December 17, 2015

Dr. Sean McDeavitt, Director
Nuclear Science Center
Texas A&M University
Texas Engineering Experiment Station
1095 Nuclear Science Road, MS 3575
College Station, Texas 77843

SUBJECT: EXAMINATION REPORT NO. 50-128/OL-16-01, TEXAS A&M UNIVERSITY

Dear Dr. McDeavitt:

During the week of November 16, 2015, the Nuclear Regulatory Commission (NRC) administered an operator licensing examination at your TRIGA 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 Phillip T. Young at (301) 415-4094 or via electronic mail Phillip.young@nrc.gov.

Sincerely,

/RA/

Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-128

Enclosures: 1. Examination Report No. 50-128/OL-16-01
2. Written examination

cc without enclosures: See next page

December 17, 2015

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Nuclear Science Center
Texas A&M University
Texas Engineering Experiment Station
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College Station, Texas 77843

SUBJECT: EXAMINATION REPORT NO. 50-128/OL-16-01, TEXAS A&M UNIVERSITY

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Office	PROB/CE	IOLB/OLA	PROB/BC
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Date	12/17/2015	12/16/2015	12/17/2015

OFFICIAL RECORD COPY

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

REPORT NO.: 50-128/OL-16-01

FACILITY DOCKET NO.: 50-128

FACILITY LICENSE NO.: R-83

FACILITY: TEXAS A&M UNIVERSITY

EXAMINATION DATES: November 17 - 19, 2015

SUBMITTED BY: **/RA/** **12/17/2015**
Philip T. Young, Chief Examiner Date

SUMMARY:

During the week of November 17, 2015, the NRC administered the operator licensing examinations to six (6) Reactor Operator initial candidates, one (1) Reactor Operator Retake candidate and one (1) Senior Reactor Operator Retake candidate. One (1) Reactor Operator initial candidate and one (1) Senior Reactor Operator Retake candidate failed a portion of the written examination, all others passed all portions of their examinations.

REPORT DETAILS

1. Examiner: Philip T. Young, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	6/1	0/1	6/2
Operating Tests	6/0	0/0	6/0
Overall	6/1	0/1	6/2

3. Exit Meeting:
Philip T. Young, Chief Examiner
Jerry Newhouse, Assistant Director, Texas A&M University TRIGA

The examiner thanked the facility for their support during the examination. The facility indicated that they did not have any comments on the written examination.

ENCLOSURE 1

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

FACILITY: TEXAS A&M UNIVERSITY

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 11/17/2015

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
20.00	33.3	_____	____	C. Facility and Radiation Monitoring Systems
60.00		_____	____% FINAL GRADE	TOTALS

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

_____
Candidate's Signature

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 <u>only</u> 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.

13. When you have completed and turned in you examination, leave the examination area. If you are observed in this area while the examination is still in progress, your license may be denied or revoked.

$$\dot{Q} = \dot{m}\, c_p\, \Delta T = \dot{m}\, \Delta H = UA\, \Delta T$$

$$\lambda_{eff} = 0.1 \text{ seconds}^{-1}$$

$$SUR = 26.06\left[\frac{\lambda_{eff}\,\rho}{\beta - \rho}\right]$$

$$SCR = \frac{S}{-\rho} \approx \frac{S}{1 - K_{eff}}$$

$$CR_1(1 - K_{eff_1}) = CR_2(1 - K_{eff_2})$$

$$CR_1(-\rho_1) = CR_2(-\rho_2)$$

$$M = \frac{1 - K_{eff_0}}{1 - K_{eff_1}}$$

$$M = \frac{1}{1 - K_{eff}} = \frac{CR_1}{CR_2}$$

$$P = P_0\, 10^{SUR(t)}$$

$$P = P_0\, e^{\frac{t}{T}}$$

$$P = \frac{\beta(1-\rho)}{\beta - \rho} P_0$$

$$SDM = \frac{(1 - K_{eff})}{K_{eff}}$$

$$T = \frac{\ell^*}{\rho - \bar{\beta}}$$

$$T = \frac{\ell^*}{\rho} + \left[\frac{\beta - \rho}{\lambda_{eff}\,\rho}\right]$$

