December 2, 2014

Dr. Sean O'Kelly, Manager of Operations and Engineering
NIST Center for Neutron Research
National Institute of Standards and Technology
U. S. Department of Commerce
100 Bureau Drive, Mail Stop 8561
Gaithersburg, MD 20899-8561

SUBJECT: EXAMINATION REPORT NO. 50-184/OL-15-01, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY REACTOR

Dear Dr. O'Kelly:

During the week of November 10, 2014, the NRC administered operator licensing examinations at your NIST reactor. The examinations were conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report at the conclusion of the examination.

In accordance with Title 10 of the Code of Federal Regulations Section 2.390, 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 NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Phillip T. Young at (301) 415-4094 or via internet e-mail Phillip.Young@nrc.gov.

Sincerely,

/RA/

Kevin Hsueh, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-184

Enclosures:
1. Examination Report No. 50-184/OL-15-01
2. Written examination as administered

cc without enclosures:
Please see next page

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ADAMS ACCESSION #: ML14328A451 NRR-074

OFFICE	NRR/DPR/PRTB:CE	E	NRR/DPR/IOLB:LA	E	NRR/DPR/PRTB:BC	
NAME	PYoung		CRevelle		KHsueh	
DATE	11/24/2014		12/01/2014		12/02/2014	

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cc:

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

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

REPORT NO.: 50-184/OL-15-01

FACILITY DOCKET NO.: 50-184

FACILITY LICENSE NO.: TR-5

FACILITY: NSBR

EXAMINATION DATES: November 12, 2014

SUBMITTED BY: **/RA/** 11/24/2014
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of November 10, 2014 the NRC administered licensing examinations to one Senior Reactor Operator-Instant (SROI) applicants. The applicant passed all portions of the examination.

ENCLOSURE 1

REPORT DETAILS

1. Examiners: Phillip T. Young, Chief Examiner, NRC

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

3. Exit Meeting:

An exit meeting was not conducted.

Section A Reactor Theory, Thermo, and Facility Characteristics

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

FACILITY: National Institute of Standards and Technology

REACTOR TYPE: Heavy Water cooled and moderated Tank

DATE ADMINISTERED: 11/12/2014

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.

% of Category Value	% of Total	Candidates Score	Category Value	Category
20.00	33.3	_____	____	A. Reactor Theory, Thermodynamics and Facility Operating Characteristics
21.00	33.3	_____	____	B. Normal and Emergency Operating Procedures and Radiological Controls
22.00	33.3	_____	____	C. Facility and Radiation Monitoring Systems
63.00		_____	____%	TOTALS
			FINAL GRADE	

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

_____
Candidate's Signature

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have neither received nor given assistance in completing the examination. This must be done after you complete the examination.

3. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

4. Use black ink or dark pencil <u>only</u> to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet and each answer sheet.

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

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

8. If the intent of a question is unclear, ask questions of the examiner only.

9. When turning in your examination, assemble the completed examination with examination questions, examination aids and answer sheets. In addition turn in all scrap paper.

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

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

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

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

Section A Reactor Theory, Thermo, and Facility Characteristics

EQUATION SHEET's

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

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

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

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

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

$$CR_1(-\rho_1) = CR_2(-\rho_2)$$

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

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

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

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

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

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

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

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

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

$$T_{‰} = \frac{0.693}{\lambda}$$

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

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

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

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

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

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

1 Curie = 3.7 x 10^{10} dis/sec
1 Horsepower = 2.54 x 10^3 BTU/hr
1 BTU = 778 ft/lbf
1 gal (H_2O) ≈ 8 lbm
c_P = 1.0 BTU/hr/lbm/ºF

1 kg = 2.21 lbm
1 Mw = 3.41 x 10^6 BTU/hr
ºF = 9/5 °C + 32
ºC = 5/9 (°F - 32)
c_p = 1 cal/sec/gm/ºC

Section A Reactor Theory, Thermo, and Facility Characteristics

Question: A.001 [1.0 point] (1.0)
A reactor scram has resulted in the instantaneous insertion of .003 ΔK/K of negative reactivity. Which ONE of the following is the stable negative reactor period resulting from the scram?

a. 45 seconds

b. 56 seconds

c. 80 seconds

d. 112 seconds

Answer: A.001 c
Reference: Lamarsh, J.R., Introduction to Nuclear Engineering, Addison-Wesley Publishing, Reading, Massachusetts, 1983. § 7.1, p. 289

Question: A.002 [1.0 point] (2.0)
Which ONE of the following correctly describes the behavior of the reactor as it approaches criticality during a startup. (Assume equal reactivity additions)

	Time to stabilize neutron count	Size of change in equilibrium neutron count
a.	longer	larger
b.	shorter	larger
c.	longer	smaller
d.	shorter	smaller

Answer: A.002 a.
Reference: Standard NRC Reactor Theory Question

Question: A.003 [1.0 point] (3.0)
Which ONE of the following combinations of characteristics make a good reflector?

