November 16, 2009

Dr. Jeff Geuther, RCF Director
NES Building, Room 1-10, MANE Department
Rensselaer Polytechnic Institute
110 8th St.
Troy, NY 12180

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-225/OL-10-01,
RENSSELAER POLYTECHNIC INSTITUTE

Dear Dr. Geuther:

During the week of October 26, 2009, the NRC administered operator licensing examinations at your Rensselaer Polytechnic Institute Reactor. The examinations were conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report at the conclusion of the examination.

In accordance with Title 10 of the Code of Federal Regulations Section 2.390, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Phillip T. Young at (301)-415-4094 or via internet e-mail phillip.young@nrc.gov.

Sincerely,

/RA by John J. Donohue Acting For/
Johnny H. Eads, Jr., Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-225

Enclosures: 1. Initial Examination Report No. 50-225/OL-10-01
2. Written examination with facility comments incorporated

cc without enclosures:
Please see next page

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OFFICE	PRTB:CE	E	IOLB:OLA		PRTB:BC	
NAME	PYoung:		CRevelle		JEads (JDonohue for)	
DATE	11/10/2009		11/13/2009		11/16/2009	

C = COVER E = COVER & ENCLOSURE N = NO COPY
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cc:

Mayor of the City of Schenectady
Schenectady, NY 12305

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Chief, Radiation Section
Division of Hazardous Waste and Radiation Management
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Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

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

REPORT NO.: 50-225/OL-10-01

FACILITY DOCKET NO.: 50-225

FACILITY LICENSE NO.: R-110

FACILITY: Rensselaer Polytechnic Institute

EXAMINATION DATES: October 28, 2009

SUBMITTED BY: _____ _____
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of July 07, 2008, the NRC administered operator licensing examinations to one Senior Reactor Operator (SRO) candidate. The candidate passed 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	1/1	1/0
Operating Tests	0/0	1/1	1/0
Overall	0/0	1/1	1/0

3. Exit Meeting:
Phillip T. Young, Chief Examiner, NRC
Mrs. Jessica Berry, RCF Supervisor

The NRC Examiner thanked the facility for their support in the administration of the examination.

ENCLOSURE 1

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

FACILITY: RPI

REACTOR TYPE: Critical Experimental

DATE ADMINISTERED: 10/28/2009

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 parentheses 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	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20.00	35.7	_____	____	A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
20.00	35.7	_____	____	B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
16.00	28.6	_____	____	C. FACILITY AND RADIATION MONITORING SYSTEMS
56.00		_____ FINAL GRADE	____%	TOTALS

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

Candidate's Signature

ENCLOSURE 2

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

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

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

4. Use black ink or dark pencil only to facilitate legible reproductions.

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

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

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

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

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

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

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

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

EQUATION SHEET

$Q = m\, c_p\, \Delta T$ $\qquad$ $CR_1\,(1-K_{eff})_1 = CR_2\,(1-K_{eff})_2$

$SUR = 26.06/\tau$ $\qquad$ $P = P_0\, 10^{SUR(t)}$

$P = P_0\, e^{(t/\tau)}$ $\qquad$ $\tau = (\ell^*/\rho) + [(\beta-\rho)/\lambda_{eff}\rho]$

$\lambda_{eff} = 0.1 \text{ seconds}^{-1}$ $\qquad$ $DR_1 D_1^{\,2} = DR_2 D_2^{\,2}$

$DR = DR_o e^{-\lambda t}$ $\qquad$ $DR = 6CiE/D^2$

$\rho = (K_{eff} - 1)/K_{eff}$ $\qquad$ $1 \text{ eV} = 1.6\text{x}10^{-19}$ watt-sec.