$$\Delta\rho = \frac{K_{eff_2} - K_{eff_1}}{k_{eff_1}\, x\, K_{eff_2}}$$

$$T_{1/2} = \frac{0.693}{\lambda}$$

$$\rho = \frac{(K_{eff} - 1)}{K_{eff}}$$

$$DR = DR_0\, e^{-\lambda t}$$

$$DR = \frac{6CiE(n)}{R^2}$$

$$DR_1\, d_1^{\,2} = DR_2\, d_2^{\,2}$$

DR – Rem; Ci – curies; E – Mev; R – feet

$$\frac{(\rho_2 - \beta)^2}{Peak_2} = \frac{(\rho_1 - \beta)^2}{Peak_1}$$

1 Curie = 3.7 x 10^{10} dis/sec
1 Horsepower = 2.54 x 10^3 BTU/hr
1 BTU = 778 ft-lbf
1 gal (H_2O) ≈ 8 lbm
c_P = 1.0 BTU/hr/lbm/°F

1 kg = 2.21 lbm
1 Mw = 3.41 x 10^6 BTU/hr
°F = 9/5 °C + 32
°C = 5/9 (°F - 32)
c_p = 1 cal/sec/gm/°C

Section A Reactor Theory, Thermo, and Facility Characteristics

Question A.001 [1.0 point] {1.0}
When a reactor is scrammed, the xenon population starts to increase. This occurs primarily because:

a. delayed neutrons are continuing to be produced and cause fissions, resulting in xenon production.

b. the half-life for the decay of I-135 is shorter than the half-life for the decay of Xe-135.

c. Xe-135 is stable and does not decay.

d. xenon burnout does not occur due to the low neutron population.

Answer: A.01 b.
Reference: Burn, Introduction to Nuclear Reactor Operations

Question A.002 [1.0 point] {2.0}
In order to make the maximum use of the NSCR reactor core:

a. Graphite reflectors are kept near the periphery edges.

b. Control rods are located in the lower flux areas.

c. Two rod bundles are used next to flux traps on the core edge.

d. Flux near the core edge is kept lower than in the center to avoid losses.

Answer: A.02 a
Reference: Reactor Training Manual - Reactor Physics and Kinetics

Question A.003 [1.0 point] {3.0}
Which ONE of the following explains the response of a SUBCRITICAL reactor to equal insertions of positive reactivity as the reactor approaches criticality?

a. Each insertion causes a SMALLER increase in the neutron flux resulting in a LONGER time to stabilize.

b. Each insertion causes a LARGER increase in the neutron flux resulting in a LONGER time to stabilize.

c. Each insertion causes a SMALLER increase in the neutron flux resulting in a SHORTER time to stabilize.

d. Each insertion causes a LARGER increase in the neutron flux resulting in a SHORTER time to stabilize.

Answer: A.03 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1988, §

Question A.004 [1.0 point] {4.0}
Which of the following does NOT affect the Effective Multiplication Factor (Keff)?

a. The moderator-to-fuel ratio.

b. The physical dimensions of the core.

c. The strength of installed neutron sources.

d. The current time in core life.

Answer: A.04 c.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 3.3.4, p. 3-21.

Question A.005 [1.0 point] {5.0}
The delayed neutron fraction, β, is defined as a ratio of:

a. Thermal utilization over fast fission factor.

b. The number of thermal neutrons over the number of fast neutrons in the core.

c. The number of delayed neutrons over the number of total neutrons in the core.

d. The number of thermal neutrons absorbed in fuel over the number of thermal neutrons absorbed in core materials including in fuel.

Answer: A.05 c.
Reference: Introduction to Nuclear Operation, Reed Burn, 1988, Sec 3.3.3, page 3-11.

Question A.006 [1.0 point] {6.0}
The NSCR operates on the bottom of a 30 foot deep pool filled with 106, 000 gallons of water:

a. Providing a large static head forcing flow up through the reactor.

b. Permitting greater margin to boiling because of the higher static pressure.

c. Creating a thermal heat sink separated from the core by greater distance.

d. Allowing a more even distribution of BTUs in the reactor core.

Answer: A.06 b.
Reference: License Amendment Submittal, 7/15/96, pp 23

Question A.007 [1.0 point] {7.0}
A reactor is critical at full rated power, with reactivity at zero. A control rod is inserted and the power decreases to a lower steady-state value. The reactivity of the reactor at the lower power level is zero because:

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

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

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

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

Answer: A.07 a.
Reference: Since the fuel temperature must drop, positive reactivity is added.