	Scattering Cross Section	Absorption Cross Section
a.	High	High
b.	Low	High
c.	High	Low
d.	Low	Low

Answer: A.003 c.
Reference: Standard NRC Reactor Theory Question

Question: A.004 [1.0 point] (4.0)
In a subcritical reactor, Keff is increased from 0.861 to 0.946. Which ONE of the following is the amount of reactivity that was added to the reactor core?

a. 0.085 ΔK/K

b. 0.104 ΔK/K

c. 0.161 ΔK/K

d. 0.218 ΔK/K

Answer: A.04 b.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, Page 282
$\rho_1 = (0.861 - 1)/0.861 = -0.161\ \Delta k/k$ $\rho_2 = (0.946 - 1)/0.946 = -0.057\ \Delta k/k$
$\Delta\rho = \rho_2 - \rho_1 = -0.057 - (-0.161) = +0.104\ \Delta k/k$

Question: A.005 [1.0 point] (5.0)
Starting cooling tower fans resulted in a primary average temperature decrease of 5ºF from 105ºF to 100ºF. The regulating rod moved inward from 13" to 10". The moderator temperature coefficient is:

a. 1½¢/□F positive

b. 1½¢/□F negative

c. 2 ¢/□F positive

d. 2 ¢/□F negative

Answer: A.05 d.
Reference: NSBR - Requal Examination Addendum Additional questions

Question: A.006 [1.0 point] (6.0)
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.06 b.
Reference: Standard NRC Question[1]

Question: A.007 [1.0 point] (7.0)
A thin foil target of 10% aluminum atoms and 90% copper atoms is placed into a thermal neutron beam. Given σ_s = 1.49 and σ_a = 0.23 for aluminum and σ_s = 7.9 and σ_a = 3.79 for copper, determine the reaction with the highest probability. A neutron …

a. scattering reaction with aluminum

b. scattering reaction with copper

c. absorption in aluminum

d. absorption in copper

Answer: A.07 b.
Reference: Standard NRC Reactor Theory Question

Question: A.008 [1.0 point] (8.0)
Which one of the following characteristics of a material would result in the most efficient thermalization of neutrons?

a. LOW atomic mass number and HIGH scattering cross section.

b. HIGH atomic mass number and LOW scattering cross section.

c. LOW neutron absorption and LOW scattering cross section.

d. LOW neutron absorption and HIGH atomic mass number.

Answer: A.08 a.
Reference: Intro to Nuc Eng, John R. Lamarsh © 1983, § 3.5, pp. 59-60.

Question: A.009 [1.0 point] (9.0)
Given secondary flow through HE-1A & B is 9650gpm, HE-1A & 1B (Secondary Inlet Temperature) both read 80□F, HE-1A &1B secondary Outlet Temperature both read 91□F, and the Thermal Power constants for water is 147 watts/gpm-□F (H_2O), determine the current operating power.

a. 78%

b. 71%

c. 65%

d. 59%

Answer: A.09 a.
Reference: Previous NRC Exam administered 02/1991
Also: 9650gpm × 11□F × 142 watt/gpmºF= 15.6 × 10^6 watts;
15.6 × 10^6 ÷ 20.0 × 10^6 = 0.78 = 78%

Section A Reactor Theory, Thermo, and Facility Characteristics

Question: A.010 [1.0 point] (10.0)
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.10 c.
Reference: Standard NRC Question.
Also: period = (doubling time) ÷ (ln(2)) = 42/0.693 = 60.6 ≈ 61

Question: A.011 [1.0 point] (11.0)
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.11 b.
Reference: Standard NRC Question[1]

Question: A.012 [1.0 point] (12.0)
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.12 c.
Reference: Standard NRC Question[1]

Question: A.013 [1.0 point] (13.0)
What is the kinetic energy range of a thermal neutron?

a. > 1 MeV

b. 100 KeV – 1 MeV

c. 1 eV – 100 KeV

d. < 1 eV

Answer: A.13 d.
Reference: Standard NRC Question

Question: A.014 [1.0 point] (14.0)
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.14 c.
Reference: Standard NRC Question[1]

Question: A.015 [1.0 point] (15.0)
Given the Count Rate and number of fuel elements for a 1/M plot. Determine when the reactor will be critical.