$1 \text{ Curie} = 3.7\text{x}10^{10}$ dps $\qquad$ 1 gallon water = 8.34 pounds

1 Btu = 778 ft-lbf $\qquad$ $°F = 9/5\,°C + 32$

$1 \text{ Mw} = 3.41\text{x}10^6$ BTU/hr $\qquad$ $°C = 5/9\,(°F - 32)$

Section A: - Reactor Theory, Thermo & Fac. Operating Characteristics

QUESTION A.001 [1.00 point] (1.0)
Which ONE of the following is the reason for operating with thermal neutrons instead of fast neutrons?

a. The fission cross section of the fuel is much higher for thermal neutrons than fast neutrons.

b. Neutron absorption in non-fuel material increases exponentially as neutron energy increases.

c. Doppler and moderator temperature coefficients become positive as neutron energy increases.

d. Neutron economy is increased since thermal neutrons are less likely to leak out of the core than fast neutrons.

Answer: A.001 a.
Reference: Duderstadt and Hamilton, Nuclear Reactor Analysis, page 81.

QUESTION A.002 [1.00 point] (2.0)
A reactor is operating at criticality. Instantaneously, all of the delayed neutrons are suddenly removed from the reactor. The K_{eff} of the reactor in this state would be approximately:

a. 1.007

b. 1.000

c. 0.993

d. 0.000

Answer: A.002 c.
Reference: DOE Fundamentals Handbook, Module 2, page 30.

QUESTION A.003 [1.00 point] (3.0)
A reactor is critical at 50% of rated power, with reactivity = zero. A control rod is withdrawn and the power increases to a higher steady-state value. The reactivity of the reactor at the higher power level is zero because:

a. the positive reactivity due to the fuel temperature decrease balances the negative reactivity due to the control rod withdrawal.

b. the negative reactivity due to the fuel temperature decrease equals the positive reactivity due to the control rod withdrawal.

c. the positive reactivity due to the fuel temperature increase balances the negative reactivity due to the control rod withdrawal.

d. the negative reactivity due to the fuel temperature increase equals the positive reactivity due to the control rod withdrawal.

Answer: A.003 d.
Reference: DOE Fundamentals Handbook, Module 4, page 28.

QUESTION A.004 [1.00 point] (4.0)
Which ONE of the following does NOT affect the Effective Multiplication Factor $K_{eff?}$

a. The moderator-to-fuel ratio.

b. The moderator temperature.

c. The physical dimensions of the core.

d. The strength of an installed neutron source.

Answer: A.004 d.
Reference: DOE Fundamentals Handbook, Module 3, pages 2-9.

QUESTION A.005 [1.00 point] (5.0)
The effective neutron multiplication factor, K_{eff}, is defined as:

a. absorption/(production + leakage)

b. (production + leakage)/absorption

c. (absorption + leakage)/production

d. production/(absorption + leakage)

Answer: A.005 d.
REFERENCE: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, page 195.

QUESTION A.006 [1.00 point] (6.0)
Delayed neutron precursors decay by beta decay. Which ONE reaction below is an example of beta decay?

a. $_{35}Br^{87}$ -> $_{36}Kr^{87}$
b. $_{35}Br^{87}$ -> $_{35}Kr^{86}$
c. $_{35}Br^{87}$ -> $_{34}Kr^{86}$
d. $_{35}Br^{87}$ -> $_{33}Kr^{83}$

Answer: A.006 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, page 71.

QUESTION A.007 [1.00 point] (7.0)
Which ONE of the following elements will slow down fast neutrons most quickly, i.e. produces the greatest energy loss per collision?

a. Boron-10
b. Oxygen-16
c. Hydrogen-1
d. Uranium-238

Answer: A.007 c.
Reference: Lamarsh, Introduction to Nuclear Engineering, 3rd Edition, Section 5.9, page 254.

QUESTION A.008 [1.00 point] (8.0)
Which ONE of the reactions below is an example of a photoneutron source?

a. $_{1}H^{2} + \gamma$ -> $_{1}H^{1} + n$
b. $_{4}Be^{9} + \alpha$ -> $_{6}C^{12} + n$
c. $_{51}Sb^{123} + n$ -> $_{51}Sb^{124} + \gamma$
d. $_{92}U^{238}$ -> $_{35}Br^{87} + _{57}La^{148} + 3n + \gamma$

Answer: A.008 a.
Reference: Burn, Introduction to Nuclear Reactor Operations, page 5-3.

