November 15, 2004

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-05-01, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dear Dr. Gallagher:

During the week of November 1, 2004, 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
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-184

Enclosures: 1. Initial Examination Report No. 50-184/OL-05-01
2. Examination and answer key (SRO)

cc w/encls.: Please see next page

National Institute of Standards
and Technology

Docket No. 50-184

cc:

Montgomery County Executive
County Office Building
Rockville, MD 20858

Director
Department of State Planning
301 West Preston Street
Baltimore, MD 21201

Director
Department of Natural Resources
Power Plant Siting Program
Energy and Coastal Zone Administration
Tawes State Office Building
Annapolis, MD 21401

Dr. Seymour H. Weiss, Chief
Reactor Operations and Engineering
National Institute of Standards
and Technology
U.S. Department of Commerce
Gaithersburg, MD 20899

Honorable Michael L. Subin
Montgomery County Council
Stella B. Werner Council Office Building
Rockville, MD 20850

Dr. William Vernetson
Director of Nuclear Facilities
Department of Nuclear
Engineering Sciences
University of Florida
Gainesville, FL 32611-8300

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DISTRIBUTION w/ encls.:
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ADAMS Package Accession No.: ML042100019
ADAMS Report Accession No.: ML043150231 **TEMPLATE #: NRR-074**

OFFICE	RNRP:E/UI	E	IROB:LA		RNRP:SC	
NAME	PYoung		EBarnhill		PMadden	
DATE	11/ 12 /2004		11/ 12 /2004		11/ 15 /2004	

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

REPORT NO.: 50-184/OL-05-01

FACILITY DOCKET NO.: 50-184

FACILITY LICENSE NO.: TR-5

FACILITY: NIST

EXAMINATION DATES: 11/04/2004

EXAMINER: Phillip T. Young, Chief Examiner

SUBMITTED BY: **/RA/** 11/09/2004
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of November 4, 2004, NRC administered Operator Licensing examinations to one Senior Reactor Operator (SRO). The one SRO candidate passed the examinations.

ENCLOSURE 1

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:

Licensee Representatives attending:

Tawfik Raby, NIST

Thomas Myers, Deputy Chief, Reactor Operations and Engineering

The examiner thanked the facility for their support in conducting the examinations. The examiner did not have any observation to discuss with the facility. The facility did not provide any comments on the written examination.

ENCLOSURE 2

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

FACILITY: NIST

REACTOR TYPE: TEST

DATE ADMINISTERED: 11/04/2004

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
21.00	33.3	_____	____	C. Facility and Radiation Monitoring Systems
61.00		_____	____%	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] {1.0}

NI-1 is indicating 50 cps. An experimenter inserts an experiment into the core, and NI-1 indication decreases to 25 cps. Given the initial K_{eff} of the reactor was 0.8, what is the worth of the experiment?

a. negative 0.42

b. positive 0.42

c. negative 0.21

d. positive 0.21

Answer: A.001 a.

Reference: SDM = $(1 - K_{eff})/K_{eff}$ = (1.0 - 0.8)/0.8 = 0.25 If counts decreased by 2, then distance to criticality was increased by 2. therefore added 0.25 negative

$$\frac{CR_1}{CR_2} = \frac{1-K_{eff_1}}{1-K_{eff_2}} \qquad \frac{50}{25} = \frac{1-0.8}{1-K_{eff_2}} \qquad \text{or} \qquad 1-K_{eff_2} = 2\times 0.2 = 0.4 \qquad \text{Therefore} \qquad K_{eff_2} = 0.6 \qquad \text{which implies}$$

$$\rho = \frac{K_{eff_2}-K_{eff_1}}{K_{eff_1}K_{eff_2}} = \frac{0.6-0.8}{0.8\times 0.6} = \frac{-0.2}{0.48} = -0.41667$$

QUESTION A.002 [1.0 point] {2.0}

Given the lowest of the high power scrams is 124%, and the scram time is 0.5 sec. Approximately how high will reactor power get with a 20 second period? (NOTE: this is a theory question, there is no relation to Tech. Spec. limit.)

a. 124%

b. 127%

c. 131%

d. 200%

Answer: A.002 b.