Question A.008 [1.0 point] {8.0}
Which ONE of the following is the correct amount of reactivity added if the multiplication factor, k, is increased from 0.800 to 0.950?

a. 0.150

b. 0.158

c. 0.188

d. 0.197

Answer: A.08 d.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, Sec 3.3.3, page 3-21.
. In order to solve the question A.08, the applicant can use one of the following methods:
At k=0.8; $\rho = \Delta Keff/Keff$ or $\rho = Keff-1/Keff = -0.2/0.8 = -0.25$. At k=0.95, $\rho = -0.05/0.95$
$\rho = -0.053$. The difference between ρ is the answer ,i.e. -0.053-(-0.25)=0.197
$\Delta \rho = \rho 1 - \rho 2$ where $\rho 1 = Keff1-1/Keff1$ and $\rho 2 = Keff2-1/Keff2$. Substitute ρ1 and ρ2 with Keff1 and Keff2 into the equation above, the result is $\Delta\rho = keff1-keff2/(keff1 \times keff2)$

Question A.009 [1.0 point] {9.0}

Given the following worth: ρ_{excess} = \$0.90
SAFE = \$2.20
REG blade = \$0.30
SHIM = \$1.55

Calculate the TECHNICAL SPECIFICATION LIMIT of Shutdown Margin for this core.

a. \$0.95

b. \$1.25

c. \$1.55

d. \$3.15

Answer: A.09 a.
Reference: Total rod worth – (excess + most active rod)
\$(2.20 +1.55+0.30) –\$(0.90+2.20) =\$0.95

Question A.010 [1.0 point] {10.0}

Which ONE of the following is the definition of the term "Cross-Section?"

a. The probability that a neutron will be captured by a nucleus.

b. The most likely energy at which a charge particle will be captured.

c. The length a charged particle travels past the nucleus before being captured.

d. The area of the nucleus including the electron cloud.

Answer: A.10 a.
Reference: Reactor Training Manual - Cross Section.

Question A.011 [1.0 point] {11.0}

One of the conservative features of the NSCR :

a. Stems from the advantage of a deep reactor pool and therefore colder water.

b. Can be observed that as the reactor ages its pulsing power peaks are reduced.

c. Is the presence of Erbium -167 which acts as a resonant neutron absorber.

d. is that peak axial power in core is near the bottom where water is the coldest.

Answer: A.11 c.
Reference: SAR I The Facility

Question A.012 [1.0 point] {12.0}
Consider two identical critical reactors, with the exception that one has a beta of 0.0072 and the other has a beta of 0.0060. Each reactor is operating at 10 watts. Which one of the following compares the response of the reactors to a +0.1% delta k/k reactivity insertion?

a. The resulting period will be shorter for the reactor with the 0.0072 beta fraction

b. The resulting period will be shorter for the reactor with the 0.0060 beta fraction

c. The resulting power level will be higher for the reactor with the 0.0072 beta fraction

d. The resulting power level will be higher for the reactor with the 0.0060 beta fraction

Answer: A.12 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, §§ 3.2.2 — 3.2.3

Question A.013 [1.0 point] {13.0}
The reactor is critical and increasing in power. Power has increased from 20 watts to 80 watts in 60 seconds. How long will it take at this rate for power to increase from 0.080 KW to 160 KW?

a. 0.5 minute

b. 2.5 minutes

c. 5.5 minutes

d. 10.5 minutes

Answer: A.13 c.
Reference: $P = Poe^{t/T}$ → $80 = 20e^{60\ sec/T}$ → T = 43.28 sec 1.6 x 10^5 watts = 80et/43.28 t = 329 sec = 5.5 minutes

Question A.014 [1.0 point] {14.0}
Which ONE of the following parameters is MOST significant in determining the differential worth of a control rod?

a. Rod speed.

b. Flux Shape.

c. Fuel loading.

d. Reactor power.

Answer: A.14 b.
Reference: Fund. Of Nuclear Engineering, Chapter 3, Section 4, page 75.

Question A.015 [1.0 point] {15.0}
Which ONE of the following materials is the best moderator for the reactor?

a. Water.

b. Beryllium.

c. Graphite.

d. Uranium-238.

