September 22, 2006

Dr. Wade J. Richards
NIST Center for Neutron Research
National Institute of Standards and Technology
100 Bureau Road
Mail Stop 85601
Gaithersburg, MD 20899

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-184/OL-06-02, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dear Dr. Richards:

During the week of August 28, 2006, 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/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 Phillip T. Young at 301-415-4094 or via Internet e-mail at pty@nrc.gov.

Sincerely,

/RA/

Johnny Eads, Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-184

Enclosures:
1. Initial Examination Report No. 50-184/OL-06-02
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

cc:

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County Office Building
Rockville, MD 20858

Director
Department of State Planning
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Baltimore, MD 21201

Director
Department of Natural Resources
Power Plant Siting Program
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Honorable Michael L. Subin
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Stella B. Werner Council Office Building
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DISTRIBUTION w/ encls.:
PUBLIC RNRP\R&TR r/f JEads AAdams Facility File (EBarnhill) O-6 F-2

ADAMS ACCESSION #: ML062580436 **TEMPLATE #:NRR-074**

OFFICE	PRTB:CE	IOLB:LA	PRTB:SC
NAME	PYoung:tls*	EBarnhill*	JEads:tls*
DATE	09/19/2006	09/21/2006	09/22/2006

OFFICIAL RECORD COPY

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

REPORT NO.: 50-184/OL-06-02

FACILITY DOCKET NO.: 50-184

FACILITY LICENSE NO.: TR-5

FACILITY: NIST

EXAMINATION DATES: 08/31/2006 and 09/01/2006

EXAMINER: Phillip T. Young, Chief Examiner

SUBMITTED BY: **/RA/** 09/12/2006
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of August 28, 2006, NRC administered an Operator Licensing examination to two Senior Reactor Operators (SRO). Both SRO candidates 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**	**2/0**	**2/0**
Operating Tests	**0/0**	**2/0**	**2/0**
Overall	**0/0**	**2/0**	**2/0**

2. Exit Meeting:
Phillip T. Young, NRC Chief Examiner
Dr. Wade Richards Chief, Operations and Engineering
Tom Meyers, Deputy for Operations
Tawfik Raby, NIST fellow

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 August 31, 2006

NONE

ENCLOSURE 2

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

FACILITY: NIST

REACTOR TYPE: TEST

DATE ADMINISTERED: 08/31/2006

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
18.00	33.3	_____	____	C. Facility and Radiation Monitoring Systems
58.00		_____ FINAL GRADE	____%	TOTALS

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)
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.001 b.
Reference Standard NRC Reactor Theory Question

Question: A.002 [1.0 point] (2.0)
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.002 c
Reference: Lamarsh, J.R., Introduction to Nuclear Engineering, Addison-Wesley Publishing, Reading, Massachusetts, 1983. § 7.1, p. 289

Question: A.003 [1.0 point] (3.0)
The reactor is shutdown by 0.05 ΔK/K, this would correspond to K_{eff} of:

a. 0.9995.

b. 0.9524.

c. 0.7750.

d. 0.0500.

Answer: A.003 b.
Reference: Lamarsh, J.R., Introduction to Nuclear Engineering, Addison-Wesley Publishing, Reading, Massachusetts, 1983. § 4,1,
p. 102 & § 7.1, p. 282. p=(k-1)/k; p= -0.05; -0.05k = k-1; 1 = k-(-0.05k) = k(1+0.05); k=1/1.05; k=0.9524

Question: A.004 [1.0 point] (4.0)
Which statement best describes Xe-135 behavior following a Rx 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.004 d.
Reference: Standard NRC Reactor Theory Question

Question: A.005 [1.0 point] (5.0)
An initial count rate of 100 is doubled five times during startup. Assuming an initial K_{eff} = 0.950, what is the new K_{eff}?

a. 0.957

b. 0.979

c. 0.988

d. 0.998

Answer: A.005 d.
Reference: $CR1/CR2 = (1 - K_{eff2})/(1 - K_{eff1})$ $1/32\ (1 - 0.95) = 1 - K_{eff2}$
$1 - 0.05/32 = Keff2$ $K_{eff2} = 0.9984$

Question: A.006 [1.0 point] (6.0)
Which ONE of the following describes "EXCESS REACTIVITY"?

a. Extra reactivity into the core due to the presence of the source neutrons.

b. A measure of the resultant reactivity if all of the control elements were withdrawn.

c. The combined reactivity worth of control rods and other poisons needed to keep the reactor shutdown.

d. The maximum reactivity insertion with the reactor shutdown with control rods fully inserted under peak Xenon conditions.