QUESTION A.009 [1.00 point] (9.0)
During a reactor startup, the count rate is increasing linearly with time, with no rod motion. This means that:

a. the reactor is critical and the count rate increase is due to source neutrons.

b. the reactor is subcritical and the count rate increase is due to source neutrons.

c. the reactor is subcritical and the count rate increase is due to the buildup of delayed neutron precursors.

d. the reactor is critical and the count rate increase is due to the buildup of delayed neutron precursors.

Answer: A.009 a.
Reference: Burn, Introduction to Nuclear Reactor Operations, page 5-25.

QUESTION A.010 [1.00 point] (10.0)
You enter the control room and observe that the neutron instrumentation indicates a steady neutron level with no rods in motion. Which ONE condition below CANNOT be true?

a. The reactor is critical.

b. The reactor is subcritical.

c. The reactor is supercritical.

d. The neutron source is in the core.

Answer: A.010 c.
Reference: A supercritical reactor cannot indicate a steady neutron level.

QUESTION A.011 [1.00 point] (11.0)
A negative fuel temperature coefficient means that:

a. when fuel temperature decreases, reactor power increases.

b. when fuel temperature increases, positive reactivity is added.

c. when fuel temperature decreases, positive reactivity is added.

d. when fuel temperature decreases, negative reactivity is added.

Answer: A.011 c.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, page 307.

QUESTION A.012 [1.00 point] (12.0)
Which ONE of the following describes the response of the subcritical reactor to equal insertions of positive reactivity as the reactor approaches critical? Each reactivity insertion causes:

a. a LARGER increase in the neutron flux, resulting in a LONGER time to reach equilibrium.

b. a LARGER increase in the neutron flux, resulting in a SHORTER time to reach equilibrium.

c. a SMALLER increase in the neutron flux, resulting in a LONGER time to reach equilibrium.

d. a SMALLER increase in the neutron flux, resulting in a SHORTER time to reach equilibrium.

Answer: A.012 a.
Reference: Burn, Introduction to Nuclear Reactor Operations, page 5-11.

QUESTION A.013 [1.00 point] (13.0)
A reactor fuel consisting of only U-235 and U-238 is 20% enriched. This means that:

a. 20% of the weight of the fuel consists of U-235.

b. 20% of the volume of the fuel consists of U-235.

c. 20% of the total number of atoms in the fuel consists of U-235.

d. the ratio of the number of U-235 atoms to the number of U-238 atoms is 0.20 (20%).

Answer: A.013 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, page 112.

QUESTION A.014 [1.00 point] (14.0)
For U-235, the thermal fission cross-section is 582 barns, and the capture cross-section is 99 barns. When a thermal neutron is absorbed by U-235, the probability that fission will occur is:

a. 0.146

b. 0.170

c. 0.830

d. 0.855

Answer: A.014 d.
Reference: Duderstadt and Hamilton, Nuclear Reactor Analysis, page 18.

QUESTION A.015 [1.00 point] (15.0)
If the reactor is supercritical at 1 watt with a stable positive period of 29 seconds, reactor power ONE minute later will be approximately:

a. 3 watts.
b. 6 watts.
c. 8 watts.
d. 25 watts.

Answer: A.015 c.
Reference: From Equation Sheet, $P = P_o e^{t/\tau}$; $P = 1 x e^{(60/29)} = e^{2.069} = 7.91$ watts.

QUESTION A.016 [1.00 point] (16.0)
A critical reactor is operating at a steady state power level of 1.000 watts. Reactor power is increased to a new steady-state power level of 1.004 watts. Neglecting any temperature effects, what reactivity insertion is required to accomplish this power change?

a. 0.004 delta k/k.
b. 0.4% delta k/k.
c. 1.004% delta k/k.
d. Indeterminate, since any amount of positive reactivity could be used.