Reference: $P = P_0 e^{t/\tau}$ P_o = 124% τ = 20 sec. t = 0.5 $P = 124\ e^{0.5/20}$ = 127.1%

QUESTION A.003 [1.0 point] {3.0}

Which ONE of the following is the dominant factor in determining differential rod worth?

a. Rod speed

b. Total Reactor Power

c. Axial and Radial Flux

d. Delayed neutron fraction

Answer: A.003 c.

Reference: Standard NRC Theory Question

QUESTION A.004 [1.0 point] {4.0}

With the reactor on a ***CONSTANT*** period, which ONE of the following transients will take the ***LONGEST*** time to complete? A reactor increase from …

a. 1 to 5% of full power.

b. 10 to 20% of full power.

c. 20 to 35% of full power.

d. 40 to 60% of full power.

Answer: A.004 a.

Reference: time is proportional to P/P_0 5/1 > 20/10 > 35/20 > 60/40

QUESTION A.005 [1.0 point] {5.0}

Which ONE of the following is the MAJOR source of energy released from the fission process?

a. Kinetic energy of the fission neutrons

b. Kinetic energy of the fission fragments

c. Decay of the fission fragments

d. Prompt gamma rays

Answer: A.005 b.

Reference: Standard NRC Reactor Theory Question

QUESTION A.006 [1.0 point] {6.0}

The term ***PROMPT JUMP*** refers to …

a. the instantaneous change in power due to moving a control element.
b. a reactor which has attained criticality on prompt neutrons alone.
c. a reactor which is critical using both prompt and delayed neutrons.
d. a negative reactivity insertion which is greater than β_{eff}.

Answer: A.006 a.

Reference: Standard NRC Reactor Theory Question

QUESTION A.007 [2.0 points] {8.0}

Match the neutron terms in column A with their corresponding description in Column B.

Column A	Column B
a. Fast neutrons	1. Neutrons released within 10^{-5} sec of fission
b. Prompt neutrons	2. High energy neutrons
c. Slow neutrons	3. Neutrons released by decay of fission products
d. Delayed neutrons	4. Low energy neutrons

Answer: A.007 a, 2; b, 1; c, 4; d, 3

Reference: Standard NRC Reactor Theory Question

QUESTION A.008 [1.0 point] {9.0}

You are performing a startup from a very low reactor power level. If you establish a 26 second period, approximately how long will it take to increase reactor power by a factor of 1000?

a. 1 minutes

b. 3 minutes

c. 10 minutes

d. 30 minutes

Answer: A.008 b.

Reference: Standard NRC Question: SUR = 26/τ 26/26 = 1 SUR = time in[1.0] minutes to increase power by a factor of 10. 1000 = three decades 3 × 1 = 3 minutes.

QUESTION A.009 [1.0 point] {10.0}

Most nuclear text books list the delayed neutron fraction (β) as being 0.0065Δρ. Most research reactors however have an effective delayed neutron fraction ($\beta_{effective}$) of 0.0070 Δρ. Which ONE of the following is the reason for this difference?

a. Delayed neutrons are born at higher energies than prompt neutrons resulting in a greater worth for the neutrons.

b. Delayed neutrons are born at lower energies than prompt neutrons resulting in a greater worth for the neutrons.

c. The fuel includes U^{238} which has a relatively large β for fast fission.

d. The fuel includes U^{238} which via neutron absorption becomes Pu^{239} which has a larger β for fission.

Answer: A.009 b.

Reference: Standard NRC Reactor Theory Question

QUESTION A.010 [1.0 point] {11.0}

A fast neutron will lose the most energy in a collision with which ONE of the following atoms?

a. H^{1}

b. H^{2}

c. C^{12}

d. U^{238}

Answer: A.010 a.

Reference: Standard NRC Reactor Theory Question

QUESTION A.011 [1.0 point] {12.0}

Which ONE of the following is the reason for an installed neutron source within the reactor? A startup without a neutron source …

a. is impossible as there would be no neutrons available to start the fission process.

b. would be very slow due to the long time to build up neutron population from so low a level.

c. could result in a very short period due to the reactor going critical before neutron population can build up high enough to be read on nuclear instrumentation.

d. can be compensated for by adjusting the compensating voltage on the source range detector.

Answer: A.011 c.