Answer: A.006 b.
Reference: Standard NRC Reactor Theory Question

Question: A.007 [1.0 point] (7.0)
If reactor power is increasing by a decade every minute, it has a period of:

a. 13 sec

b. 26 sec

c. 52 sec

d. 65 sec

Answer: A.007 b
Reference: Glasstone, S. and Sesonske, A, Nuclear Reactor Engineering, Kreiger Publishing, Malabar, Florida, 1991, § 5.18, p. 234.

Question: A.008 [1.0 point] (8.0)
Which ONE of the following conditions would increase shutdown margin?

a. An experiment which added positive reactivity.

b. Depletion of the burnable poison added to the uranium fuel.

c. Depletion of uranium fuel.

d. Decreasing fuel temperature.

Answer: A.008 c.
Reference: Adding negative reactivity increases the shutdown margin.

Question: A.009 [1.0 point] (9.0)
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.009 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.010 [1.0 point] (10.0)
The fuel temperature coefficient of reactivity is -1.25×10^{-4} ΔK/K/°C. When a control rod with an average rod worth of 0.1 % ΔK/K/inch is withdrawn 10 inches, reactor power increases and becomes stable at a higher level. At this point, the fuel temperature has:

a. increased by 80°C

b. decreased by 80°C

c. increased by 8°C

d. decreased by 8°C

Answer: A.010 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, Page 306
Reactivity added by control rod = +(0.001 Δk/k/inch)(10 inches) = 0.01 Δk/k.
Fuel temperature change = -Reactivity added by rod / fuel temperature coefficient
Fuel temperature change = (-0.01 Δk/k) / (-1.25×10^{-4} Δk/k/°C) = 80°C.

Question: A.011 [1.0 point] (11.0)
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.011 a.
Reference: *Intro to Nuc Eng,* John R. Lamarsh © 1983, § 3.5, pp. 59-60.

Question: A.012 [1.0 point] (12.0)
Which ONE of the following is the time period in which the maximum amount of Xe^{135} will be present in the core?

a. 7 to 11 hours after a startup to 100% power

b. 3 to 6 hours after a power increase from 50% to 100%.

c. 3 to 6 hours after a power decrease from 100% to 50%.

d. 7 to 11 hours after a scram from 100%

Answer: A.012 d.
Reference: *Intro to Nuc Eng,* John R. Lamarsh © 1983, § 7.4 Figure 7.13, p. 322.

Question: A.013 [1.0 point] (13.0)
Which ONE of the following statements describes the Nuclear Instrumentation response for a rod withdrawal while the reactor is subcritical? (Assume the reactor remains subcritical)

a. Count rate will rapidly increase (prompt jump), then gradually increase to a new stable value.

b. Count rate will rapidly increase (prompt jump), then gradually decrease to the initial value.

c. Count rate will rapidly increase (prompt jump) to a new stable value.

d. Count rate will not change until criticality is reached.

Answer: A.013 a.
Reference: *Intro to Nuc Eng,* John R. Lamarsh © 1983, § 7.1, pp. 286-258.

Question: A.014 [1.0 point] (14.0)
Which factor in the six factor formula is represented by the ratio:

$$\frac{\text{number of neutrons that reach thermal energy}}{\text{number of neutrons that start to slow down}}$$

a. fast non-leakage probability (L_f)

b. resonance escape probability (p)

c. reproduction factor (η)

d. thermal utilization factor (f)

Answer: A.014 b.
Reference: *Intro to Nuc Eng,* John R. Lamarsh © 1983, § 6.5 p. 239.

