November 17, 2008

Dr. Wade Richards, 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: INITIAL EXAMINATION REPORT NO. 50-184/OL-09-01,
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dear Dr. Richards:

During the week of October 27, 2008, the NRC administered an operator licensing examination at your NIST Center for Neutron Research Reactor. The examination was conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed 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 pty@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads, Jr., 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-09-01
2. Written examination with facility comments incorporated

cc without enclosures: See next page

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DISTRIBUTION w/ encls.:
PUBLIC PRTB r/f RidsNRRDPRPRTA
RidsNRRDPRPRTB Facility File (CRevelle) O-13 D-07
ADAMS ACCESSION #: ML083080159 TEMPLATE #:NRR-074

OFFICE	PRTB:CE		IOLB:LA	E	PRTB:SC	
NAME	PYoung		CRevelle		JEads	
DATE	11/07/2008		11/13/2008		11/17/2008	

OFFICIAL RECORD COPY

cc:

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

REPORT NO.: 50-184/OL-09-01

FACILITY DOCKET NO.: 50-184

FACILITY LICENSE NO.: TR-5

FACILITY: NIST Center for Neutron Research

EXAMINATION DATES: October 27 and 28, 2008

SUBMITTED BY: /RA/ 11/07/2008
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of October 27, 2008 the NRC administered operator licensing examinations to two Senior Operator applicants. All applicants passed all portions of the examinations.

REPORT DETAILS

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

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

3. Exit Meeting:
Phillip T. Young, NRC, Examiner
Dr. Wade Richards, Manager of Operations and Engineering
Mr. Warren Eresian

The examiner thanked the facility for their cooperation during the examination.

ENCLOSURE 1

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

License Operator Written Examination
With ANSWER KEY

OL-09-01

National Institute of Standards and Technology

October 27, 2008

Question A.001 [1.0 point] {1.0}
You enter the control room and note that **ALL** nuclear instrumentation show a **STEADY NEUTRON LEVEL**, and no rods are in motion. Which **ONE** of the following conditions **CANNOT** be true?

a. The reactor is critical.
b. The reactor is sub-critical.
c. The reactor is super-critical.
d. The neutron source has been removed from the core.

Answer: A.001 c.
Reference: Standard NRC Question

Question A.002 [1.0 point] {2.0}
The neutron microscopic cross-section for absorption σ_a generally…

a. increases as neutron energy increases.
b. decreases as neutron energy increases.
c. increases as the mass of the target nucleus increases.
d. decreases as the mass of the target nucleus increases.

Answer: A.002 b.
Reference: Standard NRC Question[1]

Question A.003 [2.0 points, ½ each] {4.0}
Match type of radiation (Column A) with the proper penetrating power (Column B).

Column A	Column B
a. Gamma	1. Stopped by thin sheet of paper
b. Beta	2. Stopped by thin sheet of metal
c. Alpha	3. Best shielded by light (low-z) material
d. Neutron	4. Best shielded by heavy (high-z) material

Answer: A.003 a. = 4; b. = 2; c. = 1; d. = 3
Reference: Standard NRC Question[1]

Question A.004 [1.0 point] {5.0}
Given that the NBSR is shutdown with a K_{eff} of 0.84, and β_{eff} is 0.008. Calculate the amount of reactivity required to achieve criticality.

a. 12.8$
b. 16$
c. 24$
d. 30$

Answer: A.004 c.
Reference: Standard NRC Question.
Also: $\rho = (K_{eff} - 1)/K_{eff}$ (0.84 - 1)/0.84 = -0.16/0.84 = -0.19 ΔK/K. 0.19/0.008 = $23.809 or $24

Question A.005 [1.0 point] {6.0}
Which ONE of the following is the reason that Xenon Peaks after a shutdown?

a. Iodine decays faster than Xenon decays
b. Promethium decays faster than Xenon decays
c. Xenon decays faster than Iodine decays
d. Xenon decays faster than Promethium

Answer: A.005 a.
Reference: Standard NRC Question[1]

Question A.006 [1.0 point] {7.0}
To make a just critical reactor ***"PROMPT CRITICAL"***, by definition you must add reactivity equal to …

a. τ_{eff}
b. λ_{eff}
c. β_{eff}
d. K_{eff}

Answer: A.006 c.
Reference: Standard NRC Question

Question A.007 [1.0 point] {8.0}
Which ONE of the following is an example of beta (β) decay?

a. $_{35}Br^{87}$ —> $_{33}As^{83}$

b. $_{35}Br^{87}$ —> $_{35}Br^{86}$

c. $_{35}Br^{87}$ —> $_{34}Se^{86}$

d. $_{35}Br^{87}$ —> $_{36}Kr^{87}$

Answer: A.007 d.
Reference: Standard NRC Reactor Theory Question, Chart of the Nuclides

Question A.008 [1.0 point] {9.0}
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.008 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

$$\frac{CR_1}{CR_2} = \frac{(1-K_{eff_2})}{(1-K_{eff_1})} \qquad \frac{50}{25} = \frac{(1-K_{eff_2})}{(1-0.8)} \qquad \textit{or}$$

$$1-K_{eff_2} = 2 \times .02 = 0.4 \quad \textit{Therefore} \quad K_{eff_2} = 0.6 \quad \textit{which implies}$$