Answer: A.15 a.
Reference: NRC Standard Question

Question A.016 [1.0 point] {16.0}
Which ONE of the following is the MAJOR source of energy released during SHUTDOWN?

a. Prompt gamma rays.

b. Decay of the fission fragments.

c. Kinetic energy of the fission neutrons.

d. Kinetic energy of the fission fragments.

Answer: A.16 b.
Reference: Introduction to Nuclear Operation, Reed Burn, 1988, Sec 3.2, page 3-5

Question A.017 [1.0 point] {17.0}
Which ONE of the following conditions will DECREASE a shutdown margin of reactor?

a. Fuel depletion

b. Insertion of a positive reactivity worth experiment

c. Insertion of a negative reactivity worth experiment

d. increase moderator temperature (Assume negative temperature coefficient)

Answer: A.17 b.
Reference: Adding a positive reactivity in the reactor core will decrease the shutdown margin.

Question A.018 [1.0 point] {18.0}
Which ONE of the following isotopes has the HIGHEST thermal neutron cross section?

a. Cd-112

b. Sm-149

c. Xe-135

d. U-238

Answer: A.18 c.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1988, Table2.5, page 2-59.

Question A.019 [1.0 point] {19.0}
The injection of a sample results in a 50 millisecond period. If the scram setpoint is 1200 KILOWATTS and the scram delay time is 0.1 seconds, which ONE of the following is the peak power of the reactor at shutdown?

a. 1270 kW

b. 4370 kW

c. 8870 kW

d. 12200 kW

Answer: A.19 c.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982,
$P = P0\ et/\tau$, $P = 1200$ kilowatts $\times$ e0.1/0.05 = 1200 $\times$ e2 = 8866.9 kilowatts

Question A.020 [1.0 point] {20.0}
Which one of the following describe the difference between a moderator and reflector?

a. A reflector increases the fast non-leakage factor and a moderator increases the thermal utilization factor.

b. A reflector increases the neutron production factor and a moderator increases the fast fission factor.

c. A reflector decreases the thermal utilization factor and a moderator increases the fast fission factor.

d. A reflector decreases the neutron production factor and a moderator decreases the fast nonleakage factor.

Answer: A.20 a.
Reference: Glasstone & Sesonke, Nuclear Reactor Engineering, Chapter 1

Section B___Normal/Emergency Procedures & Radiological Controls

Question: B.001 [1.00] {1.0}
Which ONE of the statements below describes the reason for maintaining bulk pool water chemistry?

a. Reduce the corrosion of the pool liner.

b. Maintain water pH in the range 8.5 and 10.5.

c. Maintain water clarity to facilitate completion of Tech. Spec. required surveillances.

d. Minimize the possibility for corrosion of the cladding on the fuel elements.

Answer: B.01 d.
Reference: TA&M Technical Specifications, Section 3.8, Bases.

Question B.002 [1.0 point] {2.0}
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.02 d.
Reference: 10 CFR 20.4 A rem is a rem is a rem

Question B.003 [1.0 point] {3.0}
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.03 c.
Reference: At twenty feet, the dose rate consists only of gamma radiation.
The gamma dose rate at one foot is:
$DR_1d_1^2 = DR_2d_2^2$; $(DR_1)(1) = (0.1)(400)$; $DR_1 = 40$ mrem/hour.
The beta dose rate at one foot is 60 mrem/hour = 60%.

Question: B.004 [1.00 point, 0.25 each] {4.0}
Identify each of the following as either a channel **check**, a channel **test** or a channel **cal**ibration.

a. Dipping a temperature detector in ice water and verifying the channel reads 32□F (0□C)

b. Verifying proper overlap between Nuclear Instrumentation Channels during startup.

c. After receiving an alarm on an Area Radiation Monitor, you verify the reading with a hand-held meter.

d. Performing a reactor pool water rate-of-temperature-rise measurement, then adjusting the detectors to the correct readout.

Answer B.04 a. = test; b. = check; c. = check; d. = cal
Reference: Technical Specifications § 1.3.