Question: A.015 [1.0 point] (15.0)
Which ONE of the following is true concerning the differences between prompt and delayed neutrons?

a. Prompt neutrons account for less than 1% of the neutron population while delayed neutrons account for approximately 99% of the neutron population.

b. Prompt neutrons are released during fast fissions while delayed neutrons are released during thermal fissions.

c. Prompt neutrons are released during the fission process while delayed neutrons are released during the decay process.

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

Answer: A.015 c.
Reference: *Intro to Nuc Eng,* John R. Lamarsh © 1983, § 3.7 pp. 73 – 75.

Question: A.016 [1.0 point] (16.0)

Which condition below describes a critical reactor?

a. $K = 1, \Delta K/K = 1$

b. $K = 1, \Delta K/K = 0$

c. $K = 0, \Delta K/K = 1$

d. $K = 0, \Delta K/K = 0$

Answer: A.016 b.
Reference: *Intro to Nuc Eng,* John R. Lamarsh © 1983, § 7.1, p. 282.

Question: A.017 [1.0 point] (17.0)
In a reactor at full power, the thermal neutron flux (Ø) is 2.5×10^{12} neutrons/cm^2/sec., and the macroscopic fission cross-section Σ_f is 0.1 cm^{-1}. The fission rate is:

a. 2.5×10^{11} fissions/cm/sec.

b. 2.5×10^{13} fissions/cm/sec.

c. 2.5×10^{11} fissions/cm^3/sec.

d. 2.5×10^{13} fissions/cm^3/sec.

Answer: A. 17 c.
Reference: Standard EQB question. $R = \text{Ø}\ \Sigma_f = (2.5 \times 10^{12}) \times 0.1 = 2.5 \times 10^{11}$

Question: A.018 [1.0 point] (18.0)
The term "Prompt Critical" refers to:

a. the instantaneous jump in power due to a rod withdrawal

b. a reactor which is supercritical using only prompt neutrons

c. a reactor which is critical using both prompt and delayed neutrons

d. a reactivity insertion which is less than β_{eff}

Answer: A.018 b.
Reference: Lamarsh, Introduction to Nuclear Engineering, 1975, Page 250

Question: A.019 [1.0 point] (19.0)
Which ONE of the following describes the difference between reflectors and moderators?

a. Reflectors decrease core leakage while moderators thermalize neutrons

b. Reflectors shield against neutrons while moderators decrease core leakage

c. Reflectors decrease thermal leakage while moderators decrease fast leakage

d. Reflectors thermalize neutrons while moderators decrease core leakage

Answer: A.019 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 1975, Pages 57, 214

Question: A.020 [1.0 point] (20.0)
Which ONE of the following statements describes the difference between Differential (DRW) and Integral (IRW) rod worth curves?

a. DRW relates the worth of the rod per increment of movement to rod position. IRW relates the total reactivity added by the rod to the rod position.

b. DRW relates the time rate of reactivity change to rod position. IRW relates the total reactivity in the core to the time rate of reactivity change.

c. IRW relates the worth of the rod per increment of movement to rod position. DRW relates the total reactivity added by the rod to the rod position.

d. IRW is the slope of the DRW at a given rod position

Answer: A.020 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 1975, Page 270

Question: B.001 [1.0 point] (1.0)
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.001 b.
Reference: O.I. 1.1B (Checklist B) step I.B.

Question: B.002 [1.0 point] (2.0)
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.002 b.
Reference: E.I.1.1 page 1, E.I.1.2

Question: B.003 [1.0 point] (3.0)
During Startup to full power, per procedure (O.P. 01) you are required to stop and take data at the 100 kilowatt, 1 megawatt, 5 megawatt and 10 megawatt levels. Which ONE by procedure requires you to hold the power level for an hour?

a. 100 kilowatt

b. 1 megawatt

c. 5 megawatt

d. 10 megawatt

Answer: B.003 d.
Reference: O.P. 1.1 § III steps 12, 13, and 14.

Question: B.004 [2.0 points, ½ point each] (5.0)
For Research and Test reactors we primarily worry about two isotopes N^{16} and Ar^{41}. Identify the approximate half-life and gamma energy for each. (Each item has only one answer.)

