June 15, 2005

Dr. Patrick D. Gallagher, Director
NIST Center for Neutron Research
National Institute of Standards
and Technology
U. S. Department of Commerce
Gaithersburg, MD 20899

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-184/OL-05-02, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dear Dr. Gallagher:

During the week of May 16, 2005, the NRC administered an operator licensing examination at your Center for Neutron Research. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1.

In accordance with 10 CFR 2.390 of the Commission's regulations, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/indesx.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 Phillip T. Young at 301-415-4094 or via Internet e-mail at pty@nrc.gov.

Sincerely,

/RA/

Patrick M. Madden, Section Chief
Research and Test Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-184

Enclosures: 1. Initial Examination Report No. 50-184/OL-05-02
2. Facility Comments with NRC resolution
3. Examination and answer key (SRO)

cc w/encls.: Please see next page

National Institute of Standards
and Technology

Docket No. 50-184

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Examination Package Accession No.: ML050770247
Report Accession No.: ML051570443 **TEMPLATE #: NRR-074**

OFFICE	RNRP:E/UI		IROB:LA		RNRP:SC	
NAME	PYoung		EBarnhill		PMadden	
DATE	06/ 10 /2005		06/10 /2005		06/ 14 /2005	

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

REPORT NO.: 50-184/OL-05-02

FACILITY DOCKET NO.: 50-184

FACILITY LICENSE NO.: TR-5

FACILITY: NIST

EXAMINATION DATES: 05/17/2005

EXAMINER: Phillip T. Young, Chief Examiner

SUBMITTED BY: **/RA/** 06/10 /2005
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of May 16, 2005, NRC administered an Operator Licensing examination to one Senior Reactor Operator (SRO). The SRO candidate passed the examinations.

REPORT DETAILS

1. Examiners:
Phillip T. Young, Chief Examiner

2. Results:

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

2. Exit Meeting:
Phillip T. Young, NRC Chief Examiner
Tawfik Raby, NIST

The examiner thanked the facility for their support in conducting the examinations. The examiner did not have any generic observations to discuss with the facility.

ENCLOSURE 1

Facility Comments Regarding NRC Exam Administered on March 15, 2004

Question A.19

Facility Comment: Both answer a. and c. are correct.

NRC Resolution: Agree with comment. The answer key has been modified to show acceptance of either a. or c. as the correct answer to question A.19.

ENCLOSURE 2

U. S. NUCLEAR REGULATORY COMMISSION
NON-POWER INITIAL REACTOR LICENSE EXAMINATION (Examination with Answer Key}

FACILITY: NIST

REACTOR TYPE: TEST

DATE ADMINISTERED: 05/17/2005

CANDIDATE: _____

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

Category Value	% of Total	% of Candidates Score	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
22.00	33.3	_____	____	C. Facility and Radiation Monitoring Systems
62.00		_____	____%	TOTALS
		FINAL GRADE		

All work done on this examination is my own. I have neither given nor received aid.

_____
Candidate's Signature

Question A.001 [1.0 point] (1)

You enter the control room and note that **ALL** nuclear instrumentation show a **STEADY NEUTRON LEVEL**, and no rods are in motion. Which **ONE** of the following conditions **CANNOT** be true?

a. The reactor is critical.

b. The reactor is sub-critical.

c. The reactor is super-critical.

d. The neutron source has been removed from the core.

Answer: A.001 c.

Reference: Standard NRC Question[1]

Question A.002 [1.0 point] (2)

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 the mass of the target nucleus increases.

d. decreases as the mass of the target nucleus increases.

Answer: A.002 b.

Reference: Standard NRC Question[1]

Question A.003 [1.0 point] (3)

Which ONE of the four listed factors (of the six-factor formula) is greater than one for the NIST reactor?

a. Fast Fission Factor (ε)

b. Thermal Utilization Factor (f)

c. Thermal Non-Leakage probability (Λ_{th})

d. Resonance Escape probability (p)

Answer: A.003 a.