Count Rate	# of Elements in Core
50	2
67	4
100	6

a. 8

b. 10

c. 12

d. 14

Answer: A.15 b.
Reference: Standard NRC Reactor Theory Question

Question: A.016 [1.0 point] (16.0)
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.16 c.
Reference: Standard NRC Reactor Theory Question

Question: A.017 [1.0 point] (17.0)
For U^{235}, the thermal fission cross-section is 582 barns, and the capture cross-section is 99 barns. When a thermal neutron is absorbed by U^{235}, the probability that fission will occur is:

a. 0.146

b. 0.170

c. 0.830

d. 0.855

Answer: A.017 d.
Reference: DOE Fundamentals Handbook, Module X,
Probability = $\sigma_f/(\sigma_f + \sigma_a)$ = 582/(528 + 99) = 582/681 = 0.855

Question A.018 [1.0 point] (18.0)
Inserting a shim arm predominantly affects K_{eff} by changing the …

a. fast fission factor

b. thermal utilization factor

c. neutron reproduction factor

d. resonance escape probability.

Answer: A.018 b.
Reference: Standard NRC Question

Question A.019 [1.0 point] (19.0)
As a reactor continues to operate over time, for a **CONSTANT** power level, the average **THERMAL** neutron flux…

a. decreases, due to the increase in fission product poisons.
b. increases, in order to compensate for fuel depletion.
c. decreases, because the fuel is being depleted.
d. remains the same

Answer: A.19 b.
Reference: Standard NRC Question

Question A.020 [1.0 point] (20.0)
Which statement best describes Xe-135 behavior following a Reactor Scram?

a. Xenon concentration decreases due to production rate from fission stops.
b. Xenon concentration decreases due to production rate from I-135 decay increasing.
c. Xenon concentration increases due to production rate from Pm-149 increasing.
d. Xenon concentration increases due to I-135 decay exceeding Xe-135 decay.

Answer: A.20 d.
Reference: Standard NRC Reactor Theory Question

Section B Normal/Emergency Procedures & Radiological Controls

Question B.001 [2.0 points, 0.4 each] (2.0)
Identify each of the following as either a Safety Limit (**SL**), Limiting Safety System Setting (**LSSS**) or a Limiting Condition for Operation (**LCO**).

a. Reactor Power 130%

b. Inner Plenum Flow 235 gpm/MW

c. D_2 concentration at 4% in helium sweep system

d. Reactor vessel level at 24" below overflow line

e. Reactor Operation exceeding applicable temperature line on either Figure 2.1 or 2.2 of Technical Specifications.

Answer: B.01 a. = LSSS; b. = LSSS; c. = LCO; d. = LCO; e. = SL
Reference: T.S. 2.0 through 2.3.

Question B.002 [2.0 points, 0.5 each] (4.0)
Identify each of the following actions as either an CHANNEL CHECK (**CHECK**), CHANNEL TEST (**TEST**) or CHANNEL CALIBRATION (**CAL**).

a. Verifying overlap between Nuclear Instrumentation channels.

b. Replacing a Resistance Temperature Detector (RTD) with a precision resistance decade box to verify proper channel output for a given resistance.

c. Performing a calorimetric (heat balance) on the primary system, then adjusting Nuclear Instrumentation to agree with results.

d. Placing a radioactive source next to a radiation detector, and verifying meter movement.

Answer: B.02 a. = CHECK; b. = TEST; c. = CAL; d. = TEST
Reference: T.S. § 1.0 DEFINITIONS

Question B.003 [1.0 points] (5.0)
During fuel movements in the vessel, which one of the following is **NOT REQUIRED**?

a. Confinement integrity shall be in force.

b. A Health Physics representative shall be present.

c. A licensed operator shall be stationed in the Control Room.

d. A communication system shall be in operation between the Control Room and the reactor top.

