October 17, 2007

Dr. David E. Moncton, Director
of Nuclear Reactor Lab
Nuclear Reactor Laboratory
Massachusetts Institute of Technology
138 Albany Street
Cambridge, MA 02139

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-020/OL-07-02, MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR (MITR-II).

Dear Dr. Moncton:

During the week of September 04, 2007, the U.S. Nuclear Regulatory Commission (NRC) administered an initial operator licensing examination at your MITR-II Reactor. The examination was conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed at the conclusion of the examination with those members of your staff identified in the enclosed report.

In accordance with Title 10, Section 2.390, of the Code of Federal 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 http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room). The NRC is forwarding the individual grades to Edward Lau of your staff in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Paul V. Doyle, Jr. at (301)415-1058 or via internet e-mail pvd@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. 50-020

Enclosures: 1. Examination Report No. 50-020/OL-07-02
2. Written Examination

cc w/enclosures:
Please see next page

October 17, 2007

Dr. David E. Moncton, Director
of Nuclear Reactor Lab
Nuclear Reactor Laboratory
Massachusetts Institute of Technology
138 Albany Street
Cambridge, MA 02139

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-020/OL-07-02, MASSACHUSETTS INSTITUTE OF TECHNOLOGY REACTOR (MITR-II).

Dear Dr. Moncton:

During the week of September 04, 2007, the U.S. Nuclear Regulatory Commission (NRC) administered an initial operator licensing examination at your MITR-II Reactor. The examination was conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed at the conclusion of the examination with those members of your staff identified in the enclosed report.

In accordance with Title 10, Section 2.390, of the Code of Federal 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 http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room). The NRC is forwarding the individual grades to Edward Lau of your staff in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Paul V. Doyle, Jr. at (301)415-1058 or via internet e-mail pvd@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. 50-020
Enclosures: 1. Examination Report No. 50-020/OL-07-02
2. Written Examination
cc w/enclosures:
Please see next page
DISTRIBUTION w/ encls.:
PUBLIC PRTB r/f RidsNrrDprPrtb
Facility File (CHart) O-12 G-15 RidsNrrDprPrta

ADAMS ACCESSION #: ML072630303 Package: ML071500005 **TEMPLATE #:NRR-074**

OFFICE	PRTB:CE		IOLB:LA		PRTB:SC	
NAME	PDoyle pd		CHart cah		JEads jhe	
DATE	10/16/2007		10/17/2007		10/17/2007	

OFFICIAL RECORD COPY

cc:

City Manager
City Hall
Cambridge, MA 02139

Department of Environmental Protection
One Winter Street
Boston, MA 02108

Director
Radiation Control Program
Department of Public Health
90 Washington Street
Dorchester, MA 02121

Nuclear Preparedness Manager
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

Edward Lau, Reactor Superintendent
Nuclear Reactor Laboratory
Massachusetts Institute of Technology
138 Albany Street
Cambridge, MA 02139

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

REPORT NO.: 50-020/OL-07-02

FACILITY DOCKET NO.: 50-020

FACILITY LICENSE NO.: R-37

FACILITY: MITR-II

EXAMINATION DATES: September 04 – 06, 2007

SUBMITTED BY: **/RA/** 10/16/07
Paul V. Doyle, Jr., Chief Examiner Date

SUMMARY:
During the week of September 03, 2007, the NRC administered operator licensing examinations to 7 operator licensing candidates, five for reactor operator, 1 for senior reactor operator (upgrade) and 1 for senior reactor operator (instant). All seven candidates passed all applicable sections of their operator licensing examinations.