Reference: Standard NRC Question[1]

Question A.004 [1.0 point] (4)

Which one of the following is the correct reason that delayed neutrons allow human control of the reactor?

a. More delayed neutrons are produced than prompt neutrons.

b. Delayed neutrons increase the mean neutron lifetime.

c. Delayed neutrons take longer to thermalize than prompt neutrons.

d. Delayed neutrons are born at higher energies than prompt neutrons.

Answer: A.004 b.

Reference: Standard NRC Question[1]

Question A.005 [2.0 points, ½ each] (6)

Match type of radiation (Column A) with the proper penetrating power (Column B).

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 (low-z) material
d. Neutron	4. Best shielded by heavy (high-z) material

Answer: A.005 a. = 4;b. = 2; c. = 1; d. = 3

Reference: Standard NRC Question[1]

Question A.006 [1.0 point] (7)

Which one of the following figures most closely depicts the reactivity versus time plot for xenon for the following series of evolutions: (See attached figure(s) on last page of handout for choice selections.)

TIME	EVOLUTION
1	10 MW startup, clean core
2	Reduce power operate at 5 MW
3	Shutdown
4	Restart reactor operate at 5 Mw.

a. Figure a

b. Figure b

c. Figure c

d. Figure d

Answer: A.006 a.

Reference: Standard NRC Question[1]

Question A.007 [1.0 point] (8)

Using the Integral Rod Worth Curve provided identify which ONE of the following represents K_{excess}

a. Area under curve “B”.

b. ρ_C

c. $\rho_{max} - \rho_C$

d. Areas under curve “A” & “B”

Answer: A.007 c.

Reference: Standard NRC Question[1]

Question A.008 [1.0 point] (9)

Given that the NBSR is shutdown with a K_{eff} of 0.84, and β_{eff} is 0.008. Calculate the amount of reactivity required to achieve criticality.

a. 12.8$

b. 16$

c. 24$

d. 30$

Answer: A.008 c.

Reference: Standard NRC Question[1].
Also: $\rho = (K_{eff} - 1)/K_{eff}$ (0.84 - 1)/0.84 = -0.16/0.84 = -0.19 ΔK/K. 0.19/0.008 = $23.809 or $24

Question A.009 [1.0 point] (10)
To calibrate the shim arms, you measure doubling time then calculate period. If the doubling time was 42 seconds, which ONE of the following is the period?

a. 29 seconds

b. 42 seconds

c. 61 seconds

d. 84 seconds

Answer: A.009 c.

Reference: Standard NRC Question[1].
Also: period = (doubling time) ÷ (ln(2)) = 42/0.693 = 60.6 . 61

Question A.010 [1.0 point] (11)

Which ONE of the following is the correct definition of $\beta_{effective}$? The relative amount of delayed neutrons compared to the total number of neutrons …

a. per generation.

b. per generation corrected for leakage.

c. per generation corrected for time after the fission event.

d. per generation corrected for both leakage and time after the fission event.

Answer: A.010 b.

Reference: Standard NRC Question[1]

Question A.011 [1.0 point] (12)

Which ONE of the following is the reason that Xenon Peaks after a shutdown?

a. Iodine decays faster than Xenon decays

b. Promethium decays faster than Xenon decays

c. Xenon decays faster than Iodine decays

d. Xenon decays faster than Promethium

Answer: A.011 a.

Reference: Standard NRC Question[1]

Question A.012 [1.0 point] (13)

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)

Answer: A.012 c.

Reference: Standard NRC Question[1]

Question A.013 [1.0 point] (14)

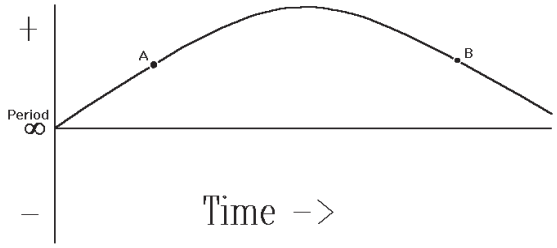
Shown below is a trace of reactor period as a function of time. Between points A and B reactor power is:

a. continually increasing.

b. continually decreasing.

c. increasing, then decreasing.

d. constant.