Isotope	Radiological Parameters			
a. Ar^{41} half-life	1) 1.8 sec	2) 1.8 min	3) 1.8 hour	4) 1.8 day
b. Ar^{41} gamma energy	1) 10 KeV	2) 100 KeV	3) 1 MeV	4) 10 MeV
c. N^{16} half-life	1) 7 sec	2) 7 min	3) 7 hour	4) 7 day
d. N^{16} gamma energy	1) 6 kev	2) 60 keV	3) 600 keV	4) 6 Mev

Answer: B.004 a. = 3; b. = 3; c. = 1; d. = 4
Reference: Technical Specifications § 4.0 (1) & (2), 3.3 (2)(b) and 3.4 Bases

Question: B.005 [1.0 point] (6.0)
You use a ***Geiger-Müller detector*** at the same distance from two point sources having the ***same curie strength***. Source A's gammas have an energy of 1.0 MeV, while Source B's gammas have an energy of 2.0 MeV. Which ONE of the following would you expect for the readings due to each source?

a. The reading from source B is four times that of source A.
b. The reading from source B is twice that of source A.
c. Both readings are the same.
d. The reading from source B is half that of source A.

Answer: B.005 c.
Reference: Geiger-Müller detector output is independent of incident energy.

Question: B.006 [1.0 point] (7.0)
Approximately how many half-lives does it take to reduce radiation from an isotope by a factor of 1000?

a. 5
b. 10
c. 15
d. 20

Answer: B.006 b.
Reference: Rewrite of NBSR Requalification Examination question January, 2000.

Question: B.007 [1.0 point] (8.0)
Rescue personnel, are authorized to receive a pre-established radiation exposure **WITHOUT** Emergency Director (ED) approval in order to save someone's life. What is this limit?

a. 5 Rem

b. 25 Rem

c. 50 Rem

d. 75 Rem

Answer: B.007 b.
Reference: Emergency Instructions Manual, E.I. 1.5, "General Information", Page 5 of 5

Question: B.008 [1.0 point] (9.0)
Which ONE of the following is the definition for ***"Annual Limit on Intake (ALI)"***? A 10CFR20 derived limit based on …

a. the concentration of a radio-nuclide in air which, if inhaled by an adult worker for a year, results in a total effective dose equivalent of 100 millirem.

b. a Committed Effective Dose Equivalent of 5 Rems whole body or 50 Rems to any individual organ, for the amount of radioactive material inhaled or ingested in a year by an adult worker.

c. the effluent concentration of a radio-nuclide in air which, if inhaled continuously over a year, would result in a total effective dose equivalent of 50 millirem for noble gases.

d. projected dose commitment values to individuals, that warrant protective action following a release of radioactive material.

Answer: B.008 b.
Reference: 10CFR20

Question: B.009 [1.0 point] (10.0)
O.I. 6.4 "*NBSR Spent Fuel Cask Loading and Shipping*" specifies the closest a fueled section is allowed to be raised when loading a spent fuel cask as 48 inches. Given that a "thumb rule" for gamma attenuation is that 2 feet is equivalent to a tenth thickness, radiation from the fuel should be reduced by a factor of at least

a. $1/10^{th}$

b. $1/20^{th}$

c. $1/100^{th}$

d. $1/1000^{th}$

Answer: B.009 c.
Reference: Standard NRC question

Question: B.010 [1.0 point] (11.0)
While operating one of the shim arms falls to its lower stop. Per Annunciator Procedure 0.3 *"Stuck or Faulty Operation of Shim Arms"* you should …

a. maintain the reactor as is (subcritical) until Reactor Supervisor directs corrective action.

b. continue to operate if able to latch and shim out the fallen shim arm.

c. continue to operate using the remaining shim arms to stay critical.

d. shutdown the reactor.

Answer: B.010 d.
Reference: Annunciator Procedures, A.P. 0.4.

Question: B.011 [1.0 point] {12.0}
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.011 c.
Reference: Emergency Instructions Introduction, ¶ 2.