REPORT DETAILS

1. Examiners: Paul V. Doyle, Jr., Chief Examiner
Phillip T. Young, Examiner

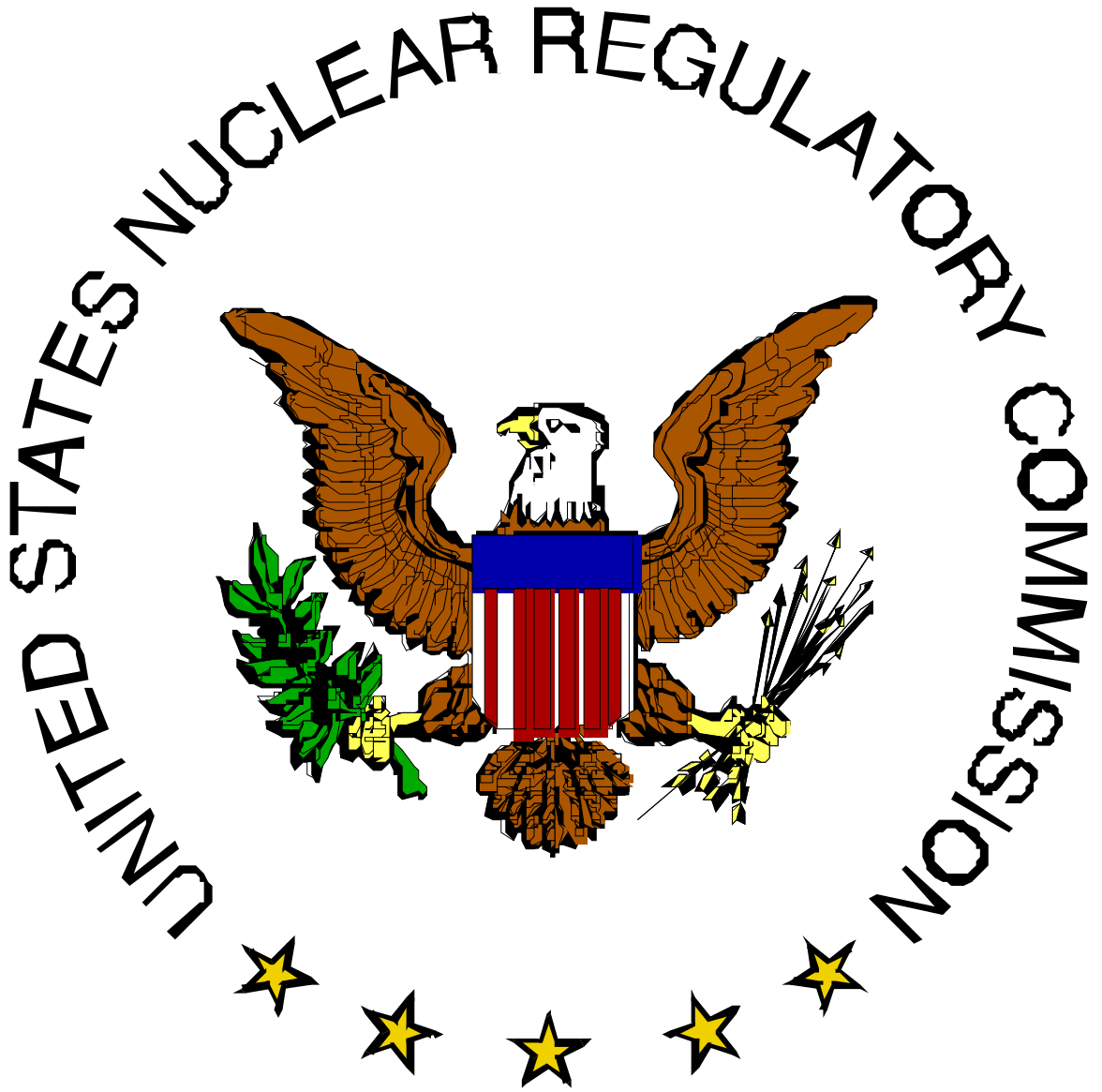
2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	5/0	1/0	6/0
Operating Tests	5/0	2/0	7/0
Overall	5/0	2/0	7/0

3. Exit Meeting:
Paul V. Doyle, Jr., NRC, Examiner
Edward Lau, MIT, Reactor Superintendent
Frank Warmsley, MIT, Operations Coordinator

The examiner thanked the facility staff for their support in the administration of the examination. The facility staff supplied the examiner with some minor changes to the examination (correction of typographical errors, and two instances where the facility equipment had been modified from the material used to create the examination). The examiners noted an improvement in the level of knowledge demonstrated by this years initial license candidates over previous years initial licensed candidates. The Upgrade candidate, on the other hand, had serious holes in his knowledge which should have been addressed by the facility training program prior to the administration of the NRC examination. We expect the facility training personnel to address these weaknesses with the candidate as soon as possible.