Answer: B.03 b.
Reference: OI 6.1, Fueling and Defueling Procedures

Question B.004 [1.0 points] (6.0)
During operation of the D_2O AUXILIARY SYSTEMS, which of the following should be avoided?

a. The pressure drop across the pre-filter is 6.0 psig (flow is normal).

b. Flow through an IX column is 20 gpm.

c. D_2O temperature of 135ºF

d. DWV-24 is closed

Answer: B.04 d.
Reference: OI 2.2, OPERATION OF THE D_2O AUXILIARY SYSTEMS

Question B.005 [1.0 points] (7.0)
Which ONE of the following correctly describes an automatic response of the Reactor Building Ventilation System?

a. SF-2 will shut down unit if the temperature on the outlet of the heating coils drops below 40°F

b. Filter F-2 on the suction of SF-2 has an automatic roll filter which will advance the filter when the ΔP becomes 0.5" H_2O across the filter.

c. Pressure switch 151 controls ACV-12, the building vacuum break - Open at 1.5" H_2O negative.

d. SPC-3 controls discharge damper D-3 on EF-3 to maintain the first floor 0.1" H_2O negative in relation to the High Bay area

Answer: B.05 a.
Reference: OI 4.8, REACTOR BUILDING VENTILATION SYSTEM

Question B.006 [1.0 points] (8.0)
The Emergency Plan allows which of the following voluntary radiation exposure limits without Emergency Director approval. Serious events _____ Rem or to save a life ____ Rem.

	Column A	Column B
a.	5	25
b.	5	50
c.	25	75
d.	25	100

Answer B.06 a.
Reference: Emergency Plan, 7.6 PROTECTIVE ACTION EXPOSURE GUIDELINES

Question B.007 [1.0 points] (9.0)
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.07 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.008 [1.0 points] (10.0)
According to Emergency Instructions, which one of the following lists the two individuals (by title) who may serve as Emergency Director until relieved by higher authority?

a. Reactor Supervisor, or in his absence the Reactor Operator on the console
b. Reactor Supervisor, or in his absence the Senior Reactor Operator.
c. Deputy Chief Engineer, or in his absence the Reactor Supervisor
d. Deputy Chief Engineer, or in his absence the Senior Reactor Operator

Answer: B.08 a.
Reference: E.I. Figure 6.1 NBSR Emergency And Support Organizations

Question B.009 [1.0 points] (11.0)
The CURIE content of a radioactive source is a measure of

a. the number of radioactive atoms in the source.
b. the amount of energy emitted per unit time by the source
c. the amount of damage to soft body tissue per unit time.
d. the number of nuclear disintegrations per unit time.

Answer: B.09 d.
Reference: Standard Health Physics Definition 10 CFR 20

Question B.010 [2.0 points, 0.5 each] (13.0)
Match the radiation reading from column A with its corresponding radiation area classification (per 10 CFR 20) listed in column B. (Assume gamma radiation)

COLUMN A	COLUMN B
a. 10 mRem/hr	1. Unrestricted Area
b. 150 mRem/hr	2. Radiation Area
c. 10 Rem/hr	3. High Radiation Area
d. 550 Rem/hr	4. Very High Radiation Area

Answer: B.10 a. = 2; b. = 3; c. = 3; d. = 4
Reference: 10 CFR 20.1003, Definitions

Question B.011 [1.0 point] (14.0)
A room contains a source which, when exposed, results in a general area dose rate of 175 millirem per hour. This source is scheduled to be exposed continuously for 35 days. Select an acceptable method for controlling radiation exposure from the source within this room.

a. Post the area with the words "Danger-Radiation Area".
b. Equip the room with a device to visually display the current dose rate within the room.
c. Equip the room with a motion detector that will alarm in the control room.
d. Lock the room to prevent inadvertent entry into the room.

Answer: B.11 d
Reference: 10CFR20.1601(a)(3)

Question B.012 [1.0 point] (15.0)
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.12 b.
Reference: Modified 1998 NBSR Requalification Examination.

Question B.013 [1.0 point] (16.0)
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.13 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.014 [1.0 point, 0.333 each] (17.0)
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. Absolute worth of any individual experiment	1. 15% Δρ
b. Maximum Core Excess Reactivity	2. 4.0% Δρ
c. The sum of the absolute Value of all experiments	3. 2.6% Δρ
	4. 1.0% Δρ
	5. 0.5% Δρ

Answer: B.14 a. = 0.5% Δρ; b. = 15% Δρ; c. = 2.6% Δρ
Reference: Technical Specifications § 3.1.2 (1) and 3.8.1 (1) and 3.8.1 (2)

Question B.015 [1.0 point] (18.0)
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.15 a.
Reference: Technical Specifications, § 3.8.2 Materials

Question B.016 [1.0 point] (19.0)
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.16 b.
Reference: TS, § 3.4.2
NBSR Reactor Operations Training Guide
8.1 Reactor Building And Confinement System

Question B.017 [1.0 point] (20.0)
In which of the following examples is entry into the Process Room and Sub-Pile Room **NOT** allowed:

a. with addition portable survey instruments.
b. during operations to check on a D_2O leak alarm or excessive noise
c. initial entry, after reactor shutdown upon approval of the person in charge of the shift or higher authority.
d. entry into the Sub-pile is permitted during irradiated fuel movement from or to the reactor vessel.

