August 3, 2005

Dr. Gerald E. Tripard, Director
Nuclear Radiation Center
Washington State University
Pullman, WA 99164-1300

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-027/OL-05-01, WASHINGTON STATE UNIVERSITY

Dear Dr. Tripard:

During the week of July 04, 2005, the NRC administered operator licensing examinations to employees of your facility who had applied for a license to operate your Washington State University Reactor. 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.

Sincerely,

/RA Alexander Adams for/

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

Docket No. 50-027

Enclosures: 1. Initial Examination Report No. 50-027/OL-05-01
2. Written examination and answer key

cc w/enclosures: Please see next page

cc:

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EXAMINATION PACKAGE ACCESSION NO.: ML052060343
REPORT ACCESSION NO.: ML052060356 **TEMPLATE #: NRR-074**

OFFICE	RNRP:CE		IEHB:LA		RNRP:SC	
NAME	PYoung		EBarnhill		PMadden (Al Adams for)	
DATE	07/ 26 /2005		08/ 1 /2005		08/ 1 /2005	

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

REPORT NO.:	50-027/OL-05-01
FACILITY DOCKET NO.:	50-027
FACILITY LICENSE NO.:	R-76
FACILITY:	Washington State University
EXAMINATION DATES:	07/06 - 07/2005
EXAMINER:	Phillip T. Young, Chief Examiner

SUBMITTED BY: **/RA/** 07/ 26 /2005
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of July 04, 2005, NRC administered examinations, consisting of a written examination and an operating test, to three Reactor Operator (RO) applicants and one Senior Operator (SRO). All four candidates passed all portions of their respective examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiner:

Phillip T. Young, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**3/0**	**1/0**	**4/0**
Operating Tests	**3/0**	**1/0**	**4/0**
Overall	**3/0**	**1/0**	**4/0**

3. Exit Meeting:

Personnel attending:

Phillip T. Young, NRC
Dr. Gerald E. Tripard, Director
Eric Corwin, Reactor Supervisor
Keith Fox, Project Associate

The licensee commented that question C.017 is a duplicate of question B.017. There were no generic concerns raised by the examiner. The examiner thanked the facility for their assistance in conducting the examinations.

Washington State University

Written Examination and Answer Key

OPERATOR LICENSING EXAMINATION

July 6, 2005

Enclosure 2

QUESTION A.001 [1.0 point] (1.0)

Which ONE of the four factors listed below is the MOST affected by an increase in poison level in the reactor?

a. Fast Fission Factor (ε)
b. Fast Non-Leakage Probability (Λ_f)
c. Thermal Utilization Factor (f)
d. Reproduction Factor (η)

Answer A.001 c.
Reference WSU RO Training Manual, Unit 5, p. 119

QUESTION A.002 [1.0 point] (2.0)

A FAST neutron will lose the MOST energy per collision when interacting with the nucleus of which ONE of the following isotopes?

a. H^1
b. H^2
c. C^{12}
d. U^{238}

Answer A.002 a.
Reference WSU RO Training Manual, Unit 5, p. 76.

QUESTION A.003 [1.0 point] (3.0)

The reactor had a shutdown margin of 2.5$, and a source range count rate of 15 counts per minute. After placing samples in the reactor the count rate increased to 30 counts per minute. What is the worth of the sample?

a. -63¢

b. +63¢

c. -1.26$

d. +1.26$

Answer A.003 d.
Reference SDM = 2.5$ = 0.0175 ΔK/K, $K_{eff} = 1/(1.0175) = 0.9828$
$1 - K_{eff2} = (1 - K_{eff1}) \times CR_1/CR_2$ 6 $K_{eff2} = 1 - [(1 - K_{eff1})CR_1/CR_2]$
$K_{eff2} = 1 - [(1 - 0.9828) \times ½] = 1 - [\ 0.0172 \times 0.5\ ] = 1 - 0.0086 = 0.9914$
$\rho = (0.9828 - 0.9914)/(0.9828 \times 0.9914) = 0.0 = \$1.26$