U.S. Nuclear Regulatory Commission
Operator Licensing Examination
WITH ANSWER KEY



Massachusetts Institute of Technology
September 04, 2007

QUESTION A.01 [2.0 points, 0.5 each]

Using the drawing of the Integral Rod Worth Curve provided, identify each of the following reactivity worths.

a. Total Rod Worth

b. Actual Shutdown Margin

c. Technical Specification Shutdown Margin Limit

d. Excess Reactivity

1. B - A
2. C - A
3. C - B
4. D - C
5. E - C
6. E - D
7. E - A

QUESTION A.02 [1.0 point]

Reactor power is rising on a 100 second period. Approximately how long will it take for power to double?

a. 35 seconds

b. 50 seconds

c. 70 seconds

d. 100 seconds

QUESTION A.03 [1.0 point]

During a fuel loading of the core, as the reactor approaches criticality, the value of 1/M:

a. Increases toward one

b. Decreases toward one

c. Increases toward infinity

d. Decreases toward zero

QUESTION A.04 [1.0 point]

The number of neutrons passing through a one square centimeter of target material per second is the definition of which one of the following?

a. Neutron Population (np)

b. Neutron Impact Potential (nip)

c. Neutron Flux (nv)

d. Neutron Density (nd)

QUESTION A.05 [1.0 point]

Given the following data, which ONE of the following is the closest to the half life of the material?

a. 11 minutes

b. 22 minutes

c. 44 minutes

d. 51 minutes

TIME	ACTIVITY
0	2400 cps
0 min.	1757 cps
0 min.	1286 cps
0 min.	941 cps
0 min	369 cps

QUESTION A.06 [1.0 point]

Which one of the following describes the characteristics of a good moderator?

a. Low scattering cross section and low absorption cross section

b. Low scattering cross section and high absorption cross section

c. High scattering cross section and low absorption cross section

d. High scattering cross section and high absorption cross section

QUESTION A.07 [1.0 point]

The neutron microscopic cross-section for absorption σ_a generally …

a. increases as neutron energy increases

b. decreases as neutron energy increases

c. increases as target nucleus mass increases

d. decreases as target nucleus mass increases

QUESTION A.08 [1.0 point]

With the reactor on a constant period, which of the following changes in reactor power would take the **LONGEST** time?

a. 5% — from 1% to 6%

b. 15% — from 20% to 35%

c. 20% — from 40% to 60%

d. 25% — from 75% to 100%

QUESTION A.09 [1.0 point]

You are assigned to check the operation of a new nuclear instrumentation channel. You know that the reactor will stabilize with a - 80 second period shortly after shutdown. To check the channel you measure the time for power to decrease by a factor of 10. This time should be approximately…

a. 45 seconds (¾ minute)

b. 90 seconds (1-½ minutes)

c. 135 seconds (2-¼ minutes)

d. 180 seconds (3 minutes)

QUESTION A.10 [1.0 point]

Which ONE of the following is the difference between prompt and delayed neutrons? Prompt neutrons …

a. account for less than 1% of the neutron population, while delayed neutrons account for the rest.

b. are released during only fast-fission events, while delayed neutrons are released during the decay process.

c. are released during the fission process (fast & thermal), while delayed neutrons are released during the decay process.

d. are the dominating factor in determining reactor period, while delayed neutrons have little effect on reactor period.

QUESTION A.11 [1.0 point]

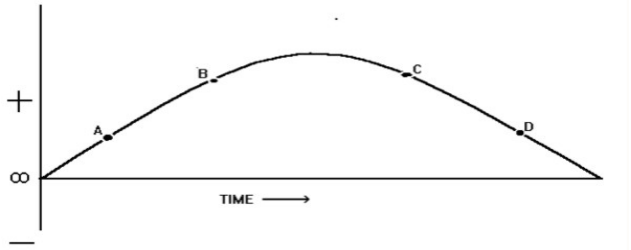
Shown below is a trace of reactor period as a function of time. Between points A and B reactor power is:
Note this was NOT the original drawing. For this drawing, the question should be between points A and D.

a. continually increasing.

b. continually decreasing.

c. increasing, then decreasing.

d. constant.