Question B.005 [1.0 point] {5.0}
Consider the plant conditions:

- all rods fully inserted
- reactor is subcritical
- shim/safety rod #1 uncoupled from the drive
- regulating rod controller in MANUAL
- rod motion switches in neutral
- appropriate log entries made
- reactor key in the console
- shim/safety rod #1 drive motor being replaced

Which ONE of the following statements describes the status of the plant?

a. The reactor is operating.

b. The reactor is shutdown and the console is secured.

c. The reactor is secured but the console is not secured.

d. The reactor is shutdown and the console is not secured.

Answer: B.05 d.
Reference: SOP II-F Reactor Shutdown; Technical Specifications, 1.24, 1.25. 1.27. and 1.28

Section B___Normal/Emergency Procedures & Radiological Controls

Question: B.006 [1.00 point, 0.25 each] {6.0}
Identify each of the following as either a Safety Limit (SL), a Limiting Safety System Setting (LSSS) or a Limiting Condition for Operation (LCO)

a. The temperature in a TRIGA-FLIP fuel element shall not exceed 2100□°F (1150□°C) under any conditions of operation.

b. … shall be 975□°F (525□°C) as measured in an instrumented fuel element. The instrumented fuel element shall be located adjacent to the central bundle with the exception of corner positions.

c. The reactivity to be inserted for pulse mode operation shall not exceed that amount which will produce a peak fuel temperature of 1526°□F (830□°C).

d. Conductivity of the bulk pool water shall be no higher than 5×10-6 mhos/cm for a period not to exceed two weeks.

Answer: B.06 a. = SL; b. = LSSS; c. = LCO; d. = LCO
Reference: Technical Specifications §§ 2.1, 2.2, 3.1.2 and 3.8

Question: B.007 [1.00] {7.0}
The reactivity worth of a particular experiment is determined to be $1.50. Which ONE of the statements below is correct concerning this experiment?

a. The experiment cannot be allowed in the core due to an excessive reactivity value.

b. The experiment can be placed in the core as a non-secured experiment.

c. The experiment is allowed in the core but must be secured.

d. The experiment is allowed in the core providing analysis indicates the worth is such that removal will not exceed the safety limit.

Answer: B.07 c.
Reference: TA&M Technical Specifications, Section 3.6.1.

Question: B.008 [1.00] {8.0}
A power calibration (calorimetric) of the linear power channel has been performed. In order to make the front panel meter indication agree with the calculated power:

a. the compensating voltage of the linear channel CIC is adjusted.

b. the high voltage of the linear channel CIC is adjusted.

c. the position of the linear channel CIC is adjusted.

d. the full power gain adjust potentiometer is adjusted.

Answer: B.08 d.
Reference: SOP II-J Power Calibration

Question: B.009 [1.00] {9.0}
The Period scram may be bypassed. Select the statement which correctly describes operational requirements and minimum level of authorization for this scram to be bypassed.

a. During maintenance with the reactor secured; the reactor supervisor

b. During core manipulations; the SRO

c. For pulsing operations; the SRO

d. After reaching criticality; the RO

Answer: B.09 b.
Reference: SOP II-D.4 Steady State Mode Operation

Question: B.010 [1.00] {10.0}
Which ONE of the following does not require the direct supervision (i.e., presence) of an SRO?

a. Movement of the reactor bridge.

b. Initiation of a pulse.

c. Removal of a control rod.

d. Performance of a power calibration of the Linear Power Channel.

Answer: B.10 d.
Reference: SOP II-G Step 1 Movement of the Reactor Bridge
SOP II-I Step 1 a Reactor Core Manipulation - SOP II-E Step g Pulsing Operations
SOP II-J Power Calibration

Question: B.011 [1.00] {11.0}
In accordance with the Emergency Classification Guide, all alarms from the Facility Air Monitor System are classified as Operational Events with the exception of:

a. Stack Particulate Monitor.

b. Building Gas Monitor.

c. Fission Gas Monitor.

d. Stack Gas Monitor.

Answer: B.11 c.
Reference: Emergency Classification Guide, pg. 2.

Question: B.012 [1.00] {12.0}
An area in which radiation levels could result in an individual receiving a dose equivalent in excess of 120 mRem/hr is defined as:

a. Radiation area.

b. Restricted Area.

c. High Radiation Area.

d. Very High Radiation Area.