QUESTION A.004 [1.0 point] (4.0)

A THERMAL neutron has the LEAST probability of being absorbed by which ONE of the following isotopes?

a. H^1

b. H^2

c. C^{12}

d. U^{238}

Answer A.004 b.
Reference WSU RO Training Manual, Unit 5, § II,C. Also Chart of the Nuclides

QUESTION A.005 [1.0 point] (5.0)

β for U^{235} is 0.0065. $\beta_{effective}$ for the WSU reactor is 0.007. Why is $\beta_{effective}$ larger?

a. The reactor contains U^{238} which has a larger β for fast fission than U^{235}.

b. The reactor contains Pu^{239} which has a larger β for thermal fission than U^{235}.

c. Delayed neutrons are born at a higher average energy than fission neutrons resulting in a greater amount of fast fissioning.

d. Delayed neutrons are born at a lower average energy than fission neutrons resulting in fewer being lost to fast leakage.

Answer A.005 d.
Reference WSU RO Training Manual, Unit 6, § 2.2 Delayed Neutrons

QUESTION A.006 [1.0 point] (6.0)

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

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.006 b.
Reference WSU RO Training Manual, Unit 5, p. 7.

QUESTION A.007 [1.0 point] (7.0)

A reactor is exactly critical. What is the resultant K_{eff} if all delayed neutrons were instantaneously removed from the reactor?

a. 1.007

b. 1.000

c. 0.993

d. 0.0000

Answer A.007 c.
Reference WSU RO Training Manual, Unit 5,

QUESTION A.008 [1.0 point] (8.0)

As primary coolant temperature increases, control rod worth:

a. increases due to higher reflector efficiency.

b. decreases due to higher neutron absorption in the moderator.

c. increases due to the increase in thermal diffusion length.

d. remains the same due to constant poison cross-section of the control rods.

Answer A.008 c.
Reference WSU RO Training Manual, Unit 5, pp. 121 – 126.

QUESTION A.009 [1.0 point] (9.0)

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.009 d.
Reference WSU RO Training Manual, Unit 5, §IV.A Approach to Critical p. 174
$CR_1/CR_2 = (1 - K_{eff2})/(1 - K_{eff1}) = 1/32\ (1 - 0.95) =$
$1 - K_{eff2} = 1 - 0.05/32 = K_{eff2} = K_{eff2} = 0.9984$

QUESTION A.010 [1.0 point] (10.0)

Which ONE of the following is the reason that reactor indicated power (count rate) stabilizes several hours after a reactor trip? Assume all instrumentation is operable, and no reactivity changes.

a. Subcritical multiplication of source neutrons.

b. Continuing decay of the longest lived delayed neutron precursor.

c. Neutron level dropping below detection threshold, the detector reading is due to a test signal input from Nuclear Instrumentation.

d. Gamma radiation due to decay of fission products below detection threshold, the detector reading is due to a test signal input from Nuclear Instrumentation.

Answer A.010 a.
Reference WSU RO Training Manual, Unit 5, § IV.A Approach to critical pp. 130 – 140.

QUESTION A.011 [1.0 point] (11.0)

FLIP fuel contains a higher enrichment of U^{235}. Which ONE of the following is the correct reason for the addition of Erbium to FLIP fuel?

a. Erbium has a high scattering cross-section thereby increasing the amount of neutrons absorbed by U^{238} in the epithermal range.

b. Erbium has a high absorption cross-section for thermal neutrons, thereby, increasing the relative worth of neutrons absorbed by U^{238} in the epithermal range.

c. Erbium has a high absorption cross-section for epithermal neutrons, thereby compensating for the reduction in U^{238}.

d. Erbium has a low absorption cross-section for thermal neutrons, thereby increasing the relative worth of the control rods.