Reference: Standard NRC Reactor Theory Question

QUESTION A.012 [1.0 point] {13.0}

Given the Count Rate and # 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.012 b.

Reference: Standard NRC Reactor Theory Question

QUESTION A.013 [1.0 point] {14.0}

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.013 a.

Reference: Standard NRC Reactor Theory Question

QUESTION A.014 [1.0 point] {15.0}

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.014 c.

Reference: Standard NRC Reactor Theory Question

QUESTION A.015 [1.0 point] {16.0}

Which ONE of the following is the time where the ***MAXIMUM*** amount of xenon is in the core?

a. four to six hours following startup to 100% power
b. eight to twelve hours following shutdown from 100% power
c. four to six hours following increase from 50% to 100% power.
d. eight to twelve hours following decrease from 100% to 50% power.

Answer: A.015 b.

Reference: Standard NRC Reactor Theory Question

QUESTION A.016 [1.0 point] {17.0}

Starting cooling tower fans resulted in a primary average temperature decrease of 5EF from 105EF to 100EF. The regulating rod moved inward from 13" to 10". The moderator temperature coefficient is:

a. 1½¢/EF positive

b. 1½¢/EF negative

c. 2 ¢/EF positive

d. 2 ¢/EF negative

Answer: A.016 d.

Reference: NSBR - Requal Examination Addendum Additional questions

QUESTION A.017 [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.017 b.

Reference: Standard NRC Question

QUESTION A.018 [1.0 point] {19.0}

Given secondary flow through HE-1A & B is 9650gpm, HE-1A & 1B (Secondary Inlet Temperature) both read 80EF, HE-1A &1B secondary Outlet Temperature both read 91EF, and the Thermal Power constants for water is 147 watts/gpm-EF (H_2O), determine the current operating power.

a. 78%

b. 71%

c. 65%

d. 59%

Answer: A.018 a.

Reference: NRC Exam administered 02/1991
Also: 9650gpm × 11EF × 142 watt/gpmEF = 15.6×10^6 watts;
$15.6 \times 10^6 \div 20.0 \times 10^6 = 0.78 = 78\%$

QUESTION A.019 [1.0 point] {20.0}

Which ONE of the following reactor changes require a control rod INSERTION to return reactor power to its initial level following the change?

a. Buildup of Xe^{135}

b. Formation of N^{16} in the coolant.

c. Removal of an experiment with positive reactivity from the reactor.

d. A fault in the automatic system resulting in a primary coolant temperature decrease.

Answer: A.019 d.

Reference: Standard NRC Question

****

THIS IS END OF SECTION A
REACTOR THEORY, THERMO, AND FACILITY CHARACTERISTICS

****

QUESTION B.001 [1.0 point] {1.0}

Total Effective Dose Equivalent (TEDE) is defined as the sum of the deep dose equivalent and the committed dose equivalent. The deep dose equivalent is related to the …

a. dose to organs or tissues.

b. external exposure to the skin or an extremity.

c. external exposure to the lens of the eye.

d. external whole-body exposure.

Answer: B.001 d.

Reference: 10CFR20.1201

QUESTION B.002 [1.0 point] {2.0}

Two sheets of ¼ inch thick lead reduce a radiation beam from 200 mR/hr to 100 mR/hr at one foot. Which ONE of the following will be the radiation measurement at 1 foot if you add another two (for a total of 4) ¼ inch lead sheets?

a. 71

b. 50

c. 35

d. 17

Answer: B.002 b.

Reference: A ½ thickness is 2 sheets. $I = I_0 (½)^2$ = 200 mR/hr × 0.25 = 50. mR/hr.

QUESTION B.003 [1.0 point] {3.0}

Which ONE of the following is the ***LOWEST*** level of NIST management who may authorize reactor startup (to previous shim position) following a scram, where the cause of the scram remains unknown?

a. Reactor Operator
b. Senior Reactor Operator
c. Reactor Supervisor
d. Deputy Chief Engineer

Answer: B.003 b.

Reference: O.I. 1.1B (Checklist B) step I.B.

QUESTION B.004 [2.0 points ¼ each] {5.0}

Match the actions in column A with the nuclear instrumentation readings in column B. (Note items from column b may be used more than once or not at all.)

