:
RSM-4.3

ANSWER: 008 (1.00)
A
REFERENCE:
RSM-8.12

ANSWER: 009 (1.00)
C
REFERENCE:
PM 3.3.1

ANSWER: 010 (1.00)
B
REFERENCE:
PM 3.3.1.1, Step 39

ANSWER: 011 (1.00)
B
REFERENCE:
PM 5.6.1, RSM 7.6

ANSWER: 012 (1.00)
D
REFERENCE:
RSM-2.9, Section 2.4

ANSWER: 013 (1.00)
B
REFERENCE:
RSM-3.4, Section 3.2.5

ANSWER: 014 (1.00)
B
REFERENCE:
PM 5.2.6

ANSWER: 015 (1.00)
D
REFERENCE:
RSM-5.9, Section 5.6.3

ANSWER: 016 (1.00)
D
REFERENCE:
RSM-5.1; -7.3

ANSWER: 017 (1.00)
B
REFERENCE:
RSM-8.10, Section 8.2.3

ANSWER: 018 (1.00)
C
REFERENCE:
RSM-3.4, Section 3.2.6; PM 5.2.8, Step B.2

ANSWER: 019 (1.00)
C
REFERENCE:
RSM-3.9, Section 3.3.6

ANSWER: 020 (1.00)
C
REFERENCE:
PM 5.2.12, Step 7; RSM-6.1, Section 6.2.1 and Table 6.1

C. PLAN

(********** END OF EXAMINATI

(***** END OF CATEGORY

020 019b 018bdac 017bdac 016bdac 015bdac 014bdac 013bdac 012bdac 011bdac 010bdac 009bdac 008bdac 007bdac 006bdac 005bdac 004bdac 003bdac 002bdac 001bdac MULTIPLE CHOICE (Circle your answer ...

A. RX TH

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

A N S W E R S H

020 a 019b a 018b a 017b a 016b a 015b a 014b a 013b a 012b a 011b a 010b a 009b a 008b a 007b a 006b a 005b a 004b a 003b a 002b a 001b a MULTIPLE CHOICE If you change your answer (Circle,

B. NOR

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

A N S W E R S H E E

020 0a19b 0a18bda17bda16bda15bda14bda13bda12bda11bda10bda09bda08bda07bda06bda05bda04bda03bda02bda01bdac_bdMULTIPLE CHOICE

C. PLAN

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

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

A N S W E R