Question: B.012 [1.0 point] (13.0)
Which of the following radioisotopes is considered a fission product?

a. N^{16}

b. Ar^{41}

c. H^{3}

d. I^{135}

Answer: B.012 d.
Reference: Standard NRC question

Question: B.013 [1.0 point] (14.0)
The reactor is considered "Shutdown" if it contains less than …

a. 2.2 lbm of U^{235}

b. 2.2 Kg of U^{235}

c. 10 lbm of U^{235}

d. 10 Kg of U^{235}

Answer: B.013 b.
Reference: Technical Specification 1.6

Question: B.014 [1.0 point] (15.0)
During Reactor Startup, per SOP 0.1, the minimum allowable period allowed is …

a. 10 seconds

b. 20 seconds

c. 30 seconds

d. 56 seconds

Answer: B.014 b.
Reference: Standard Operating Instructions O.I.1.1, *Reactor Startup*: § II.C.

Question: B.015 [2.0 points, 0.5 each] (17.0)
Identify the source (Irradiation of Air, Coolant (D_2O) or Fission Product (FP)) for each of the radioisotopes listed below.

a. Xe^{135}

b. Ar^{41}

c. N^{16}

d. H^3

Answer: B.015 a. = FP; b. = Air; c. = D_2O; d. = D_2O
Reference: Standard NRC Question

Question: B.016 [1.0 point] (18.0)
A Radiation Work Permit (RWP) has been written to perform a non-repetitive task on potentially contaminated equipment. How long will this RWP remain in effect?

a. Until the job is completed.

b. 8 hours or until the end of the current shift.

c. A maximum of 24 hours.

d. Indefinitely, if reviewed daily by Health Physics.

Answer: B.016 a.
Reference: Health Physics Procedures, H.P. 2.4, "Radiation Work Permit (RWP), Page 1 of 2

Question: B.017 [2.0 points, 0.5 each] (20.0)
Match the 10CFR55 requirements for an active operator license in column A with the appropriate time periods in column B.

Column A (License requirement)	Column B (years)
a. Renewal of license	1
b. Medical Examination	2
c. Requalification Written Examination	3
d. Requalification Operating Test	4
	5
	6

Answer: B.017 a. = 6; b. = 2; c. = 2; d. = 1
Reference: 10 CFR 55.xx

Question: C.001 [1.0 point] (1.0)
Which ONE of the following reactor instrumentation channels ***WILL NOT*** cause a reactor rundown, prior to activating a reactor scram?

a. Nuclear Power Channels

b. Nuclear intermediate channel (Log-N)

c. Reactor Primary Outlet Flow

d. Reactor Vessel Level

Answer: C.001 c.
Reference: TS 2.2 Limiting Safety System Setting - Specification

Question: C.002 [2.0 points, ½ point each] (3.0)
Identify whether each of the listed signals will cause a Scram (S), a Major Scram (MS) or may cause either (E) type.

a. High flux level (2 of 3 or 1 of 2 logic only)

b. High activity effluent air exhaust

c. Low Reactor Vessel D_2O Level.

d. Manual Pushbuttons in the control room.

Answer: C.002 a. = S; b. = MS; c. = S; d. = E
Reference: T.S. § 3.4

Question: C.003 [2.0 points, ½ point each] (5.0)
Identify the valves listed below A 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.003 a. = MO; b. = MO; c. = AO; d. = MO
Reference: NBSR Operations Training Guide, § 2.2.4 and Drawing 2.1

Question: C.004 [1.0 point] (6.0)
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.004 a.
Reference: NBSR Training Manual, Figure 3.1.

Question: C.005 [1.0 point] (7.0)
During a reactor startup, the 123 Strainer Inlet Isolation valve SCV-200 is inadvertantly left closed. As the startup progresses, the reactor receives a rundown signal, the signal was due to

a. low secondary flow

b. low thermal shield flow

c. high inlet temperature

d. high outlet temperature

Answer: C.005 d.
Reference: NIST SAR Sections 5.2.2.7.1 Strainer & 5.2.4.1 Removal of Heat from the Fuel

Question: C.006 [1.0 point] (8.0)
Which ONE of the following is the material used as a ***NEUTRON POISON*** in the safety-shim arms?

a. Erbium

b. Cadmium

c. Aluminum

d. Boron

Answer: C.006 b.
Reference: NBSR Reactor Operations Training Guide, § 1.1.5 2nd ¶.