Answer: A.016 d.
Reference: Since time is not a factor, any amount of positive reactivity will cause the power to rise.

QUESTION A.017 [1.00 point] (17.0)
Which ONE of the following describes the term prompt jump?

a. The instantaneous change in power level due to withdrawing a control rod.
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 positive reactivity insertion which is less than β_{eff}.

Answer: A.017 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, page 287.

QUESTION A.018 [1.00 point] (18.0)
Which ONE of the following conditions will DECREASE shutdown margin?

a. Addition of uranium fuel.

b. Xenon buildup following shutdown.

c. Adding an experiment which inserts negative reactivity.

d. Increasing pool water temperature, if temperature coefficient is negative.

Answer: A.018 a.
Reference: Anything which adds positive reactivity will increase the shutdown margin.

QUESTION A.019 [1.00 point] (19.0)
Which ONE of the following statements describes the difference between Differential (DRW) and Integral (IRW) rod worth curves?

a. IRW is the slope of the DRW at a given 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. 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.

d. 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.

Answer: A.019 c.
Reference: Laboratory 4 Experiment.

QUESTION A.020 [1.00 point] (20.0)
A <u>thermal neutron</u> is a neutron which:

a. is produced as a result of thermal fission.

b. possesses thermal rather than kinetic energy.

c. has been produced several seconds after its initiating fission occurred.

d. experiences no net change in its energy after several collisions with atoms of the diffusing medium.

Answer: A.020 d.
Reference: Laboratory 5 Experiment

(*** End of Section A ***)

QUESTION B.001 [1.00 point] (1.0)
Two point sources have the same curie strength. Source A's gammas have an energy of 1 Mev, whereas Source B's gammas have an energy of 2 Mev. You obtain a reading from the same GM tube 10 feet from each source. Concerning the two readings, which ONE of the following statements is correct?

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.001 c.
Reference: GM tube cannot distinquish between energies.

QUESTION B.002 [1.00 point] (2.0)
The dose rate from a mixed beta-gamma source is 100 mrem/hour at a distance of one (1) foot, and is 0.1 mrem/hour at a distance of twenty (20) feet. What percentage of the source consists of beta radiation?

a. 20%
b. 40%
c. 60%
d. 80%

Answer: B.002 c.
Reference: At 20 feet, there is no beta radiation. Gamma at 20 feet = 0.1 mrem/hour, gamma at 1 foot = 40 mrem/hour. Therefore beta at 1 foot = 60 mrem/hour = 60%.

QUESTION B.003 [1.00 point] (3.0)
"Experiments containing known explosives or highly flammable materials shall not be installed in the reactor." This is an example of a:

a. safety limit.
b. surveillance requirement.
c. limiting safety system setting.
d. limiting condition for operation.

Answer: B.003 c.
Reference: RPI Technical Specifications, Section 3.4.

QUESTION B.004 [1.00 point] (4.0)
In accordance with the Technical Specifications, which ONE condition below is permissible during reactor operation?

a. Control room area gamma monitoring system bypassed.
b. Positive isothermal temperature coefficient of reactivity.
c. A movable experiment with a reactivity worth of $0.65.
d. Three operable control rods.

Answer: B.004 b.
Reference: RPI Technical Specifications, Section 3.2.

QUESTION B.005 [1.00 point] (5.0)
In accordance with the Power Calibration Procedure, if the absolute power level of the log power chamber does not agree within 10% of the log power recorder:

a. The log power recorder scale must be recalibrated.
b. The position of the chamber must be adjusted to give the proper indication.
c. The high voltage to the chamber must be adjusted to give the proper indication.
d. The compensating voltage of the chamber must be adjusted to give the proper indication.

Answer: B.005 a.
Reference: Surveillance Procedures, “Power Calibration”.