Answer: B.12 c.
Reference: 10 CFR 20

Question: B.013 [1.00] {13.0}
A radiation survey of an area reveals a general radiation reading of 1 mrem/hr. However, there is a small section of pipe which reads 20 mrem/hr at one (1) meter. Assuming that the pipe is a point source, which ONE of the following defines the posting requirements for the area in accordance with 10CFR Part 20?

a. Radiation Area

b. High Radiation Area

c. Controlled Access Area

d. Grave Danger, Very High Radiation Area

Answer: B.13 b.
Reference: 20 mrem/hr at 1 meter (100 cm.) = 222.2mrem/hr at 30 cm.
20 mrem/hr*(100cm) 2 /(30 cm) 2 = 222.2 mrem/hr at 30 cm

Question: B.014 [1.00] {14.0}
Which one of the following is the definition of Total Effective Dose Equivalent (TEDE) specified in 10 CFR Part 20?

a. The sum of thyroid dose and external dose.

b. The sum of the external deep dose and the organ dose.

c. The sum of the deep dose equivalent and the committed effective dose equivalent.

d. The dose that your whole body is received from the source, but excluded from the deep dose.

Answer: B.14 c.
Reference: 10 CFR 20.

Question: B.015 [1.00] {15.0}
Select the correct sequence of rod withdrawal during a normal reactor startup.

a. Shim-Safeties in gang to upper limit, Transient to mid position, Regulating to criticality

b. Regulating to upper limit, Transient to mid position, Shim-Safeties in gang to criticality

c. Transient to upper limit, Regulating to mid position, Shim-Safeties in gang to criticality

d. Transient to upper limit, Shim-Safeties in gang to mid position, Regulating to criticality.

Answer: B.15 c.
Reference: SOP II-C Reactor Startup, pg. 2 of 4

Question: B.016 [1.00] {16.0}
You have not performed the functions of an RO or SRO in the past 6 months. Per the Regulations, prior to resuming activities authorized by your license, how many hours must you complete in that function under the direction of an RO or SRO as appropriate?

a. 4

b. 6

c. 12

d. 40

Answer: B.16 b.
Reference: 10CFR55.53(f)(2))

Question: B.017 [1.00] {17.0}
Which ONE of the following is the appropriate Emergency Classification when the Xe-125 monitor alarms and indicates a release of 150 Ci from the reactor building?

a. Operational Events

b. Notification of Unusual Events

c. Alert

d. Site Area Emergency

Answer: B.17 b.
Reference: EP Table I, page 19

Question: B.018 [1.00] {18.0}
According to emergency classification guide, the pool leakage which indicated abnormal loss at a rate exceeding makeup capacity is defined as:

a. Operational Event

b. Notification of Unusual Event

c. Alert

d. Site Area Emergency

Answer: B.18 c.
Reference: Emergency Plan, Section 4, Emergency Classification System Table-I.

Question: B.019 [1.00] {19.0}
An Emergency Action Level is:

a. a condition which calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.

b. a class of accidents for which predetermined emergency measures should be taken or considered.

c. a specific instrument reading or observation which may be used as a threshold for initiating appropriate emergency procedures.

d. a procedure that details the implementation actions and methods required to achieve the objectives of the emergency plan.

Answer: B.19 c.
Reference: Emergency Plan Definition 2.8, pg. 9.

Question: B.020 [1.00] {20.0}
In accordance with SOP "Personnel Dosimetry," an Expected High Dose Individual is a person who:

a. may receive a dose greater than the annual limit.

b. may receive a dose greater than 10% of the annual limit.

c. will not be expected to exceed 10% of the annual limit.

d. has received an unknown amount of radiation resulting from an accident.

Answer: B.20 b.
Reference: SOP Personnel Dosimetry.

Section C Facility and Radiation Monitoring Systems

Question C.001 (1.0 point) {1.0}
For the Shim Safety Control Rod drives, which ONE of the following statements is correct?

a. An IN signal for one shim rod overrides an IN signal for the gang of shim rods.

b. An OUT signal for one shim rod overrides an IN signal for the gang of shim rods.

c. An IN signal for one shim rod overrides an OUT signal for the gang of shim rods.

d. An OUT signal for one shim rod overrides an OUT signal for the gang of shim rods.