Answer: B.17 d.
Reference: A.R. 7.0 PROCESS ROOM AND SUB-PILE ROOM ENTRY

Question B.018 [1.0 point] (21.0)
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.18 d.
Reference: Annunciator Procedures 0.3.

Section C Facility and Radiation Monitoring Systems

Question C.001 [1.0 point] (1.0)
Which of the following instruments provide the best backup for the primary outlet flow for both information and trip function?

a. Primary inlet and outlet temperature.

b. HE-1A and HE-1B primary flow.

c. Overflow.

d. Inner and outer plena flows.

Answer: C.001 d.
Reference: NBSR 1998 Requal Exam Question C.012

Question C.002 [1.0 point] (2.0)
The reactor has been operating at full power for a week, when all commercial power is lost. How is decay heat removed from the core?

a. Natural Circulation flow due to large ΔT across core and inlet higher than outlet.

b. Natural Circulation flow due to large ΔT across core and outlet higher than inlet.

c. DC Shutdown pumps powered from emergency battery.

d. D_2O injection from Emergency tank.

Answer: C.02 c.
Reference: NBSR March 1994 Requalification examination

Question C.003 [1.0 point] (3.0)
An important function of the tritium monitor is to....

a. Monitor the confinement building for tritium in the air.

b. Monitor the secondary to detect a primary to secondary leak.

c. Continuously measure the tritium level in the primary system.

d. Monitor the releases to radwaste to detect the presence of tritium system.

Answer: C.003 a.
Reference: NBSR 1998 Requal Exam Question C.014

Question C.004 [1.0 point] (4.0)
Even though virtually no fission products are found in the helium sweep system, the fission products monitor, in the helium sweep system, usually indicates greater than 10,000 cpm at full power. This indication is mainly caused by:

a. Radiolytic gasses.
b. Nitrogen-16 formation.
c. Argon-41 formation from trapped air.
d. Tritium vapor from the primary coolant.

Answer: C.04 c.
Reference: NBSR 1998 Requal Exam Question

Question C.005 [1.0 point] (5.0)
Rod drop testing is in progress with the reactor in rod test. One shim is fully withdrawn, what will the result be if the operator begins to withdraw a second shim?

a. A console alarm to alert the operator not to withdraw the rod.
b. A major scram.
c. A rundown.
d. A scram

Answer: C.05 c.
Reference: NBSR Requal Exam Question

Question C.006 [1.0 point] (6.0)
Select the condition resulting in regulating rod control swapping from automatic to manual.

a. A control limit alarm is received
b. Servo deviation of 8%
c. Slight movement of the shim arm bank switch
d. Slight movement of the regulating rod switch

Answer: C.06 d.
Reference: NBSR 2006 Requailification Examination

Question C.007 [1.0 point] (7.0)
Which ONE of the following is the method used to prevent over and under pressure conditions in the D_2O experimental cooling system.

a. Backpressure regulator (DWV-25).

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

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

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

Answer: C.07 a.
Reference: NBSR Operations Training Guide, § 4.2.2.

Question C.008 [1.0 point] (8.0)
When operating at power, leakage from the primary coolant system to the secondary cooling system would be first detected by:

a. RM 3-2.

b. tritium monitors.

c. RM 3-1 and RM 3-3.

d. RM 4-1.

Answer: C.08 c.
Reference: NBSR 2006 Requailification Examination

Question C.009 [1.0 point] (9.0)
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.006 b.
Reference: NBSR Reactor Operations Training Guide,
4.10.3 Ventilation System Under Accident Conditions.

Section C Facility and Radiation Monitoring Systems

Question C.010 [2.0 point, ½ point each] (11.0)
Identify the type of detector (B^{10} Proportional Counter (**B^{10}**), Fission Counter (**FC**), Compensated Ion Chamber (**CIC**) or Uncompensated Ion Chamber(**UIC**)) utilized by each of the Nuclear Instrumentation channels listed below. (Note detector types may be used more than once or not at all.)

a. Source Channels 1& 2

b. Intermediate Range (Log-N) Channels 3 & 4

c. Linear Power and Automatic Regulating Rod Control Channel 5

d. Power Range Channels 6, 7 & 8.