QUESTION A.12 [1.0 point]

Which ONE of the following statements correctly describes the concentration of Xenon in the core following a scram from extended operation at 5 Megawatts? Xenon concentration …

a. initially decreases due to the loss of Iodine production, then increases to maximum concentration.

b. decreases to a Xenon free condition in approximately 6 to 10 hours.

c. increases to maximum in approximately 6 to 10 hours due to the reduction in burnup.

d. remains at equilibrium, because without fission no new Xenon is being produced.

QUESTION A.13 [1.0 point]

Which ONE of the reactions below is an example of a **PHOTONEUTRON** source?

a. $_1H^2 + _0\gamma^0 \rightarrow _1H^1 + _0n^1$

b. $_{92}U^{238} \rightarrow _{35}Br^{87} + _{57}La^{148} + 3_0n^1 + _0\gamma^0$

c. $_{51}Sb^{123} + _0n^1 \rightarrow _1H^1 + _0\gamma^0$

d. $_4Be^9 + _2\alpha^4 \rightarrow _6C^{12} + _0n^1$

QUESTION A.14 [1.0 point]

ELASTIC SCATTERING is the process by which a neutron collides with a nucleus and …

a. recoils with the same kinetic energy it had prior to the collision

b. recoils with less kinetic energy than it had prior to the collision with the nucleus emitting a gamma ray.

c. is absorbed, with the nucleus emitting a gamma ray.

d. recoils with a higher kinetic energy than it had prior to the collision with the nucleus emitting a gamma ray.

QUESTION A.15 [1.0 point]

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 $ß_{eff}$

QUESTION A.16 [1.0 point]

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 A.17 [1.0 point]

Which one of the following conditions would ***INCREASE*** the shutdown margin of a reactor?

a. Inserting an experiment adding positive reactivity.

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

c. Depletion of a burnable poison.

d. Depletion of uranium fuel.

QUESTION A.18 [1.0 point]

Which one of the following is the principal source of heat in the reactor after a shutdown from extended operation at 5.0 MW?

a. Production of delayed neutrons

b. Subcritical reaction of photo-neutrons

c. Spontaneous fission of U^{238}

d. Decay of fission fragments

QUESTION A.19 [1.0 point]

Which one of the following statements describes why installed neutron sources are used in reactor cores?

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

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

c. To provide neutrons to initiate the chain reaction.

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

QUESTION B.01 [1.0 point]

Which ONE of the following situations would illustrate a time when the reactor is shutdown but ***NOT*** secured?

a. One of the control rods is removed for inspection while the other control rods are fully inserted and all fuel remains in the same configuration.

b. All control rods are fully inserted and fuel is being rearranged in the fuel storage pool.

c. The control rods are withdrawn to the subcritical position and the core is subcritical by 1% ΔK/K.

d. All control rods are fully inserted and an experiment having a negative reactivity effect is installed in the reactor.

QUESTION B.02 [1.0 point]

What action should be taken if the shim bank exceeds the estimated critical position (ECP) by more than 0.5 inches and the reactor has not reached criticality?

a. Continue withdrawing rods until the reactor is critical and note new rod heights in log book.

b. Immediately scram the reactor and follow the appropriate emergency procedure.

c. Notify the SRO on duty and continue under careful scrutiny.

d. Lower rods by 1 inch or more and determine the cause of the discrepancy.

QUESTION B.03 [2.0 points, ¼ each]

Identify whether each of the following plans and procedures are designated as Class A, Class B or Class C.

a. Administrative Procedure PM 1.10 *"Experiment Review and Approval"*

b. Abnormal Operating Procedure PM 5.3.3 *"Low Level D_2O Reflector"*

c. Administrative Procedure PM 1.16 *"Requalification Plan for Licensed Personnel"*

d. Standard Operating Plan PM 2.1 *"General Instructions"*

QUESTION B.04 [1.0 point]

What is the lowest level of supervision that can waive the daily surveillance check?

a. Operations coordinator.

b. Superintendent.

c. Shift supervisor.

d. Operator.

QUESTION B.05 [1.0 point]

In response to a "COOLING TOWER FANS OFF" alarm an attempt to restart the fans was unsuccessful. With the reactor operating at 4 MW the immediate action required is to:

a. perform a minor scram.

b. perform a major scram.

c. shut the secondary blowdown valves and monitor primary coolant flow.

d. depress the "ALL RODS IN" pushbutton and lower power to 1 MW or less.