Answer: C.01 c.
Reference: SAR, 7.3.1 Shim Safety Rod Control

Question C.002 (1.0 point) {2.0}
Why is the pneumatic system vented to the main exhaust stack?

a. Prevent exposure to Ar-41 due to buildup of air in the line.

b. Prevent exposure to N-16 due to buildup of water in the line.

c. Prevent exposure to CO_2, which is an asphyxiation hazard.

d. Prevent exposure to fission product gases due to a fuel cladding breach.

Answer: C.02 a.
Reference: SOP IV-C Pneumatic System Operation; Precautions

Question C.003 (1.0 point) {3.0}
What is the maximum acceptable time between the initiation of a scram signal, and the time that the SHIM rod is fully inserted in the core?

a. 2.5 sec

b. 2.0 sec

c. 1.2 sec

d. 1.0 sec

Answer: C.03 c.
Reference: TS 3.2.3

Section C Facility and Radiation Monitoring Systems

Question C.004 (1.0 point) {4.0}
The output of 1kW interlock signal comes from:

a. Wide Range Linear Monitor

b. Log Power Channel Monitor

c. Safety Channel 1 Power Monitor

d. Safety Channel 2 Power Monitor

Answer: C.04 b.
Reference: SAR, 7.2.3.1 Log Power Channel and Figure 7.2

Question C.005 (1.0 point) {5.0}
Assume the reactor is initially operating in the Steady State mode at a power level of 500 Kw. Which one of the following describes the response of the control rods on the receipt of a scram signal generated by ONLY Safety Amplifier Channel #1? Assume no operator action.

a. Shim-safety rods #1 and #2 will scram, all other rods will remain at their pre-scram positions.

b. Shim-safety rods #1 and #3 will scram, all other rods will remain at their pre-scram positions.

c. All Shim-safety rods and the transient rod will scram, regulating rod will remain at its pre-scram position.

d. All six control rods will scram.

Answer: C.05 c.
Reference: SAR, 7.2.3.6 Scram System

Question C.006 (1.0 point) {6.0}
What prevents liquid radioactive waste from spilling uncontrollably into the environment if one of the liquid waste effluent tanks exceeds its capacity?

a. Drain on the concrete pad leading to a sanitary sewer.

b. Electrical heater in tank accelerates evaporation.

c. Connection to other waste effluent tanks.

d. Pressure sealed caps.

Answer: C.06 c.
Reference: NRC Inspection Report No. 50-128/2003-201

Section C Facility and Radiation Monitoring Systems

Question C.007 (1.0 point) {7.0}
Select the statement that describes the method of selecting the amount of reactivity inserted for a pulse.

a. Placement of the mechanical pulse stop on the transient rod mounting plate.

b. Adjustment of the air supply pressure to the pneumatic cylinder.

c. Placement of the mechanical pulse stop on the air supply solenoid valve.

d. Adjustment of the position of the pneumatic cylinder.

Answer: C.07 d.
Reference: SAR, 7.3.1.1 Transient Rod Control

Question C.008 (1.0 point) {8.0}
What prevents a fuel followed control rod from falling out of the core should it become detached from its mounting?

a. Bottom of pool is within 2 inches of grid plate.

b. Notch in control rod pole connected to reactor frame.

c. Safety plate assembly beneath the reactor grid plate.

d. Tapered section above absorber prevents passage through reactor frame.

Answer: C.08 c.
Reference: SAR, 4.2.5 Core Support Structure

Question C.009 (1.0 point) {9.0}
Which ONE of the following elements is used as the neutron absorber in the Shim-Safety rods?

a. Hafnium

b. Borated Graphite

c. Xenon

d. Cadmium

Answer: C.09 b.
Reference: TS 5.4

Section C Facility and Radiation Monitoring Systems

Question C.010 (1.0 point) {10.0}
During reactor operation, a leak develops in the SECONDARY to PRIMARY heat exchanger. Which ONE of the following correctly explains the reactor pool level?

a. Level will increase because the Primary pressure is HIGHER than the Secondary pressure.

b. Level will decrease because the Primary pressure is LOWER than the Secondary pressure.

c Level will be the same because the Primary pressure is EQUAL to the Secondary pressure.

b. Level will decrease because the Primary pressure is HIGHER than Secondary pressure.