QUESTION B.006 [1.00 point] (6.0)
A radioactive sample is reading 25 R/hour. Four hours later, the sample reads 2.5 R/hour. The approximate time required for the sample to decay to 100 mR/hour from the 2.5 R/hour point is:

a. 1.9 hours
b. 3.8 hours
c. 5.6 hours
d. 7.8 hours

Answer: B.006 c.
Reference: Equation Sheet. $DR = DR_o e^{-\lambda t}$;
$(2.5/25) = e^{-4\lambda}$; $\lambda = 0.575\ hr^{-1}$;
therefore, $(0.1/2.5) = e^{-0.575t}$; t = 5.6 hours.

QUESTION B.007 [1.00 point] (7.0)
Two Emergency classes for the Critical Facility are:

a. Protective Action Guide and Emergency Action Level.

b. Personnel Emergency and Protective Action Guide.

c. Emergency Action Level and Emergency Alert.

d. Personnel Emergency and Emergency Alert.

Answer: B.007 d.
Reference: Emergency Plan, Section 4.

QUESTION B.008 [1.00 point] (8.0)
"Area for which offsite emergency planning is performed to assure that prompt and effective actions can be taken to protect the public in the event of an accident" defines a (an):

a. operations boundary

b. site boundary

c. emergency planning zone

d. emergency support center

Answer: B.008 c.
Reference: Emergency Plan, Definitions.

QUESTION B.009 [1.00 point] (9.0)
A KNOWN CORE is one for which:

a. the core has been critical and the critical bank position has been measured.

b. fuel movement may occur with only three control rods and rod drives operational.

c. the inverse multiplication method is used for fuel addition in the initial approach to criticality.

d. the addition, movement or removal of fuel is limited to $0.30 of reactivity or four fuel pins, whichever is smaller.

Answer: B.009 a.
Reference: Operating Procedures, G, Fuel Handling.

QUESTION B.010 [1.00 point] (10.0)
To ensure that there is adequate shutdown capability even with a stuck rod, requirements are established for the:

a. insertion time for each control rod.
b. minimum number of operable control rods.
c. maximum moderator-reflector water level.
d. actuation time for the auxiliary reactor scram.

Answer: B.010 b.
Reference: Technical Specifications, Section 3.1, Bases.

QUESTION B.011 [1.00 point] (11.0)
Which ONE of the following actions is required for a spill involving material that contains 15 microcuries of beta gamma emitters:

a. confine the spill immediately.
b. vacate and secure the affected room.
c. right the container of spilled material.
d. drop absorbent paper on the liquid spill.

Answer: B.011 b.
Reference: Emergency Procedures, 7.3.2.

QUESTION B.012 [1.00 point] (12.0)
The limit for maximum water level at no greater than 10 inches above the top of the core is based on:

a. providing adequate neutron shielding during operation.
b. avoiding hydraulic restrictions to control rod insertion during a scram.
c. limiting moderator mass to maximize negative temperature coefficient effects during transients.
d. ensuring that negative reactivity will be added within the time assumed in the safety analysis by loss of the reflector above the core following a scram.

Answer: B.012 d.
Reference: Technical Specifications, Section 3.1, Bases.

QUESTION B.013 [2.00 points - ½ point each] (14.0)
Match the 10 CFR Part 55 requirements listed in Column A for an actively licensed operator with the correct time period from Column B. Column B answers may be used once, more than once, or not at all.

Column A	Column B
a. License Expiration	1. 1 year
b. Medical Examination	2. 2 years
c. Requalification Written Examination	3. 3 years
d. Requalification Operating Test	4. 6 years

Answer: B.013 a. = 4; b. = 2; c. = 2; d. = 1.
Reference: 10 CFR Part 55

QUESTION B.014 [1.00 point] (15.0)
Which ONE of the following surveillances are required to be performed before a reactor startup?

a. Moderator-reflector water height verification.
b. Criticality detector system calibration.
c. Control rod drop time determination.
d. Shutdown margin determination.

Answer: B.014 a.
Reference: RPI Technical Specifications, Section 4.1.