QUESTION B.06 [2.0 points, ½ each]

Match type of radiation (a thru d) with the proper penetrating power (1 thru 4)

a. Gamma	1. Stopped by thin sheet of paper
b. Beta	2. Stopped by thin sheet of metal
c. Alpha	3. Best shielded by light material
d. Neutron	4. Best shielded by dense material

QUESTION B.07 [1.0 point]

Based on the Requalification Plan for licensed personnel, each licensed operator must complete a minimum of _____ reactivity manipulations during each 2 year cycle.

a. 4

b. 10

c. 20

d. 28

QUESTION B.08 [1.0 point]

With the reactor top shield **NOT** in place, the maximum allowed power level is …

a. 100 W

b. 1.0 kW

c. 10.0 kW

d. 100.0 kW

QUESTION B.09 [1.0 point]

Two senior reactor operators are operating the reactor at night. One receives a phone call for an emergency at home. They drive all the control rods in and shutdown the reactor. The minimum complement of personnel required to restart the reactor is to call in a 2nd person who is a …

a. student.

b. operator-in-training.

c. licensed operator

d. licensed senior operator

QUESTION B.10 [1.0 point]

A four inch thick steel plate reduces the gamma radiation dose rate from 60 mrem/hr to 6 mrem/hr. If a one inch plate of the same composition steel is added, the new dose rate will be …

a. 0.56 mrem/hr.

b. 1.50 mrem/hr.

c. 2.62 mrem/hr.

d. 3.37 mrem/hr.

QUESTION B.11 [1.0 point]

According to the Emergency Plan, the Emergency Planning Zone (EPZ) is

a. the area within the containment building including the airlocks.

b. the area included within the containment building, buildings NW-12 and NW-13 and the chain link fence surrounding the areas outside.

c. the area within a 100 foot radius of the containment building.

d. the area within a 100 meter radius of the containment building.

QUESTION B.12 [1.0 point]

Administrative Procedure 1.10.8 requires the use of tongs at least 6 inches long to handle irradiated rabbit samples. The reason for this control is the presence of probable high …

a. alpha radiation levels

b. beta radiation levels

c. gamma radiation levels

d. surface temperature of the polyethylene container

QUESTION B.13 [2.0 points, ½ each]

Identify each of the four surveillances listed as a channel **CHECK**, a channel **TEST**, or a channel **CAL**ibration.

a. During shutdown you verify operation of period channel by verifying power decreases by a factor of 10 in three minutes

b. Following maintenance on Nuclear Instrument channel 1 you compare its readings to Nuclear Instrument channel 2 readings.

c. You verify a temperature channel's operation by replacing the RTD with a precision variable resistance and checking proper output.

d. You a heat balance (calorimetric) on the primary system and based on Nuclear Instrumentation readings you make adjustments.

QUESTION B.14 [1.0 point]

Which one of the following materials requires monitoring of container during irradiation?

a. Metastable

b. Explosive

c. Corrosive

d. Radiolytically Decomposable

QUESTION B.15 [1.0 point]

Technical Specification defines a reportable occurrence as … "1. any actual safety system setting less conservative than specified in these Technical Specifications"…. Using this guidance, which one of the following is a reportable occurrence, if discovered during normal operations?

a. Nuclear Instrumentation Channel 4 High Flux scram setpoint is 5.7 MW

b. Main Tank Low coolant level scram setpoint is 4 inches below overflow pipe

c. Reactor Coolant Outlet temperature scram setpoint is 65°C

d. Primary coolant flow rate scram setpoint is 1750 gpm.

QUESTION B.16 [1.0 point]

During a frisk you discover one of your hands is contaminated. Which one of the following would be your initial attempt to remove the contamination?

a. Use of a mildly acidic solvent, rinsed with hot water.

b. Wash hand with soap and lukewarm water.

c. Wash hand with grit, and cold water.

d. Wipe hand with dry paper towels.