Answer A.011 c.
Reference WSU RO Training Manual, Unit 11, p. 13

QUESTION A.012 [1.0 point] (12.0)

You have shutdown the reactor. Reactor period has just stabilized and reactor power is at 1000 cpm. What would you expect reactor power to read three minutes later.

a. 500 cpm

b. 333 cpm

c. 100 cpm

d. 10 cpm

Answer A.012 c.
Reference $P = P_0 e^{-t/T}$, Reactor period stabilizes at - 80 seconds.
Time (t) = 180 seconds (three minutes).
$P = 1000 e^{-180/80} = 1000 (e^{-9/4}) = 1000 (0.1054) = 105.4$

QUESTION A.013 [1.0 point] (13.0)

If a \$1.50 pulse has a peak power of 250 MW, a FWHM of 100 ms, and a fuel temperature rise of 145EC, what would you estimate the peak power, FWHM, and fuel temperature rise values would be for a \$2.00 pulse?

a. Peak power: 780 MW FWHM: 80 ms Temp. rise: 210EC

b. Peak power: 1000 MW FWHM: 50 ms Temp. rise: 290EC

c. Peak power: 1200 MW FWHM: 50 ms Temp. rise: 350EC

d. Peak power: 900 MW FWHM: 80 ms Temp. rise: 210EC

Answer A.013 b.
Reference RO Training Manual, Unit 11, page 4. Simplified Pulsing Equations:
Peak Power is proportional to $\Delta\$_{prompt}^2$, FWHM is proportional to $1/\Delta\$_{prompt}$ and temperature increase is proportional to $\Delta\$_{prompt}$ where $\Delta\$_{prompt} = (\rho-\beta)$

QUESTION A.014 [1.0 point] (14.0)

Immediately after a pulse [approx. 1 millisecond] the HOTTEST part of a fuel element is …

a. in the centerline of the cladding

b. at the edge of the fuel adjacent to the cladding

c. at the thermocouples, midway between the fuel axial centerline and the fuel edge.

d. at the axial centerline of the fuel elements

Answer A.014 b.
Reference WSU, Reactor Operator Training Manual, Figure 6.21, p. 6-51.

QUESTION A.015 [1.0 point] (15.0)

Which ONE of the following statements correctly describes the differences between prompt and delayed neutrons? Prompt neutrons …

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

b. are released during the fission process, while delayed neutrons are released during the decay process.

c. are released during the fission process, while delayed neutrons are released during the delayed neutron process.

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

Answer A.015 b.
Reference RO Training Manual, Unit 5, § I.D Fission, pages 30 – 34.

QUESTION A.016 [1.0 point] (16.0)

During a reactor startup, the Reactor Operator notes that the source is not in. After inserting the neutron source he notes reactor power is increasing LINEARLY. What was the condition of the reactor just prior to inserting the source?

a. Substantially subcritical
b. Slightly subcritical
c. Exactly critical
d. Slightly supercritical

Answer A.016 c.
Reference RO Training Manual, Unit 6, pages 6-21, & 6-22.

QUESTION A.017 [1.0 point] (17.0)

Which ONE of the listed reactivity coefficients will be FIRST to turn reactor power following a rod withdrawal. [Assume no manual, (i.e. experiment insertion) or automatic (i.e. scram) reactivity additions.]

a. Fuel-Moderator
b. Water-Moderator
c. Void
d. Pressure

Answer A.017 a.
Reference RO Training Manual, Unit 6, page 1-2.

QUESTION A.018 [1.0 point] (18.0)

Which ONE of the following correctly describes the behavior of the reactor as you approach criticality?

	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.018 a.
Reference Standard NRC question

19 QUESTION A.019 [1.0 point] (19.0)

Which ONE of the following is an example of alpha (α) decay?

a. $_{35}Br^{87}$ o $_{33}As^{83}$

b. $_{35}Br^{87}$ o $_{35}Br^{86}$

c. $_{35}Br^{87}$ o $_{34}Se^{86}$

d. $_{35}Br^{87}$ o $_{36}Kr^{87}$

Answer A.019 a.
Reference Standard NRC question

QUESTION A.020 [1.0 point] (20.0)

Which ONE of the following isotopes has the largest microscopic cross-section for absorption for thermal neutrons?