QUESTION B.015 [1.00 point] (16.0)
Which ONE of the following defines an "Instrument Channel Check?"

a. The introduction of a signal into a channel for verification that it is operable.

b. The qualitative verification of acceptable performance by observation of channel behavior.

c. A combination of sensors, electronic circuits and output devices which measure and display the value of a parameter.

d. The adjustment of a channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures.

Answer: B.015 b.
Reference: RPI Technical Specifications, Definitions.

QUESTION B.016 [1.00 point] (17.0)
Prior to the disposal of water from the reactor tank, storage tank or sump, it must be tested to ensure:

a. the activity is within limits
b. the pH is between 4.7 and 7.0
c. the temperature is less than 70 deg. F
d. the particulate concentration is within limits

Answer: B.016 a.
Reference: Operating Procedures, I, Water Disposal.

QUESTION B.017 [1.00 point] (18.0)
Following an unintentional scram, the reactor may be prepared for startup only after the cause of the scram has been determined by the:

a. Reactor Operator
b. Senior Reactor Operator
c. Operations Supervisor
d. Facility Director

Answer: B.017 b.
Reference: Emergency Procedure 7.3.1.

QUESTION B.018 [1.00 point] (19.0)
During a reactor startup in which the rod sensitivity is known from previous measurements, withdrawal of control rods as a bank is permitted:

a. as long as the reactivity addition does not exceed 12 cents per second.
b. as long as the control rod withdrawal rate does not exceed 5 inches per minute.
c. as long as the reactivity addition does not exceed 12 cents per second up to 10 times the source level.
d. only until the source channel has increased by ONE decade and then they may only be withdrawn ONE at a time.

Answer: B.018 c.
Reference: Operating Procedures, A, Reactor Startup.

QUESTION B.019 [1.00 point] (20.0)

During performance of a power calibration, the reactor is scrammed after activation and the operator enters the high bay area to take readings. Prior to entering the high bay area the operator should verify that:

a. the neutron source has been removed to its shielded container.

b. all control rods are fully inserted and water drained from the tank.

c. the "Reactor On" key is removed and returned to the office safe.

d. 10 minutes have elapsed to allow for short lived isotopes to decay.

Answer: B.019 d.
Reference: Surveillance Procedures, 3, Power Calibration.

(*** End of Section B ***)

Section C: - Plant and Rad Monitoring Systems

QUESTION C.001 [1.00 point] (1.0)
The “Reactor Tank Fill and Drain Control” switch is turned to “Fill.” When the “Fill” light next to the switch comes on:

a. the fill pump stops.
b. the fill valve is completely opened.
c. the reactor tank is filled to 68 inches with water.
d. the return valve to the fill pump suction is fully closed.

Answer: C.001 b.
Ref: Pre-Startup Procedures, D, Water Fill.

QUESTION C.002 [1.00 point] (2.0)
Which ONE of the following will result in a control rod withdrawal interlock (i.e., rod remains as is)?

a. Neutron flux = 2 cps
b. Failure of the power supply
c. Reactor period = 20 seconds
d. Water level in tank = 11 inches above top grid

Answer: C.002 a.
Reference: SAR Figure

QUESTION C.003 [1.00 point] (3.0)
Which ONE of the following descriptions of interlock features will allow control rod motion?

a. fill pump on, period greater than 15 seconds.
b. fill pump off, period less than 15 seconds.
c. fill pump off, period greater than 15 seconds.
d. fill pump on, period less than 15 seconds.

Answer: C.003 c.
Reference: SAR, Figure

QUESTION C.004 [1.00 point] (4.0)
Maximum control rod motion is limited to:

a. 22 inches, the length of the active absorber in the control rod.

b. 36 inches, the effective height of the core.

c. 42 inches, the nominal length of a fuel pin.

d. 64 inches, the height of water in the tank.

Answer: C.004 b.
Reference: SAR, Section 4.2.2.