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

Question A.009 [1.0 point] {10.0}
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.009 b.
Reference: $P = P_0 e^{t/\tau}$ $P_o = 124\%$ $\tau = 20$ sec. $t = 0.5$ $P = 124\ e^{0.5/20} = 127.1\%$

Question A.010 [1.0 point] {11.0}
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.010 c.
Reference: Standard NRC Theory Question

Question A.011 [1.0 point] {12.0}
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.011 a.
Reference: time is proportional to P/P_0 5/1 > 20/10 > 35/20 > 60/40

Question A.012 [1.0 point] {13.0}
Which ONE of the following is the MAJOR source of energy released from the fission process?

a. Kinetic energy of the fission fragments
b. Kinetic energy of the fission neutrons
c. Decay of the fission fragments
d. Prompt gamma rays

Answer: A.012 a.
Reference: Standard NRC Reactor Theory Question

Question A.013 [1.0 point] {14.0}
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.013 a.
Reference: Standard NRC Reactor Theory Question

Question A.014 [1.0 point] {15.0}
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 via neutron absorption becomes Pu^{239} which has a larger β for fission.

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

Answer: A.014 b.
Reference: Standard NRC Reactor Theory Question

Question A.015 [1.0 point] {16.0}
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.015 a.
Reference: Standard NRC Reactor Theory Question

Question A.016 [1.0 point] {17.0}
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.016 a.
Reference: Standard NRC Reactor Theory Question

Question A.017 [1.0 point] {18.0}
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.017 c.
Reference: Standard NRC Reactor Theory Question

Question A.018 [1.0 point] {19.0}
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¢/ºF positive

b. 1½¢/ºF negative

c. 2 ¢/ºF positive

d. 2 ¢/ºF negative

Answer: A.018 d.
Reference: NSBR - Requal Examination Addendum Additional questions

Question A.019 [1.0 point] {20.0}
Given secondary flow through HE-1A & B is 9650gpm, HE-1A & 1B (Secondary Inlet Temperature) both read 80ºF, HE-1A &1B secondary Outlet Temperature both read 91ºF, and the Thermal Power constants for water is 147 watts/gpm-ºF (H_2O), determine the current operating power.

a. 78%

b. 71%

c. 65%

d. 59%

Answer: A.019 a.
Reference: 9650gpm × 11ºF × 142 watt/gpmºF= 15.6 × 10^6 watts;
15.6 × 10^6 ÷ 20.0 × 10^6 = 0.78 = 78%

Question B.001 [1.0 point] (1.0)
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.001 d.
Reference: O.P. 1.1 § III steps 12, 13, and 14.

Question B.002 [1.0 point] (2.0)
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.002 b.
Reference: Emergency Instructions Manual, E.I. 1.5, "General Information", Page 5 of 5

Question B.003 [1.0 point] (3.0)
According to the Administrative Rules, the ***MINIMUM*** number of nuclear instruments required for refueling is …

a. one on-scale instrument with trip safety function
b. two on-scale instruments with trip safety function
c. one on-scale instrument
d. two on-scale instruments

Answer: B.003 d.
Reference: Administrative Rule 3.0, § III.A, also Administrative Rule 6.0 § I.B.

Question B.004 [1.0 point] (4.0)
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.004 a.
Reference: Technical Specifications, § 4.0, Specifications (3) and (4).

Question B.005 [1.0 point] (5.0)
Which ONE of the following correctly completes the sentence. While the reactor is OPERATING, the process test switch may be placed in the "2 of 2" position …

a. for not longer than 8 hours to allow the checking of a channel's operability.
b. up to a maximum of 12 hours if no experiments are inserted into the reactor.
c. indefinitely if power is reduced below 10 MW before changing the selector's position.
d. while maintaining a steady power level but must be returned to the "1 of 2" position prior to changing power.

Answer: B.005 a.
Reference: Operation Instructions Manual, O.I. 5.7. "Operation of the Process Instrumentation Safety System", Page 2 of 3

Question B.006 [1.0 point] (6.0)
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.006 d.
Reference: 10CFR20.1201

Question B.007 [1.0 point] (7.0)
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.007 b.
Reference: A ½ thickness is 2 sheets. $I = I_0 (½)^2 = 200$ mR/hr × 0.25 = 50. mR/hr.

Question B.008 [1.0 point] (8.0)
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.008 c.
Reference: O.I. 6.2, § II.N, p. 3.

Question B.009 [1.0 point] (9.0)
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.009 c.
Reference: Special Instructions (Revised 8/14/2006) #13, Beam Key Control and Red Tag

Question B.010 [1.0 point] (10.0)
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.010 d.
Reference: HP 2.4, RADIATION WORK PERMIT (RWP)

Question B.011 [1.0 point] (11.0)
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.011 b
Reference: T.S. § 2.2, p. 4.