Answer: C.10 a. = B^{10}; b. = CIC; c. = CIC; d. = UIC
Reference: NBSR Reactor Operations Training Guide,

Question C.011 [2.0 point, ½ point each] (13.0)
Match the instrumentation in column A with the type of protection afforded from column B.

Column A	Column B
a. Nuclear Instrumentation	1. Rundown ONLY
b. Process Instrumentation	2. Scram ONLY
c. Air Radiation Monitors	3. Rundown and Scram
d. Area Radiation Monitors	4. Major Scram
	5. NONE

Answe:r C.11 a. = 3; b. = 3; c. = 4; d. = 5
Reference: NBSR Requal exam.

Question C.012 [1.0 point] (14.0)
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.12 c.
Reference: NBSR Reactor Operations Training Guide, § 1.1.5 2nd ¶.

Question C.013 [1.0 point, 0.25 points each] (15.0)
Identify the valves listed below as either Motor Operated (**MO**)or Air Operated (**AO**).

a. DWV-1 Inner Plenum Flow Control (D_2O Main Cooling System)

b. DWV-2 Outer Plenum Flow Control (D_2O Main Cooling System)

c. DWV-40 D_2O supply to Emergency Tank (D_2O Auxiliary System)

d. DWV-19 Isolation between Core and Main Pump Piping (D_2O Main Cooling System)

Answer: C.13 a. = MO; b. = MO; c. = AO; d. = MO
Reference: NBSR Operations Training Guide, § 2.2.4 and Drawing 2.1

Question C.014 [1.0 point] (16.0)
WHICH ONE of the following correctly describes the lineup of Secondary Valves 1, 2 and 3?

a. SCV 1 & 2 supply suction to pumps 4, 5 and 6, SCV 3 supplies suction to pumps 1, 2 and 3.

b. SCV 2 & 3 supply suction to pumps 4, 5 and 6, SCV 1 supplies suction to pumps 1, 2 and 3.

c. SCV 1 & 2 supply suction to pumps 1, 2 and 3, SCV 3 supplies suction to pumps 4, 5 and 6.

d. SCV 2 & 3 supply suction to pumps 4, 5 and 6, SCV 1 supplies suction to pumps 1, 2 and 3.

Answer: C.14 a.
Reference: NBSR Operations Training Guide, Figure 3.1.

Question C.015 [1.0 point] (17.0)
Upon receipt of a major scram, RM 3-4 shifts from its normal measuring point to _____ , and RM 3-5 shifts from its normal measuring point to _____.

a. the outlet of SF-19; outlet of EF-5 and EF-6.

b. the outlet of EF-5; outlet of EF-6.

c. the outlet of SF-19; the outlet of EF-2.

d. the outlet of EF-5 and EF-6; the outlet of SF-19.

Answer: C.15 a.
Reference: NBSR Reactor Operations Training Guide

Section C Facility and Radiation Monitoring Systems

Question C.016 [1.0 points, ¼ each] (18.0)
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.16 a. = 2; b. = 1; c.= 4; d. = 3
Reference: NBSR Reactor Operations Training Guide,

Question C.017 [1.0 point] (19.0)
It is desired to provide emergency cooling via bottom feed. In order to accomplish this, the operator opens valves:

a. DWV-32 and DWV-33.
b. DWV-32 and DWV-34.
c. DWV-33 and DWV-35.
d. DWV-34 and DWV-35.

Answer: C.17 d.
Reference: NBSR 2006 Requailification Examination

Question C.018 [1.0 point] (20.0)
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.18 d.
Reference: NBSR Reactor Operations Training Guide
6.4 RADIATION MONITORING SYSTEMS.

Question C.019 [1.0 point] (21.0)
In the event of a complete loss of all heavy water cooling, core cooling can still be accomplished by:

a. the helium sweep system.
b. the CO_2 system.
c. the secondary cooling system.
d. potable water by installing spool piece.

Answer: C.19 d.
Reference: NBSR 2006 Requailification Examination

Question C.020 [1.0 point] (22.0)
Following a major scram the ventilation system lineup …

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

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

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

d. 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.

Answer: C.20 c.
Reference: NBSR Reactor Operations Training Guide,
4.10.3 Ventilation System Under Accident Conditions.