Column A	Column B
a. Bypass NC-3/4 period automatic functions`	1. NC-3/4 at 2×10^{-10} amps
b. Switch Scram Logic Selector to 2 of 3	2. NC-6/7/8 on scale
c. Secure HV to NC-1/2	3. NC-6/7/8 > 10%
d. Power Range Scram Setpoint to 125%	4. NC-6/7/8 > 20%

Answer: B.004 a. = 3; b. = 2; c. = 1; d. = 2

Reference: O.I. 1.1 § III Notes after steps 9 & 13, also step 11.

QUESTION B.005 [1.0 point] {6.0}

Which ONE of the following conditions would require an immediate halt to any fuel handling in progress?

a. Calculations determine that the shutdown margin has decreased to twenty-five cents ($0.25) above the most reactive shim arm.

b. The reactor supervisor approves a request for 2 personnel to enter the Process Room.

c. The Control Room Operator notes a step change while reading NC-1, from 10 cps to 150 cps that steadies out at 90 cps.

d. Nuclear Instrumentation channel NC-3 fails down scale with NC-1, 2 and 4 still operable.

Answer: B.005 c.

Reference: O.I. 6.2, § II.N, p. 3.

QUESTION B.006 [1.0 point] {7.0} QUESTION B.007 [1.0 point] {8.0}

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.006 d.

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

QUESTION B.007 [1.0 point] {8.0}

The emergency plan allows the operator to take action which deviates from emergency procedures during an emergency. Which ONE of the following is the minimum level of staff who may authorize this action?

a. Reactor Operator
b. Senior Reactor Operator
c. Emergency Director
d. Emergency Coordinator

Answer: B.007 c.

Reference: Emergency Instructions Introduction, ¶ 2.

QUESTION B.008 [1.0 point] {9.0}

According to Emergency Instruction 1.2, 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.008 b.

Reference: E.I.1.1 page 1, E.I.1.2

QUESTION B.009 [1.0 point] {10.0}

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.009 c.

Reference: 10CFR55.53 and 10CFR55.59

QUESTION B.010 [1.0 point] {11.0}

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.010 b.

Reference: NBSR 1998 Requal Exam Question B.006

QUESTION B.011 [1.0 point] {12.0}

Beam shutter keys are only issued to:

a. the Beam Coordinator.

b. the principal experimenter.

c. Reactor Operations and Health Physics.

d. authorized users of the specific beam tube or guide tube.

Answer: B.011 c.

Reference: NBSR 1998 Requal Exam Question B.010

QUESTION B.012 [1.0 point] {13.0}

An RWP was prepared and signed by Health Physics to perform maintenance work in a High Radiation Area. For the RWP to be valid, approval of _____ must also be obtained.

a. None, only Health Physics Approval is required.

b. The Chief, or Deputy Chief, Reactor Operations.

c. The licensed Senior Operator.

d. The duty Reactor Supervisor

Answer: B.012 d.

Reference: NBSR 1998 Requal Exam Question B.012

QUESTION B.013 [1.0 point] {14.0}

For fuel to be self-protecting, the level of radiation emitted must be at least 100 R/hr at 3 feet without intervening shielding. A recent shipment of spent fuel had the following characteristics:

* Number of pieces per cask 84
* Total activity per cask 26,000 Ci
* Average radiation emission energy 1 Mev

Assume that each fuel piece has the same activity level, the radiation emitted per piece at three feet without intervening shielding is about:

a. six times the allowable limit.

b. four times the allowable limit

c. twice the allowable limit

d. the allowable limit

Answer: B.013 c.

Reference: NBSR 1998 Requal Exam Question B.017
26000/84 = 309.5;R/Hr = 6CE/ft^2 = 6 x 309.5 x 1 / 3^2; 1857/9 = 206.3 R/hr

QUESTION B.014 [1.0 point] {15.0}

A Notice of Unusual Event emergency declaration **was** made based a Level (1) indication on RD4-2. The **current** Health Physics survey indicates the projected dose downwind at the edge of the emergency planning zone will be 5 mrem for 24 hours. What action should be taken based on the current survey information?

a. Upgrade the emergency level to a Site Area Emergency.

b. Upgrade the emergency level to an Alert level.

c. Maintain the current Unusual Event emergency level.

d. Terminate the emergency.

Answer: B.014 d.