Question B.012 [1.0 point] (12.0)
An individual receives 100 mRem of Beta (ß), 25 mRem of gamma (γ), and 5 mRem of neutron radiation. What is his/her total dose?

a. 275 mRem
b. 205 mRem
c. 175 mRem
d. 130 mRem

Answer: B.012 d.
Reference: 10 CFR 20.4 A rem is a rem is a rem

Question B.013 [1.0 point] (13.0)
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.013 c.
Reference: Annunciator Procedures, A.P. 0.7.

Question B.014 [2.0 points ½ each] (15.0)
When using a meter, to convert from rad to Rem you must convert using the appropriate Quality Factor. Match the type of radiation in column A with it's Quality Factor in column B

Column A	Column B
a. Thermal Neutrons	1
b. Gamma, X-rays, Beta	2
c. Fast Neutrons, Protons	5
d. Alpha particles, heavy recoil nuclei	10
	20

Answer: B.014 a. = 2; b. = 1; c. = 10; d. = 20
Reference: 10 CFR 20.xxxx

Question B.015 [2.0 points, 0.4 each] (17.0)
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.015 a. = LSSS; b. = LSSS; c. = LCO; d. = LCO; e. = SL
Reference: T.S. 2.0 through 2.3.

Question B.016 [2.0 points, ½ each] (17.0)
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.016 a. = CHECK; b. = TEST; c. = CAL; d. = TEST
Reference: T.S. § 1.0 DEFINITIONS

Question B.017 [1.0 point] (18.0)
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.017 b.
Reference: OI 6.1, Fueling and Defueling Procedures

Question B.018 [1.0 point] (19.0)
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.018 d.
Reference: OI 2.2, OPERATION OF THE D_2O AUXILIARY SYSTEMS

Question B.019 [1.0 point] (20.0)
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 $40^{o}F$

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.019 a.
Reference: OI 4.8, REACTOR BUILDING VENTILATION SYSTEM

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:

Question C.002 [1.0 point] {2.0}
During a transient, 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. Reactor primary coolant drains to the D_2O storage tank.
b. Main Secondary Cooling Pumps trip
c. Reactor Scram Signal is initiated
d. Main D_2O Pumps trip

Answer: C.002 b.
Reference: Annunciator Procedure 4.2 AN 4-2, Moderator Dump page 1.

Question C.003 [1.0 point] {3.0}
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.003 b.
Reference: NBSR Ops Trn Guide, § 5.2.3 Emergency Distribution p. 45.

Question C.004 [1.0 point] {4.0}
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.004 b.
Reference: NBSR Training Guide

Question C.005 [1.0 point] {5.0}
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.005 c.
Reference: NBSR Training Guide - 5.2.3 Emergency Power

Question C.006 [1.0 point] {6.0}
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.006 b.
Reference: NBSR Operations Training Guide, § 4.1.3

Question C.007 [1.0 point] {7.0}
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.007 b.
Reference: NBSR Annunciator Procedure A.P AN 2-34

Question C.008 [1.0 point] {8.0}
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.008 c.
Reference: NBSR Reactor Operations Instruction Manual O.I 5.4.

Question C.009 [1.0 point] {9.0}
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.009 a.
Reference: NBSR Operations Training Guide, § 1.5.2

Question C.010 [1.0 point] {10.0}
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.010 c.
Reference: NBSR Training Guide - 6.4.5 Gaseous Fission Product Monitor, RD3-2

Question C.011 [1.0 point] {11.0}
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.011 d.
Reference: NBSR 1998 Requal Exam Question C.012

Question C.012 [1.0 point] {12.0}
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.012 a.
Reference: NBSR 1998 Requal Exam

Question C.013 [1.0 point] {13.0}
On a loss of commercial power, the emergency diesel generators normally will NOT supply power to which of the following equipment?

a. Helium blowers.
b. Thermal shield cooling pumps.
c. Primary shutdown cooling pumps.
d. Primary main cooling pumps.

Answer: C.013 d.
Reference: SAR Chapter 8

Question C.014 [1.0 point] {14.0}
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.014 a.
Reference: AN 2-15: HIGH TRITIUM ACTIVITY

Question C.015 [1.0 point] {15.0}
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.015 c.
Reference: AN 6.2, RUNDOWN

Question C.016 [2.0 points, ½ point each] {17.0}
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.016 a. = B^{10} Counter; b. = CIC; c. = CIC; d. = UIC
Reference: NBSR Reactor Operations Training Guide,

Question C.017 [2.0 points ¼ each] {18.0}
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.017 a. = 3; b. = 3; c. = 4; d. = 5
Reference: AN 6.1, SCRAM; AN 6.2, RUNDOWN;
AN 6.3, WITHDRAW PROHIBIT

Question C.018 [1.0 point] (19.0)
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.018 a.
Reference: NBSR Operations Training Guide, § 4.2.2.

Question C.019 [2.0 point, 0.25 each] (20.0)
Match the purification system primary functions in column A with the components in column B.

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

Answer: C.019 a. = 2; b. = 1; c. = 1; d. = 1
Reference: NBSR Operations Training Guide, § 4.2 Purification System