QUESTION B.17 [1.0 point]

N^{16} has a very short half-life. If you assume that it takes ***10 HALF-LIVES*** worth of time for the water to get from the core to the sample connection, then the activity due to N^{16} will have decrease by a factor of approximately ___ with respect to the level at the exit of the core.

a. 20

b. 100

c. 200

d. 1000

QUESTION C.01 [2.0 points, ¼ each]

Choice e changed to reflect facility modifications.
For purposes of this examination choice e was deleted.

Please identify each of the channel descriptions with the applicable oddly numbered channel (1, 3, 5, 7 or 9).

a. Uses **COMPENSATED** ion chamber with **NO** compensating voltage applied.

b. Uses two detectors an ion chamber and a fission chamber to detect neutrons.

c. Powered by a replaceable cell battery pack.

d. Uses a **COMPENSATED** ion chamber to detect neutron signal proportional to power level.

e. Uses an ~~ion chamber~~ fission chamber to detect ~~**GAMMA**~~ neutron signal proportional to power level.

f. Supplies power signal to the automatic control circuit.

g. Supplies High Flux scram at level corresponding to 5.5 MW.

h. Uses an **UNCOMPENSATED** ion chamber to detect neutron signal proportional to power level

QUESTION C.02 [1.0 point]

To prevent a catastrophic loss of pressure, all Differential Pressure system containment penetrations …

a. contain a 1/32 inch diameter orifice

b. have a quick shutting solenoid valve

c. are submerged in a “water seal trap”

d. have check valves preventing air from leaking into the containment.

QUESTION C.03 [1.0 point]

What is the purpose of the long hold up chamber, or plenum, in the exhaust air system?

a. To allow for the thorough measurement of the radiation levels in the exhaust air.

b. To enable the shorter lived activation products to decay before they are exhausted.

c. To filter out the particulates that would result in an airborne radiation release to the environment.

d. To delay the exhaust long enough for the butterfly dampers to close if the plenum monitor alarms.

QUESTION C.04 [1.0 point]

What is indicated when an alarm on the annunciator alarm (SCAM) panel is silent, but is continuously brightly lit?

a. The alarm condition has been corrected but not acknowledged.

b. The alarm condition has been acknowledged but not corrected.

c. The alarm condition has neither been acknowledged nor corrected.

d. The alarm condition has been acknowledged and corrected and only serves as a reminder to the operator.

QUESTION C.05 [1.0 point]
What is one of the purposes for the subcritical interlock?

a. To prevent the reactor from being manipulated to a critical position before the startup channels are switched from fission chambers to uncompensated ion chambers.

b. To provide a reference point where all instruments undergo a check before the reactor is brought to a critical position.

c. To allow for all experiments to be installed before the reactor is critical.

d. To ensure that a steady rate of startup to the critical position is achieved.

QUESTION C.06 [1.0 point]
The neutron absorbing sections of the shim control rods contain boron impregnated …

a. graphite

b. aluminum

c. cadmium

d. stainless steel

QUESTION C.07 [1.0 point]
Which one of the following flow detectors 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 C.08 [1.0 point]
Which one of the following conditions is NOT a cause of the “trouble radiation monitor alarm” occurring?

a. Loss of flow to any plenum monitor

b. Saturation of secondary water monitor

c. Low level on any effluent monitor

d. Loss of flow to any stack effluent monitor

QUESTION C.09 [1.0 point]

Which one of the following list the two radio-nuclides which will be seen by the detectors in the secondary water system signaling that there is a leak within one of the heat exchangers with the reactor operating normally (no fuel element failure)?

a. Xe^{135} and Ar^{41}

b. H^{3} and F^{18}

c. Ar^{41} and N^{16}

d. F^{18} and N^{16}

QUESTION C.10 [1.0 point]

What is the purpose of the coolant system for the lead thermal shields?

a. To maintain thermal equilibrium between the lead shields and the adjacent graphite reflector.

b. To maintain the thermal neutron shielding properties of the lead.

c. To prevent melting of the lead.

d. To prevent activation of lead by fast neutrons.

QUESTION C.11 [2.0 points, ½ each]

Choice c deleted per facility comment. Thermal column converted to fission converter for the new BNCT facility.

Match the reactor location or feature from Column I with the gas from Column II which is used as the primary cover or operating gas. Items in Column I have only one correct answer and items in Column II may be used once, more than once or not at all.