a. Sm^{149}

b. U^{235}

c. Xe^{135}

d. B^{10}

Answer A.020 c.
Reference Standard NRC question

***** End of Section A Reactor Theory, Thermodynamics, and Facility Characteristics *****

QUESTION B.001 [2.0 points, 0.4 points each] (2.0)

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.	Minimum Shutdown Margin	1. $8.00
b.	Each secured Experiment	2. $5.00
c.	Maximum Excess Reactivity	3. $2.00
d.	Total worth of all experiments	4. $1.00
e.	Each Unsecured Experiment	5. $0.25

Answer B.001 a. = 5; b. = 3; c. = 1; d. = 2; e. = 4
Reference Technical Specifications §§ 3.2, 3.4, 3.10 (1)(2) &(3)

QUESTION B.002 [1.0 point] (3.0)

The reactor scrams due to loss of power (electrical storms). Prior to restarting the reactor you must get permission from (as a minimum).

a. An NRC licensed Reactor Operator
b. An NRC licensed Senior Operator
c. The Reactor Supervisor
d. The Reactor Manager

Answer B. 2 b.
Reference SOP 4 § A.3.c.

QUESTION B.003 [2.0 points, ½ point each] (5.0)

Match the radiation reading from column A with its corresponding radiation area classification (per 10 CFR 20) listed in column B.

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

QUESTION B.004 [1.0 point] (6.0)

You must have the presence of Health Physics personnel present to handle a radioactive sample with an expected radiation field in excess of …

a. 1000 mrem/hr

b. 500 mrem/hr

c. 100 mrem/hr

d. 50 mrem/hr

Answer B.004 c.
Reference SOP 1 § L, 2nd ¶.

QUESTION B.005 [1.0 point] (7.0)

How many hours per calendar quarter must you perform the functions of an RO or SRO to maintain an active RO or SRO license?

a. 2

b. 4

c. 8

d. 12

Answer B.005 b.
Reference 10CFR55.53(e).

QUESTION B.006 [1.0 point] (8.0)

Which ONE of the following locations is the normal (no evacuation required) Emergency Support Center per the Emergency Plan?

a. Reactor Control Room

b. Reactor Shop

c. Sidewalk in front of the Nuclear Radiation Center Main Office.

d. Nuclear Radiation Center Main Office.

Answer B.006 d.
Reference Emergency Plan, § 8.1.

QUESTION B.007 [1.0 point] (9.0)

Technical Specification 5.5 requires "All fuel shall be stored in a geometrical array where the Keff is less than ____ for all conditions of moderation."

a. 0.95

b. 0.90

c. 0.85

d. 0.80

Answer B.007 d.
Reference Technical Specification 5.5(1)

QUESTION B.008 [1.0 point] (10.0)

The Quality Factor is used to convert …

a. absorbed dose in rads to dose equivalent in rems.

b. absorbed dose in rems to dose equivalent in rads.

c. contamination in rads to contamination equivalent in rems

d. contamination in rems to contamination equivalent in rads.

Answer B.008 a.
Reference 10CFR20.1004.

QUESTION B.009 [1.0 point] (11.0)

Two inches of shielding reduce the gamma exposure in a beam of radiation from 400 mR/hr to 200 mR/hr. If you add an additional four inches of shielding what will be the new radiation level? (Assume all reading are the same distance from the source.)

a. 25 mR/hr

b. 50 mR/hr

c. 75 mr/hr

d. 100 mr/hr

Answer B.009 b.
Reference Nuclear Power Plant Health Physics and Radiation Protection, Research Reactor Version©1988, § 9.2.3 "Half-Thickness and Tenth-Thickness"

QUESTION B.010 [1.0 point] (12.0)

Which ONE of the listed emergency classifications is NOT applicable at Washington State University?

a. Notification of Unusual Event

b. Site Emergency

c. Safety Event – (Non-Reactor Related)

d. Alert

Answer B.010 b.
Reference Emergency Plan, § 4.0 Emergency Classification System

QUESTION B.011 [1.0 point] (13.0)

An experimenter fell while carrying an irradiated sample. He broke his arm, and is bleeding. In addition, the sample container broke and the experimenter is contaminated by radioactive powder. Where would you send the experimenter for treatment?

a. Moscow Clinic
b. Memorial Hospital
c. Pullman Regional Hospital
d. St. Joseph Regional Medical Center

Answer B.011 c.
Reference WSU Emergency Plan, § 3.1.12, p. 13.