Reference: NBSR 1998 Requal Exam Question B.018

QUESTION B.015 [1.0 point] {16.0}

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] {17.0}

Which ONE of the following Reactor Run-Downs is ***REQUIRED*** by Technical Specifications?

a. High Thermal Power (BTUR)

b. High Reactor Outlet Temperature

c. Low Reactor Vessel Level.

d. Low Thermal Shield Cooling System Flow.

Answer: B.016 b

Reference: NBSR Requalification Examination administered March 1996.
Also T.S. § 2.2, p. 4.

QUESTION B.017 [1.0 point] {18.0}

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.

QUESTION B.018 [1.0 point] {19.0}

While working in an area marked ***"Caution, Radiation Area,"*** you discover your dosimeter is off scale and leave the area. Assuming you had been working in the area for 45 minutes, what is the maximum dose you would have received?

a. 3.8 mr

b. 35.6 mr

c. 75 mr

d. 100 mr

Answer: B.018 c.

Reference: Standard NRC stay time calculation question

QUESTION B.019 [1.0 point] {20.0}

Per Annunciator Procedure 0.7, you must shutdown the reactor if emergency cooling H_2O pressure drops below …

a. 45 psig

b. 35 psig

c. 25 psig

d. 15 psig

Answer: B.019 c.

Reference: Annunciator Procedures, A.P. 0.7.

****

THIS IS END OF SECTION B
NORMAL, EMERGENCY AND RADIOLOGICAL
CONTROL PROCEDURES

****

QUESTION C.001 [1.0 point] {1.0}

You notice that when a shim arm is driven in, it stops at about two to three degrees, yet when you scram, the shim arm stops below one degree. Which ONE of the following is the reason for this?

a. A scram is spring assisted, pushing the shim arm lower.

b. The weak shim arm motor, has too little torque to overcome the shock absorber.

c. Shim drive stop lower limit switches are designed to prevent damage due to driving the shim arm in continuously.

d. Deenergizing the scram magnet causes a change in impedance causing the readout for the shim arm to be more accurate at lower levels.

Answer: C.001 c.

Reference: Rewrite of NBSR Requalification Examination QUESTION administered March 1994.

QUESTION C.002 [1.0 point] {2.0}

Which ONE of the following core components bear all impact loads associated with the safety-shims?

a. Thermal Shield

b. Upper grid plate

c. Biological Shield

d. Lower grid plate

Answer: C.002 c.

Reference: NBSR Operations Training Guide, § 1.3.5

QUESTION C.003 [1.0 point] {3.0}

If a Secondary cooling pump trips off due to an overload, prior to restarting you must …

a. place the control room switch to off to reset the pump electrically.

b. place the control room switch to the on position (the pump resets itself electrically).

c. have an auxiliary operator push a reset button on the controller locally at the pump.

d. have an auxiliary operator take the local, auto switch to local to reset the pump, then return the switch to auto.

Answer: C.003 a.

Reference: NBSR Training Manual, § 3.2.1.

QUESTION C.004 [1.0 point] {4.0}

During a transient for which the reactor fails to scram, the operator uses moderator dump to shutdown the reactor. Which ONE of the following actions does NOT occur when the moderator dump valve is taken to the ***OPEN*** position?

a. Main Secondary Cooling Pumps trip

b. Reactor Scram Signal is initiated

c. Main D_2O Pumps trip

d. Reactor primary coolant drains to the D_2O storage tank.

Answer: C.004 a.
Reference: Annunciator Procedure 4.2 *AN 4-2, Moderator Dump* page 1.

QUESTION C.005 [1.0 point] {5.0}

During a loss of ALL AC power, the battery (by design) will supply power for at least …

a. 2 hours

b. 4 hours

c. 8 hours

d. 16 hours

Answer: C.005 b.

Reference: NBSR Ops Trn Guide, § 5.2.3 *Emergency Distribution* p. 45.

QUESTION C.006 [1.0 point] {6.0}

Emergency D_2O cooling is being provided by the inner reserve and emergency tanks. All water is directed into the core through the top feed. Which ONE of the following is the approximate time coolant will be provided by both tanks?

a. ½ hour

b. 2½ hours

c. 5 hours

d. 7½ hours

Answer: C.006 b.