Answer: C.10 d.
Reference: SAR 5.1 and figure 5-4

Question C.011 (1.0 point) {11.0}
The design basis for the confinement system ensures that:

a. the reactor building is maintained at a pressure lower than the atmosphere.

b. the reactor building is at a higher pressure than the atmosphere.

c. the reactor building is always equal to atmospheric pressure.

d. the reactor building and the adjacent laboratory are always at the same pressure.

Answer: C.11 a.
Reference: SAR; - 6.2.2, Containment page 103

Question C.012 (1.0 point) {12.0}
A three-way solenoid valve controls the air supplied to the pneumatic cylinder of the transient rod. De-energizing the solenoid causes the valve to shift to:

a. open, admitting air to the cylinder.

b. close, admitting air to the cylinder.

c. open, removing air from the cylinder.

d. close, removing air from the cylinder.

Answer: C.12 d.
Reference: SAR, page 38; Draft SAR, 7.3.1.1 Transient Rod Control (pg 7-13)

Question C.013 (1.0 point) {13.0}
Which **ONE** of the following is the main function of the demineralizer in the primary purification system?

a. Remove soluble impurity to maintain low conductivity in the tank water.

b. Reduce N-16 formation, thus reduce the dose rate at the reactor pool.

c. Absorb thermal neutrons, thus increase life of the reactor pool.

d. Absorb tritium, thus maintain purity of the pool water.

Answer: C.13 a.
Reference: NRC Standard Question

Question C.014 (1.0 point) {14.0}
Which ONE of the following statements is NOT TRUE regarding the Servo Flux Control system?

a. Alarm if the REG rod is inserted less than 20% fully withdrawn.

b. The regulating rod moves in response to the signal from the Log Power Channel.

c. The regulating rod moves in response to the signal from the Linear Power Channel.

d. The regulating rod control is automatically shift back to manual if the level drifts out of ±.5% range.

Answer: C.14 b.
Reference: SAR 7.1 Summary Description, Figure 7-1 and SOP III-C

Question C.015 (1.0 point) {15.0}
During the calibration of the NSCR Pulse Channel, you depress and hold the “Pulse Cal” button on the Power Range Monitor Module, the power displayed is approximately:

a. 100 MW

b. 500 MW

c. 1000 MW

d. 2000 MW

Answer: C.15 d.
Reference: SOP II-L Annual Pulse Calibration

Question C.016 (1.0 point) {16.0}
On a decreasing pool level the university communications room will receive an alarm as a result of lowering level. What other automatic action will occur?

a. Core pump trip.

b. Purification pump trip.

c. Recirculation pump trip.

d. Skimmer pump trip.

Answer: C.16 c.
Reference: SAR; - 6.2.3, Emergency Core Cooling System, p. 104.

Question C.017 (1.0 point) {17.0}
Which **ONE** of the following air monitor channels is designated as the Fission Product Monitor?

a. Facility Air Monitor Channel 1

b. Facility Air Monitor Channel 2

c. Facility Air Monitor Channel 3

d. Facility Air Monitor Channel 4

Answer: C.17 b.
Reference: SOP VII, Procedure B12

Question C.018 (1.0 point) {18.0}
Which ONE of the following would indicate a clog in the demineralizer tank?

a. High radiation level at pool surface.

b. High flow rate through demineralizer.

c. High temperature in demineralizer.

d. High pressure upstream of demineralizer.

Answer: C.18 d.
Reference: Standard NRC question

Section C Facility and Radiation Monitoring Systems

Question C.019 (1.0 point) {19.0}
Which ONE of the following is the correct source used to calibrate the Area Radiation Monitor?

a. Ar-41

b. Cs-137

c. P-10

d. Xe-125

Answer: C.19 b.
Reference: SOP VII-B7

Question C.020 (1.0 point) {20.0}
Which set of measurements are chosen by the reactor console thermocouple selector?

a. Fuel temperature, irradiation cell temperature, heat exchanger primary outlet temperature.

b. Fuel temperature, pool water temperature, heat exchanger primary outlet temperature.

c. Fuel temperature, irradiation cell temperature, pool water temperature.

d. Pool water temperature, irradiation cell temperature, heat exchanger primary outlet temperature.

Answer: C.20 c.
Reference: SAR; - 7.2.3.7, Fuel Temperature Channel page 109

***** END OF EXAMINATION *****