QUESTION B.012 [1.0 point] (14.0)

Identify the lowest level of authority who may authorize a substantive change to the Technical Specifications:

a. Any Reactor Operator
b. Any Senior Reactor Operator
c. The Facility Director
d. The NRC

Answer B.12 d.
Reference 10 CFR 50.90

QUESTION B.013 [1.0 point] (15.0)

When pulsing, you are required to be at a power level less than one KW. Which ONE (1) of the following is the reason for this limitation on power level prior to the pulse? To prevent exceeding …

a. the maximum power level limit
b. the fuel element temperature limit
c. the pool temperature limit
d. the reactivity insertion limits

Answer B.013 b.
Reference WSU T.S. § 3.6.3, BASES

QUESTION B.014 [1.0 point] (16.0)

Which ONE of the following conditions does not meet the requirements of an IRRADIATION?

a. Dose equivalent rate of 5 Rem/hr at 1 foot upon removal from the reactor shielding.
b. Irradiation resides in the reactor for 12 days.
c. Reactivity worth is $0.45
d. The sample contains natural uranium.

Answer B.014 c.
Reference SOP-2, § A, 2nd ¶, 1–4, pages 1 & 2, & SOP-1, § B.1 a–d, page 2.

QUESTION B.015 [1.0 point] (17.0)

A system is found to be inoperable during the Pre-startup Reactor Checkout. The system being inoperable will not violate technical specifications, written procedures, nor safe practices. What is the minimum level of authorization required before a Reactor Operator may startup the reactor?

a. Oral approval by the Senior Reactor Operator.

b. Written approval by the Senior Reactor Operator.

c. Oral approval by the Facility Director

d. Written approval by the Facility Director.

Answer B.015 b.
Reference SOP-4, § A.9, pages 2 & 3.

QUESTION B.016 [1.0 point] (18.0)

Which ONE of the following conditions is a violation of a Limiting Condition for Operation?

a. During a reactor power calibration actual power was found to be 1.2 Mwatt.

b. Peak temperature reached 810EC in a standard fuel element during a pulse.

c. The actual excess reactivity for the core is found to be 8.00$.

d. Pool conductivity was found to be 6×10^{-5} mhos/cm.

Answer B.016 d.
Reference Technical Specifications, 3.0 LCO's, §§ 3.1, 3.3, 3.4 & 3.13.

~~QUESTION B.017 [1.0 point] (19.0)~~
~~An experimenter has requested permission to use the pneumatic transfer system (rabbit) to inject an experiment into the reactor. After granting the request, the reactor operator depresses the …~~
~~a. "POWER" switch~~
~~b. "REQUEST/GRANTED" switch~~
~~c. "AUTO/TIMING" switch~~
~~d. "DELAY" switch~~
~~Answer B.017 a.~~
~~Reference SOP-2, § C, Procedure for Pneumatic Transfer System Irradiations pp. 3 – 6.~~

Question B.017 deleted due to facility comment, Question C.017 is a duplicate question.

QUESTION B.018 [1.0 point] (20.0)

Which ONE of the SCRAMS listed is NOT required for reactor operations by Technical Specifications (Table 3.2 Minimum Reactor Safety Channel)?

a. Nuclear Instrumentation Detector High Voltage Failure

b. Short Period

c. High Fuel Temperature

d. Nuclear Instrumentation High Flux

Answer B.018 b.
Reference Technical Specifications, Table 3.1.

******* End Of Section B Normal, Emergency and Radiological Control Procedures *******

QUESTION C.001 [2.0 points, ½ point each] (2.0)

Match the purification system functions in column A with the purification component listed in column B

Column A	Column B
a. remove floating dust, bug larvae, etc.	1. Demineralizer (Ion Exchanger)
b. remove dissolved impurities	2. Skimmer
c. remove suspended solids	3. Filter (strainer)
d. maintain pH	

Answer C.001 a. = 2; b. = 1; c. = 3; d. = 1
Reference SAR § 5.4, figure 5.6.