Answer: A.013 a.

Reference: Standard NRC Question[1]

Question A.014 [1.0 point] (15)

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.

Answer: A.014 c.

Reference: Standard NRC Question[1]

Question A.015 [1.0 point] (16)

To make a just critical reactor ***"PROMPT CRITICAL"***, by definition you must add reactivity equal to …

a. τ_{eff}

b. λ_{eff}

c. β_{eff}

d. K_{eff}

Answer: A.015 c.

Reference: Standard NRC Question[1]

Question A.016 [1.0 point] (17)

K_{eff} is K_4 times the

a. fast fission factor (ε)

b. reproduction factor (η)

c. total non-leakage factor ($\text{‹}_f \times \text{‹}_{th}$)

d. resonance escape probability (p)

Answer: A.016 c.

Reference: Standard NRC Question[1]

Question A.017 [1.0 point] (18)

Which ONE of the following is an example of beta (β) decay?

a. $_{35}Br^{87}$ —> $_{33}As^{83}$

b. $_{35}Br^{87}$ —> $_{35}Br^{86}$

c. $_{35}Br^{87}$ —> $_{34}Se^{86}$

d. $_{35}Br^{87}$ —> $_{36}Kr^{87}$

Answer: A.017 d.

Reference: Standard NRC Reactor Theory Question, Chart of the Nuclides

Question A.018 [1.0 point] (19)

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

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

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

c. recoils with the a lower kinetic energy than it had prior to the collision.

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

Answer: A.018 c.

Reference: Standard NRC Reactor Theory Question

Question A.019 [1.0 point] (20)

Which ONE of the following is the correct definition of ***REACTIVITY***? A measure of the core's …

a. deviation from criticality

b. fuel depletion

c. state with all control rods fully withdrawn

d. state at prompt criticality

Answer: A.019 a. or c. Per facility comment either a or c accepted as correct.

Reference: Standard NRC Reactor Theory Question

****** END OF SECTION A ******

Question B.001 [1.0 point] (1.0)

A gamma source reads 125 mR/hr @ 1 foot. How far from the source must you post a barrier for a radiation area?

a. 35

b. 25

c. 15

d. 5

Answer: B.001 d.

Reference: $A_f = A_0 (d_0/d_f)^2 \Rightarrow d_f^2 = A_0/A_f \times d_0^2 = 125/5 \times 1^2 = 25 \quad d_0 = 5$

Question B.002 [2.0 points, 0.5 each] (3)

Match each of the Technical Specification Limits in column A with its corresponding value in column B. (Each limit has only one answer, values in Column B may be used more once, more than once or not at all.)

Column A	Column B
a. Minimum negative reactivity added by moderator dump	15% Δρ
b. Absolute worth of any individual experiment	4.0% Δρ
c. Maximum Core Excess Reactivity	2.6% Δρ
d. The sum of the absolute Value of all experiments	1.0% Δρ
	0.5% Δρ

Answer: B.002 a. = 4% Δρ; b. = 0.5% Δρ; c. = 15% Δρ; d. = 2.6% Δρ

Reference: Technical Specifications § 4.0 (1) & (2), 3.3 (2)(b) and 3.4 Bases

Question B.003 [2.0 points, 0.5 each] (5)

Identify each of the following Technical Specification Requirements as being either a Safety Limit (SL) Limiting Safety System Setting (LSSS) or a Limiting Condition for Operation (LCO).

a. Minimum Coolant Flow (inner plenum) 60 gpm/MW

b. The reactor shall not be operated unless all four shim safety arms are operable.

c. The reactor shall not be operated unless at least one shutdown cooling pump is operable.

d. The reactor may be operated at power levels of up to 10 kW with reduced flow (including no flow) if decay heat is insufficient to cause significant heating of the reactor coolant.

Answer: B.003 a. = LSSS b. = LCO c. = LCO; d. = SL

Reference: Technical Specifications, 2.1 2nd specification, 3.2 1st specification, 3.4 1st specification and 2.2 3rd specification.