	Column I	Column II
a.	Graphite Reflector	1. CO_2
b.	Lead shutter region gas box	2. Ar^{40}
~~c.~~	~~Thermal Column~~	~~3. He~~
d.	Cover gas for D_2O reflector tank	4. N_2

QUESTION C.12 [1.0 point]

During an accident the Containment Building approaches its design pressure. Which one of the following is the design feature which provides over-pressure protection for the containment?

a. A pressure relief blower automatically initiates at 2.0 psig.

b. A containment relief valve will automatically open at 1.75 psig.

c. A manually operated relief valve may be opened to protect containment.

d. The main damper will cycle open and closed to maintain containment pressure less than 1.75 psig.

QUESTION C.13 [1.0 point]

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. H_2O medical shutter cooling system.

QUESTION C.14 [1.0 point]

In addition to Nuclear Instrumentation channels 1 through 9, reactor power may also be estimated using which ONE of the listed radiation monitors?

a. Argon-41

b. Reactor Top

c. Medical Room

d. Linear N-16

QUESTION C.15 [1.0 point]

Which ONE of the following statements correctly describes the "automatic rundown" interlock? With reactor control on …

a. automatic, if the regulating rod reaches the near-in limit the selected shim blade will run in after 30 seconds.

b. manual, if the regulating rod reaches the near-in limit the selected shim blade will run in after 30 seconds.

c. automatic, if the regulating rod reaches the near-in limit all shim blades will run in after 30 seconds.

d. automatic, if the regulating rod reaches the near-out limit, the selected shim blade will run in after 30 seconds

QUESTION C.16 [1.0 point]

Which ONE of the following is NOT a function associated with the reactor upper grid?

a. Trip primary pump if grid is unlatched.

b. Limit refueling to one element position at a time.

c. Ensure blades are fully inserted before a refueling is initiated.

d. Provide a position for source installation if counts are below minimum for a startup.

QUESTION C.17 [1.0 point]
How are the stack accumulators verified to be operable?

a. A signal is introduced into the detector and if the detector records readings, then it is operable.

b. The background signal is observed and compared to previously know background levels.

c. A check source is placed next to the detector and the value is compare to previous values.

d. The system is checked for the illumination of an error light.

QUESTION C.18 [1.0 point] **Note: 10 changed to 3 for future questions, no change to grading.**
Which ONE of the following describes an automatic response of the ventilation system?

a. If temperature of the outside air drops below approximately 35~~°~~F the intake fan will trip.

b. If the main intake damper fails to close within ~~10~~ 3 seconds of a trip signal, then the intake fan will trip.

c. If the auxiliary intake damper fails to close within ~~10~~ 3 seconds of a trip signal, then the main damper will close.

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

A.01 a, 7; b, 2; c, 1; d, 5
REF: Standard NRC Question

A.02 c
REF: $P = P_0 e^{t/T}$ —> ln(2) = time ÷ 100 seconds –> time = ln(2) x 100 sec. 0.693 x 100 ≈ 0.7 x 100 ≈ 70 sec.

A.03 d
REF:

A.04 c
REF:

A.05 b (22 minutes)
REF:

A.06 c
REF:

A.07 b
REF:

A.08 a.
REF: $P = P_0 e^{t/\tau}$ $\ln(P/P_0) = t/\tau$ You are looking for which would take the longest time therefore the ratio P/P_0 must be the largest.

A.09 d
REF: $P/P_0 = e^{-T/\tau}$ ln(0.1) = - T(time)/τ(-80sec) Time = ln (0.1) × -80 sec = 184 seconds ≈ 3 minutes

A.10 c
REF: Burn, R., Introduction to Nuclear Reactor Operations, © 1988, §

A.11 a
REF: Standard NRC Question[1]

A.12 c
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § xxxx

A.13 a
REF: Burn, R., *Introduction to Nuclear Reactor Operations,* © 1988, § 3.3.1, P. 3-16.

A.14 a or b. 2nd correct answer added per facility comment.
REF: DOE Fundamentals Handbook, Nuclear Physics and Reactor Theory, Volume

A.15 b
Ref: DOE Fundamentals Handbook, Nuclear Physics and Reactor Theory Volume 2, Module 4, Enabling Objective 2.8, p. 15.