Question: C.007 [1.0 point] (9.0)
Which ONE of the following correctly describes where Critical Panel 1 (CP-1) receives power from?

a. Directly from MCCA-7

b. Directly from the 20 kVA uninterruptible power supplies (UPS)

c. Directly from either Scott Transformer T9 or T10.

d. Directly from the battery

Answer: C.007 c.
Reference: NBSR Reactor Operations Training Guide, § 5.0 NBSR Electrical Systems

Question: C.008 [1.0 point] (10.0)
Reactor level is increasing above 168 inches. Which ONE of the following is the AUTOMATIC reactor scram which will occur?

a. High reactor D_2O level.

b. High flux on NC-6, NC-7 or NC-8.

c. Low reactor D_2O level.

d. High Reactor ΔT

Answer: C.008 c.
Reference: Annunicator Procedures AN.3.1 “Hi Reactor D_2O level”

Question: C.009 [1.0 point] (11.0)
Which ONE of the following is the actual method that negative building pressure is maintained following a containment building isolation and normal ventilation shutdown due to high radiation? (Assume AC power is available and no operator actions, and the containment building pressure is being maintained by the emergency exhaust system.)

a. automatic fan cycling on and off to maintain a pressure of -0.25".

b. manual fan cycling on and off to maintain a pressure of -0.25".

c. automatic fan cycling on and off to maintain a pressure of -0.1".

d. manual fan cycling on and off to maintain a pressure of -0.1".

Answer: C.009 a.
Reference: NBSR Training Guide, § 4.10.3, “Ventilation System Under accident conditions”.

Question: C.010 [2.0 points, ½ each] (13.0)
Match the Storage Pool cooling system components with their primary responsibiities.

a. Suspended Solids
b. Dissolved Solids
c. Kill Biological Impurities
d. Floating Detritus (Mosquito Larvae, dust etc.)

1. Pre and Post Filters
2. Ultraviolet Treatment Unit
3. Collection Basin
4. HOH Ion Exchanger

Answer: C.010 a. = 1; b. = 4; c. = 2; d. = 3
Reference: NBSR Training Guide, figure 4.10.

Question: C.011 [1.0 point] (14)
What type of detector does the T^3 channel use?

a. Ion chamber
b. Geiger Counter
c. Scintillation Detector
d. Proportional Counter

Answer: C.011 a.
Reference: NBSR Training Guide, § 6.4.7.

Question: C.012 [1.0 point] (15.0)
In order to detect neutrons the Nuclear Instrumentation ion chambers are coated with 96% enriched …

a. Be^{10}
b. Be^{11}
c. B^{10}
d. B^{11}

Answer: C.012 c.
Reference: NBSR Training Guide, § 6.2.3 and 6.2.4.

QUESTION DELETED - DIAGRAM NOT INCLUDED IN EXAMINATION PACKAGE

~~**Question**: C.013 [1.0 point, ¼ point each] (16.0)~~
~~Using the simplified diagram of the pneumatic tube (rabbit) system provided, identify the position of valves A through D (Open or Closed), on a sample ***INSERTION***.~~
~~a. A~~
~~b. B~~
~~c. C~~
~~d. D~~
~~Answer: C.013 a. = Closed; b. = Open; c. = Open; d. = Closed~~
~~Reference: NBSR Reactor Operations Training Guide, Figure 8.3~~

Question: C.014 [1.0 point] (17.0)
Which ONE of the following is the gas used to move the samples in the *Rabbit* systems?

a. He

b. Air

c. CO_2

d. N_2

Answer: C.014 c.
Reference: NBSR Operations Training Guide, § 8.2.5

Question: C.015 [1.0 point] (18.0)
Which ONE of the following is the purpose of the Bismuth shield within the Thermal Column?
Reduce _____ within the graphite region of the thermal column.

a. gamma radiation intensity

b. Intermediate neutron flux

c. Fast neutron flux

d. Thermal neutron flux

Answer: C.015 a.
Reference: NBSR Operations Training Guide, § 8.2.4.

Question: C.016 [1.0 point] {19.0}
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.016 c.
Reference: NBSR Operations Training Guide, § 1.3.5

Question: C.017 [1.0 point] {20.0}
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.017 a.
Reference: NBSR Training Manual, § 3.2.1.