QUESTION C.005 [1.00 point] (5.0)
The SPERT fuel elements consist of:

a. 4.8% enriched uranium with stainless steel clad.

b. 35.2% enriched uranium with stainless steel clad.

c. 4.8% enriched uranium with aluminum clad.

d. 35.2% enriched uranium with aluminum clad.

Answer: C.005 a.
Reference: SAR, Section 4.2.1.

QUESTION C.006 [1.00 point] (6.0)
A linear power channel uses a (an):

a. uncompensated ion chamber

b. compensated ion chamber

c. boron-trifluoride detector

d. fission chamber

Answer: C.006 a.
Reference: SER, page 4-7. Vol. 2, Control Instrumentation Block Diagram.

QUESTION C.007 [1.00 point] (7.0)
During normal operation, the principal airborne radionuclide formed is:

a. N-16
b. I-131
c. Cs-137
d. Ar-41

Answer: C.007 d.
Reference: SER, page 11-1.

QUESTION C.008 [1.00 point] (8.0)
With regard to the Solenoid Interrupt Circuit:

a. if one of the electrical leads in one of the instrument scram's external contacts broke (open circuit), it would cause a scram.

b. if one of the electrical leads in one of the control rod solenoid circuits broke (open circuit), it would cause all control rods to drop.

c. if one of the electrical leads in one of the manual scram's external contacts broke (open circuit), it would not cause a scram.

d. the rectified DC current flows through two series instrument scram relays, the opening of either of which would cause a scram.

Answer: C.008 d.
Reference: Vol. 2, Solenoid Interrupt Circuit.

QUESTION C.009 [1.00 point] (9.0)
There are three scram functions which may be BYPASSED. Two of them are:

a. high water level scram, reactor door scram.
b. linear power scram, period scram.
c. linear power scram, reactor door scram.
d. reactor door scram, period scram.

Answer: C.009 d.
Reference: Technical Specifications, Table 1.

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QUESTION C.010 [1.00 point] (10.0)
Period information is supplied from the:

a. BF3 detector.

b. Log Amplifier.

c. Linear Channel 1.

d. Linear Channel 2.

Answer: C.010 b.
Reference: SAR, Figure 7.1

QUESTION C.011 [1.00 point] (11.0)
If control rod sensitivity is known, withdrawal of the rods as a bank is permitted as long as:

a. reactor period is greater than 20 seconds

b. the reactivity addition does not exceed $0.05 per second

c. the reactivity addition does not exceed $0.20 per second

d. the source level channel has increased by less than one decade

Answer: C.011 b.
Reference: Operating Procedures, Section A.

QUESTION C.012 [1.00 point] (12.0)
The time required to fill the 2000 gallon reactor tank is approximately:

a. 30 minutes

b. 40 minutes

c. 60 minutes

d. 80 minutes

Answer: C.012 b.
Reference: Operating Procedures, Section J.

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QUESTION C.013 [2.00 points, ½ point each] (14.0)
For the area radiation monitoring system, match the alarm settings in Column B with the appropriate channel in Column A. Items in Column B may be used once, more than once, or not at all.

	Column A	Column B
a.	Control room	1. 20 mr/hour
b.	Reactor window	2. 100 mr/hour
c.	Reactor room	3. 40 mr/hour
d.	Reactor deck	4. 10 mr/hour

Answer: C.013 a. = 4; b. = 3; c. = 1; d. = 2.
Reference: SAR, Section 7.7.

QUESTION C.014 [1.00 points] (15.0)
Which ONE of the following safety system scram conditions has a scram BYPASS associated with it?

a. Loss of power to the reactor building.
b. Magnet switch on control panel OFF.
c. Linear power scram.
d. Reactor door OPEN.

Answer: C.014 d.
Reference: Technical Specifications, Table 1.

Question: C.015 [1.0 point] (16)
A linear power channel (LP1 or LP2) uses a (an):

a. uncompensated ion chamber
b. compensated ion chamber
c. fission chamber
d. boron-trifluoride detector

Answer: C.015 a.
Reference: Laboratory 1.

End of Section C
End of Examination