Question B.004 [1.0 point] (6)

According to the Administrative Rules, the ***MINIMUM*** number of nuclear instruments required for refueling is …

a. one on-scale instrument with trip safety function

b. two on-scale instruments with trip safety function

c. one on-scale instrument

d. two on-scale instruments

Answer: B.004 d.

Reference: Administrative Rule 3.0, § III.A, also Administrative Rule 6.0 § I.B.

Question B.005 [1.0 point] (7)

Although Tritium (H^3) has a radioactive half-life of 12 years, the relative damage to the body is less than many other radioisotopes with this long a half-life because …

a. it is a beta emitter.

b. it has a short (12 day) biological half-life.

c. it is not readily absorbed by the body.

d. it is an alpha emitter.

Answer: B.005 b.

Reference: Modified 1998 NBSR Requalification Examination.

Question B.006 [1.0 point] (8)

Which ONE of the following experiments does NOT require double encapsulation or a doubled walled container?

a. Fueled Experiment

b. Explosive experiment

c. Material corrosive to reactor

d. Material corrosive to experimental coolant

Answer: B.006 a.

Reference: Technical Specifications, § 4.0, Specifications (3) and (4).

Question B.007 [1.0 point] (9)

A radiation survey instrument was used to measure an irradiated experiment. The results were 100 mrem/hr with the window open and 60 mrem/hr with the window closed. What was the beta dose?

a. 40 mrem/hr

b. 60 mrem/hr

c. 100 mrem/hr

d. 140 mrem/hr

Answer: B.007 a.

Reference: Instrument reads only γ dose with window closed. Instrument reads both β and γ dose with window open. Therefore, β dose is window open dose less window closed dose.

Question B.008 [1.0 point] (10)

Which ONE of the following correctly completes the sentence. While the reactor is OPERATING, the process test switch may be placed in the "2 of 2" position …

a. for not longer than 8 hours to allow the checking of a channel's operability.

b. indefinitely if power is reduced below 10 MW before changing the selector's position.

c. up to a maximum of 12 hours if no experiments are inserted into the reactor.

d. while maintaining a steady power level but must be returned to the "1 of 2" position prior to changing power.

Answer: B.008 a.

Reference: Operation Instructions Manual, O.I. 5.7. "Operation of the Process Instrumentation Safety System", Page 2 of 3

Question B.009 [1.0 point] (11)

In regards to Emergency Health Physics Equipment located at the control room area, Which of the pairs of items would you expect to find.

a. protective clothing and an air sampler

b. portable emergency radios and an air sampler

c. a personnel decontamination kit and protective clothing.

d. a personnel decontamination kit and portable emergency radios

Answer: B.009 d.

Reference: Emergency Instructions E.I. 4.4, § II.C. {Modified from question B.15 on 05/22/02 NRC Exam, due to Facility comment.}

Question B.010 [1.0 point] (12)

Which **ONE** of the following statements correctly defines the term "Channel Test?"

a. The introduction of a signal into a channel and observation of the proper channel response.

b. The qualitative verification of acceptable performance by observation of channel behavior.

c. An arrangement of sensors, components and modules as required to provide a single trip or other output signal relating to a reactor or system operating parameter.

d. The adjustment of a channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures.

Answer: B.010 a.

Reference: TS, § 1.1.2

Question B.011 [1.0 point] (13)

If estimated critical position differs from actual critical position by more than one degree you must:

a. stop and recalculate the estimated critical position prior to further rod withdrawal.

b. shut down the reactor.

c. notify the Reactor Supervisor.

d. notify the Chief Nuclear Engineer.

Answer: B.011 c.

Reference: OI 1.1 § II.I p. 4 {Modified 1996 NBSR Requalification Examination Question}

Question B.012 [2.0 points, 0.5 each] (15)

Match the allowable voluntary radiation exposure limit authorized during an emergency listed in column B with the correct condition from column A.