QUESTION C.002 [1.0 point] (3.0)

Which ONE of the choices correctly identifies the radiation detector signal which if it trips will realign the ventilation system to dilute mode?

a. Continuous Air Monitor WARN alarm
b. Continuous Air Monitor HIGH alarm
c. Exhaust Gas Monitor WARN alarm
d. Exhaust Gas Monitor HIGH alarm.

Answer C.002 b.
Reference SOP 19 § C.2.d.2.a.2. p. 5

QUESTION C.003 [1.0 point] (4.0)

Following a reactor power calibration if necessary power reading on the Nuclear Instruments is adjusted by

a. adjusting the physical position (up or down) of the detector.
b. adjusting the high voltage signal to the detector.
c. adjusting the gain of the preamplifier circuit.
d. adjusting the meter face.

Answer C.003 a.
Reference NRC Examination Question bank, also SOP 13, p. 5

QUESTION C.004 [1.0 point] (5.0)

During a reactor scram, damage to electrically operated control rods is prevented by …

a. A small spring located at the bottom of the rod.
b. An electrical-mechanical brake energizes when the rod down limit switch is energized.
c. A piston attached to the upper end of the safety rod enters a special damping cylinder as the rod approaches the full insert position.
d. A dashpot which is positioned at the end of the shaft travel which decelerates the rod for the last five inches of fall.

Answer C.004 d.
Reference SAR § 4.2.2, p. 4-23

QUESTION C.005 [1.0 point] (6.0)

Which ONE of the following is the main function performed by the DISCRIMINATOR circuit in the startup channel?

a. To generate a current signal equal and of opposite polarity as the signal due to gammas generated within the Log-N Channel Detector.

b. To filter out small pulses due to gamma interactions, passing only pulses due to neutron events within the Log-N Channel Detector.

c. To convert the linear output of the Log-N Channel Detector to a logarithmic signal for metering purposes.

d. To convert the logarithmic output of the metering circuit to a t (differential time) output for period metering purposes.

Answer C.005 b.
Reference Standard NRC question, SAR figure 7-4

QUESTION C.006 [1.0 point] (7.0)

Which ONE of the following parameters is NOT measured in the Primary Cooling Loop?

a. Temperature

b. Pressure

c. Conductivity

d. pH

Answer C.006 d.
Reference SAR Figure 5-1

QUESTION C.007 [1.0 point] (8.0)

You've been asked to retrieve a rabbit sample. There is some concern that the experimenter made a math error and the sample may have a stronger radiation field than anticipated. Which ONE of the following detectors would you use as you approach the sample?

a. Geiger-Müller

b. GeLi

c. Scintillation

d. Ion Chamber

Answer C.007 d.
Reference Standard NRC Examination Question Bank

QUESTION C.008 [1.0 point] (9.0)

How is the signal supplying the control element continuous position indication generated?

a. A series of limit switches located every ½ inch of control element length open and close as the magnet passes generating a signal proportional to control element position.

b. A servo generator chain driven by the drive motor generates a signal proportional to control element position.

c. A lead screw at the top of the control element moves in and out of an induction coil generating a signal proportional to the control element position.

d. A servo generator located in the control panel, is energized by auxiliary contacts in the in-out switch generating a signal proportional to the control element position.

Answer C.008 b.
Reference WSU SOP #8, *Standard Procedure for Control Element Maintenance, Removal and Replacement,* CAUTION on page 4.

QUESTION C.009 [1.0 point] (10.0)

Which one of the following describes the operation of the containment building ventilation automatic dampers on a signal which causes the system to go from normal to dilute mode?

a. Dampers 1 and 4 close. Dampers 2 and 3 open. Damper 6 maintains static pressure.

b. Dampers 2, 3 and 6 close. Dampers 1 opens. Damper 4 maintains static pressure.

c. Dampers 2 and 3 close. Dampers 1 and 4 open. Damper 6 maintains static pressure.

d. All Dampers close.