A.16 c
Ref: DOE Fundamentals Handbook, Nuclear Physics and Reactor Theory Volume 2, Module 3, Enabling Objective 5.4, p. 51.

A.17 d
Ref: DOE Fundamentals Handbook, Nuclear Physics and Reactor Theory Volume 2, Module 4, Enabling Objective 3.6 p. 28.

A.18 d
Ref: DOE Fundamentals Handbook, Nuclear Physics and Reactor Theory Volume 1, Module 1, Enabling Objective 4.9, p. 61.

A.19 d
Ref: DOE Fundamentals Handbook, Nuclear Physics and Reactor Theory Volume 1, Module 1, Enabling Objective

B.01 d
REF: Technical Specifications 1.1 and 1.2. Also previous NRC examination

B.02 d
REF: PM 2.3 Page 2 of 7; PM 3.1.7

B.03 a, B; b, B; c, A; d, A
REF: AP1.4 "Review and Approval of Plans, Procedures, and Facility Equipment and Changes Thereto". Page 1 of 1.

B.04 b
REF: PM 2.2 Pg. 9 of 11

~~B.05 d~~ **Question deleted (no correct answer due to facility modifications).**
~~REF: PM 5.4.12~~

B.06 a, 4; b, 2; c, 1; d, 3
REF: Standard NRC Health Physics Question

B.07 b
REF: AP 1.16 *Requalification Plan for Licensed Personnel*, § 1.16.1.2a, On-the-Job Training

B.08 d
REF: TS 3.11.2.d

B.09 c
REF: AP 1.14 General Safety Rules § 1.14.1(3)

B.10 d
REF: $A_f = A_0 e^{-\mu x}$ $\ln(\frac{6}{60}) = -\mu(4 inches)$ $\mu = \frac{\ln(0.1)}{4} = 0.5756$ $A_f = 60\, e^{-0.5756(5 inches)} = 3.374$

B.11 d
REF:

B.12 b
REF: AP 1.10.8.1.1(11)

B.13 a, **CHECK or TEST**; B, **CHECK**; C, **TEST**; D, **CAL** **2nd correct answer for part a added due to examiner review.**
REF: MITR-II Tech Spec. §§ 1.12, 1.13 & 1.14

B.14 c
REF: MITR-II Tech. Spec. § 6.1, Table 6.1-1.

B.15 c or d. 2nd correct answer added per facility comment.
REF: MITR-II Tech. Spec. §§ 1.5 & 2.2 (Rewritten)

B.16 b
REF: PM 4.4.4

B.17 d
REF: $2^{10} = 1024 \approx 1000$

C.01 a, 3; b, 1; c, 3; d, 7; ~~e, 9~~; f, 9; g, 5; h, 5
Ref: Reactor Systems Manual, Chapter 5. **Choice e deleted (no correct answer due to facility modifications).**

C.02 a
REF: MITR-II Reactor Systems Manual § 6.7, p. 6-12

C.03 d
REF: RSM 8-14

C.04 b
REF: RSM 9-2

C.05 b
REF: MITR-II, Reactor System Manual § 4.3

C.06 d
REF: MITR-II Reactor Systems Manual, § 1.10

C.07 a
REF: MITR-II Training Program Sample Question C.24, also Reactor Systems Manual §§ 6.4.1 & 6.4.2.

C.08 b
REF: Reactor Systems Manual §§ 7.12 & 7.15 (Table 7.5-1)

C.09 d
REF: Reactor Systems Manual § 7.8

C.10 c
REF: Reactor Systems Manual § 3.16

C.11 a, 1; b, 1; ~~c, 1;~~ d, 3 Choice c deleted, Thermal Column was converted to a Fission Converter for the new BNCT medical facility.
REF: Reactor Systems Manual § 3.7

C.12 c
REF: Reactor Systems Manual § 8.23

C.13 c
REF: Reactor Systems Manual § 3.2.6; PM 5.2.8, Step B.2

C.14 d
REF: Reactor Systems Manual § 5.1

C.15 a
REF: Reactor Systems Manual § 4.5

C.16 d
REF: Reactor Systems Manual § 1.4

C.17 a
REF: PM 3.1.2.2 Pg. 1 of 14

C.18 a
REF: RSM-8.3.1