Column A	Column B
a. Lifesaving; without approval of Emergency Director	5 REM
b. Other Serious Events; without approval of Emergency Director	10 REM
c. Lifesaving; with approval of Emergency Director	25 REM
d. Other Serious Events; with approval of Emergency Director	50 REM
	100 REM

Answer B.012 a. = 25; b. = 5;c. = 100; d. = 25

Reference: Emergency Instruction 1.5 *General Information,* § II *Voluntary Exposure Limits.*

Question B.013 [1.0 point] (16.0)

Per 10CFR55.53, an SRO who has not maintained active status must have an authorized representative of the facility licensee certify the following:

a. a minimum of **six** hours of shift functions under the direction of an operator or senior operator as appropriate and in the position to which the individual will be assigned has been completed.

b. a minimum of **four** hours of shift functions under the direction of an operator or senior operator as appropriate and in the position to which the individual will be assigned has been completed.

c. a minimum of **six** hours of shift functions under the direction of an operator or senior operator as appropriate and in the position to which the individual will be assigned has been completed and, that in part, the individual is current in all of the facility requalification program requirements.

d. a minimum of **four** hours of shift functions under the direction of an operator or senior operator as appropriate and in the position to which the individual will be assigned has been completed and, that in part, the individual has completed a requalification program written examination and operating test within the current calendar quarter.

Answer: B.013 c.

Reference: 10CFR55.53 and 10CFR55.59

Question B.014 [1.0 point] (17.0)
During shipment of spent fuel, the truck door was closed whenever time was spent loading baskets in the pool. The truck door was closed to.....

a. safeguard the fuel.

b. establish confinement integrity.

c. limit the spread of contamination.

d. prevent an unauthorized entry point.

Answer: B.014 b.

Reference: NBSR 1998 Requal Exam Question B.006

Question B.015 [1.0 point] (18.0)

You've detected a stuck regulating rod. Which ONE of the following is your immediate action(s) according to Annunciator Instruction 0.3?

a. Attempt to drive the regulating rod in until power decreases by 2%.

b. Drive all shim arms in verifying the stuck regulating rod fails to move.

c. Scram the reactor, noting the position of the stuck rod.

d. Control reactor power using the shim arms.

Answer: B.015 d.

Reference: Annunciator Instruction 0.3.

Question B.016 [1.0 point] (19)

A radiation work permit is written to allow performance of a non-repetitive task on potentially contaminated equipment. How long is the RWP allowed to remain in effect?

a. Until the job is completed.

b. Eight hours or until the end of the current shift

c. No longer than twenty-four hours.

d. Indefinitely, if reviewed daily by Health Physics.

Answer: B.016 a.

Reference: Health Physics Procedures H.P. 2.4. Also 1991 NRC examination

Question B.017 [1.0 point] (20)

Per Annunciator Procedure 0.1 *"D_2O System Rupture"*, Immediate Action, you would stop and isolate the shutdown cooling pumps and initiate top feed if vessel level falls below …

a. 60 inches.

b. 100 inches.

c. 140 inches.

d. 180 inches.

Answer: B.017 c.

Reference: Annunciator Procedures, A.P. 01 § III.A.

****** END OF SECTION B ******

Question C.001 [1.0 point] (1)

A ventilation Radiation Monitor located on the B1 level is supplied with air drawn by a blower from 10 points within the ventilation system. The primary purpose of this monitor is to monitor the concentration of

a. H^3

b. Ar^{41}

c. $Xe^{1331\text{-}135}$ (Fission Gases)

d. N^{16}

Answer: C.001 a.

Reference: NBSR Reactor Operations Training Guide, §6.4.7, page 52.

Question C.002 [2.0 points, 0.5 each] (3)

Match each type of gas listed with its correct purpose.

Gas		Purpose
a. Air	1.	Gas used in the Pneumatic Tube (Rabbit) System.
b. CO_2	2.	Used to operate ventilation system butterfly valves.
c. N_2	3.	Cover gas on primary system to prevent loss of D_2O.
d. He	4.	Backup to operate ventilation system butterfly valves.