Answer C.009 a.
Reference SOP 5, p. 13.

QUESTION C.010 [1.0 point] (11.0)

Which ONE of the following materials is NOT used for neutron absorption in the control blades (1 through 5).

a. hafnium

b. boron-carbide

c. boral (boron and aluminum alloy)

d. stainless-steel

Answer C.010 a.
Reference SAR §§ 4.5, 4.6 and 4.7.

QUESTION C.011 [1.0 point] (12.0)

WHICH ONE of the following detectors is used primarily to measure N16 release to the environment?

a. None, because of its short half-life, there is no need for environmental monitoring of N^{16}.

b. Continuous Air Monitor (Particulate)

c. Area Radiation Monitor

d. Gaseous Effluent

Answer C.011 a.
Reference WSU Safety Analysis for Conversion to FLIP fuel, § 6.0 Environmental Effects of Facility Operation, (d) Radioactive Discharges, (1) Gaseous pp. 9 & 10.

QUESTION C.012 [2.0 points, ½ each] (14.0)

For each of the gasses listed in column A identify its primary source (i.e. neutron irradiation of **air**, neutron irradiation of **water** or fission product {**FP**}).

a. H3

b. N16

c. Ar41

d. Xe138

Answer C.012 a. = Water; b. = Water; c. = Air; d. = Fission Product
Reference Standard NRC question

QUESTION C.013 [1.0 point] (15.0)

How is radioactive effluent discharged using the dilution method?

a. The Dump/recirc pump supplies water to the eductor, which in turn provides motive force for the raw water.

b. The Dump/recirc pump supplies water to vacuum break, which in turn provides motive force for the raw water.

c. The raw water flow through the eductor provides motive force for the radioactive effluent from the sample tank.

d. The raw water flow through the vacuum break provides motive force for the radioactive effluent from the sample tank.

Answer C.013 c.
Reference Standard Procedure for Liquid Waste Samples,
§ D *Dilution System,* pp. 4 – 6.

QUESTION C.014 [2.0 points, ½ each] (17.0)

Identify each of the listed scrams as having input into the **logic** element, the low scram **relay** or **both**.

a. High Fuel Temperature

b. Building Evacuation

c. Short Period

d. Seismometer

Answer C.014 a. = both; b. = relay; c. = both; d. = relay
Reference SAR 7.4 and Figure 7-9

QUESTION C.015 [1.0 point] (18.0)

Which one of the following methods is used to prevent freezing in the secondary system during cold weather?

a. A heater in the secondary sump, controlled from by the control room operator.

b. A heater in the secondary sump, automatically controlled by a thermostat.

c. Addition of chemicals to reduce the freezing temperature of the secondary coolant.

d. The pumps and cooling tower shut down automatically upon low temperatures.

Answer C.015 b.
Reference SAR 5.3.

QUESTION C.016 [1.0 point] (19.0)

A pipe breaks just downstream of the primary coolant pump. What design feature of the system prevents draining of the pool?

a. Signal from a pool float which shuts a valve in the pump suction line.

b. Signal from a pool float which shuts off the primary pump.

c. Level in the pool drops below a minimum required to supply suction pressure to the pump. (Net Positive Suction Head)

d. Level in the pool drops below siphon break holes in the suction pipe.

Answer C.016 d.
Reference SAR 5.3

QUESTION C.017 [1.0 point] (20.0)

An experimenter has requested permission to use the pneumatic transfer system {rabbit} to inject an experiment into the reactor. After granting the request, the reactor operator depresses the …

a. "POWER" switch

b. "DELAY" switch

c. "AUTO/TIMING" switch

d. "REQUEST/GRANTED" switch

Answer C.017 a.
Reference SOP-2, § C, Procedure for Pneumatic Transfer System Irradiations pp. 3 – 6.

******* End Of Section C Facility and Radiation Monitoring Systems *******

********* End of Examination *********