Reference: NBSR Requalification examination administered March 1994 (Rewrite).

QUESTION C.007 [1.0 point] {7.0}

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. D_2O injection from Emergency tank.

d. DC Shutdown pumps powered from emergency battery.

Answer: C.007 d.

Reference: NBSR Requalification Examination administered March 1994 (Rewrite).

QUESTION C.008 [2.0 points ¼ each] {9.0}

Match the types of 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.008 a. = 3; b. = 3; c. = 4; d. = 5

Reference: NBSR Requal exam questions administered March 1994 (Rewrite).

QUESTION C.009 [1.0 point] {10.0}

Assuming no operator action, approximately how long will the Inner Reserve Tank supply water to the top of the core?

a. 10 minutes
b. 30 minutes
c. 1 hour
d. 3 hours

Answer: C.009 b.

Reference: NBSR Operations Training Guide, § 4.1.3

QUESTION C.010 [1.0 point] {11.0}

Which ONE of the following is the pressure at which the 100# air compressor starts?

a. 95 psi

b. 90 psi

c. 85 psi

d. 80 psi

Answer: C.010 b.

Reference: NBSR Annunciator Procedure A.P AN 2-34

QUESTION C.011 [1.0 point] {12.0}

The operation mode will switch from automatic to manual if the regulating rod reaches its upper or lower limit or if the operator uses the withdraw/insert reg. rod switch or if there is a power deviation equal to or greater than …

a. 2%

b. 5%

c. 10%

d. 15%

Answer: C.011 c.

Reference: NBSR Reactor Operations Instruction Manual O.I 5.4.

QUESTION C.012 [1.0 point] {13.0}

Which ONE of the following is the design feature which reduces the activation of the fuel transfer mechanisms?

a. Poisoned Hold-down Tubes

b. Experimental Thimbles

c. Top Grid Plate Insert

d. Top D_2O Reflector

Answer: C.012 a.

Reference: NBSR Operations Training Guide, § 1.5.2

QUESTION C.013 [1.0 point] {14.0}

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:

3. Radiolytic gasses.
4. Nitrogen-16 formation.
5. Argon-41 formation from trapped air.
6. Tritium vapor from the primary coolant.

Answer: C.013 c.

Reference: NBSR 1998 Requal Exam Question C.007

QUESTION C.014 [1.0 point] {15.0}

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.
2. HE-1A and HE-1B primary flow.
3. Overflow.
4. Inner and outer plena flows.

Answer: C.014 d.

Reference: NBSR 1998 Requal Exam Question C.012

QUESTION C.015 [1.0 point] {16.0}

Subcritical and critical are indicated on the log-N and linear channels charts by.....

a. A continuous vertical line for both subcritical and critical for both channels.

b. A continuous vertical line for log-N and an exponential curve for linear for both subcritical and critical.

c. A slopping straight line in the negative for subcritical and a vertical line for critical for both channels.

d. A slopping straight line in the negative for subcritical and a slopping straight line in the positive for critical for both channels.

Answer: C.015 a.

Reference: NBSR 1998 Requal Exam Question C.013

QUESTION C.016 [1.0 point] {17.0}

On a loss of commercial power, the emergency diesel generators normally will **NOT** supply power to which of the following equipment?

a. Helium blowers.

2. Thermal shield cooling pumps.

3. Primary shutdown cooling pumps.

4. Primary main cooling pumps.

Answer: C.016 d.

Reference: NBSR 1998 Requal Exam Question C.014

QUESTION B.017 [1.0 point] {18.0}

An important function of the tritium monitor is to....

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

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

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

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

Answer: C.017 a.

Reference: NBSR 1998 Requal Exam Question C.014

QUESTION C.018 [1.0 point] {19.0}

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.

2. A major scram.

3. A rundown.

4. A scram

Answer: C.018 c.

Reference: NBSR 1998 Requal Exam Question C.014

QUESTION C.019 [2.0 points, ½ point each] {21.0}

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.019 a. = B^{10} Counter; b. = CIC; c. = CIC; d. = UIC

Reference: NBSR Reactor Operations Training Guide,

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THIS IS END OF SECTION C
FACILITY AND RADIATION MONITORING SYSTEMS

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THIS IS END OF THE EXAMINATION

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