Answer: C.002 a. = 2;b. = 1; c.= 4; d. = 3

Reference: NBSR Reactor Operations Training Guide,

Question C.003 [1.0 point] (4)

The ***MAIN*** purpose of the activated charcoal filters in the emergency exhaust systems is to absorb radioactive …

a. Tritium

b. Iodine

c. Argon

d. Nitrogen

Answer: C.003 b.

Reference: Modified NBSR Requalification Examination Question, 1998.

Question C.004 [1.0 point] (5)

Which ***ONE*** of the following signals does ***NOT*** generate a ***MAJOR SCRAM***?

a. High Irradiated Air Monitor Activity Level

b. High Normal Air Monitor Activity Level

c. High Stack Monitor Activity Level

d. High Fission Products Monitor Activity Level

Answer: C.004 d.
Reference: Rewrite of NBSR Requalification Exam administered April 1998.

Question C.005 [1.0 point] (6)

You discover several scratches on the outer plate of a fuel element. You inform the Reactor Supervisor who decides to use the element. The decision to use this element was

a. appropriate because the outer plates contain no fuel.

b. inappropriate because of the higher fuel loading of the outer plates.

c. inappropriate because it could lead to fission product release from the plate due to reduced cladding.

d. appropriate because the outer two plates are thicker than the inner plates, due to thicker cladding.

Answer C.005 a.

Reference: NBSR Requalification Exam administered April 1998.

Question C.006 [1.0 point] (7)

Following a major scram the ventilation system lineup …

a. must be reconfigured manually, the operator must start the dilution fan to maintain confinement pressure at no less than 0.25 inches negative.

b. must be reconfigured manually, the operator must secure the normal ventilation and start the emergency exhaust system which maintains confinement pressure at no less than 0.25 inches negative.

c. reconfigures automatically, the dilution fan energizes to maintain confinement pressure at no less than 0.25 inches negative.

d. reconfigures automatically, normal ventilation secures, and the emergency exhaust system maintains confinement pressure at no less than 0.25 inches negative.

Answer: C.006 d.

Reference: NBSR Reactor Operations Training Guide, § 4.10.3 1st & 2nd ¶s.

Question C.007 [1.0 point] (8)

Operation with the shim safety arms less than 12E is prohibited because …

a. the worth of the shim arms below this level is insignificant

b. the scram spring force is insufficient to overcome shock absorber resistance.

c. there is too much stress on the shim arm below this angle.

d. the scram spring force is insufficient to overcome the pressure differential due to full core flow.

Answer: C.007 b.

Reference: NBSR Reactor Operations Training Guide, § 1.3.5 4th ¶.

Question C.008 [1.0 point] (9)

Which ONE of the following is the material used as a neutron poison in the Regulating Rod?

a. Erbium

b. Cadmium

c. Aluminum

d. Boron

Answer: C.008 c.

Reference: NBSR Reactor Operations Training Guide, § 1.1.5 2nd ¶.

Question C.009 [2.0 points, 0.5 each] (11)

Identify each of the essential electrical loads listed as being powered by AC Only (AC), DC Only, (DC) or AC or DC (AC/DC).

a. Emergency Cooling Sump

b. D_2O Shutdown Pumps

c. Emergency Exhaust Fans (EF 5 and EF 6)

d. Annunciator Power and Evacuation Alarm

Answer: C.009 a. = AC; b. = AC/DC; c. = AC/DC; d. = DC

Reference: NBSR Training Guide, § 5.4, pp. 42-4328.

Question C.010 [1.0 point] (12)

Which ONE of the following Reactor Rundown Signals can NOT be bypassed?

a. Cold Source flow

b. Cold Source pressure

c. Reactor Outlet Temperature

d. Reactor Thermal Power.

Answer: C.010 c.

Reference: NIST Requalification Examination question administered January, 2000.

Question C.011 [1.0 point] (13)

WHICH ONE of the listed components within the Helium Sweep Gas system is responsible for the recombination of disassociated D_2 and O_2?

a. The ¼" thick aluminum vessel containing alumina-palladium pellets.

b. The 304 Stainless Steel cold Trap.

c. The ¼" aluminum plate tank containing an activated charcoal filter.

d. The 6061 aluminum cylinder Gas Holder.

Answer: C.011 a.

Reference: NBSR Training Guide, § 4.7.2, pp. 27-28.

Question C.012 [1.0 point] (14)

Which ONE of the following is the method used to get rid of radioactive liquid waste? Radioactive liquid waste is sent to Health Physics where it is

a. held, for decay of short lived isotopes then sampled for 10CFR20 limits and if satisfactory, pumped to the sewer system.

b. put through evaporators, filters ion exchangers, reducing the liquid waste to proper solid form.

c. diluted to less than 10CFR20 limits, then pumped to the sewer system.

d. tested for 10CFR20 limits, then pumped to the sewer system.

Answer: C.012 b.

Reference: NBSR Training Guide, § 4.1.2.2. 3rd ¶.

Question C.013 [1.0 point] (15)

The Compensated Ion Chambers used at NIST do not have the compensating voltage connected. The reason that compensating voltage is not required in your reactor is because …

a. The Deuterium in the primary absorbs many gammas (gamma-neutron reaction).

b. The Tritium in the primary absorbs many gammas (gamma-neutron reaction).

c. There are lead windows located between the core and the detectors which absorb many gammas.

d. A D_2O moderated core must be larger than an H_2O moderated core resulting in greater self-shielding of gammas.

Answer: C.013 c.

Reference: NBSR Training Guide, §§ 6.2.3 and 6.2.4, p. 46

Question C.014 [1.0 point, 0.25 each] (17)

Identify each of the parts of the Thermal Column from the figure provided. (Ignore cooling gap.)

Column A	Column B
a. A	1. Bismuth
b. B	2. Boral
c. C	3. D_2O
d. D	4. Graphite
	5. H_2O

Answer: C.014 a. = 3;b. = 1; c. = 2; d. = 4

Reference: NBSR Training Guide, Figure I.2.

Question C.015 [1.0 point] (18)

Which ONE of the following is the purpose of the thermal shield?

a. To thermalize neutrons for detection by nuclear instrumentation
b. To reduce the amount of gamma radiation heating of the biological shield.
c. To reduce the amount of gamma radiation reaching the nuclear instrumentation.
d. To reduce the amount of neutron radiation heating of the biological shield.

Answer: C.015 b.

Reference: NBSR Operations Training Guide, § 7.2 *Thermal Shield*

Question C.016 [1.0 point] (19)

Which ONE of the following is the reason that many D_2O valves are equipped with spark plugs?

a. To recombine D_2 and O leaking from the primary, thereby reducing explosion risk.
b. To detect primary leak due to a diaphragm rupture.
c. To detect open/closed position of valve.
d. To detect valve vibration due to excessive flow.

Answer: C.016 b.

Reference: NBSR Requalification Examination administered March 1996.

Question C.017 [1.0 point] (20)

Which ONE of the following is the method used to prevent over and under pressure conditions in the D_2O experimental cooling system.

a. Overpressure – relief valve, underpressure, centrifugal pump (speed automatically increases)

b. Backpressure regulator (DWV-25).

c. Manually increasing supply to other loads while shutting down one of the loads.

d. A surge tank with an air blanket (accumulator) maintains constant system pressure.

Answer: C.017 b.

Reference: NBSR Operations Training Guide, § 4.2.2.

Question C.018 [2.0 point, 0.5 each] (22)

Match the purification system primary functions in column A with the components in column B.

Column A	Column B
a. Remove suspended solid contaminants	1. Ion Exchangers
b. Remove dissolved contaminants	2. Filters
c. Maintain pH	
d. Reduce coolant conductivity	

Answer: C.018 a. = 2;b. = 1; c. = 1; d. = 1

Reference: NBSR Operations Training Guide, § 4.2 *Purification System*

****** END OF SECTION C******

*******END OF THE EXAMINATION*******