April 29, 2011

Dr. Warren D. Reece, Director
Nuclear Science Center
Texas Engineering Experiment Station
1095 Nuclear Science Road
MS 3575
College Station, Texas 77843

SUBJECT: EXAMINATION REPORT NO. 50-128/OL-11-02, TEXAS A&M UNIVERSITY

Dear Dr. Reece:

During the week of April 11, 2010, the U.S. Nuclear Regulatory Commission (NRC) administered operator licensing retake examinations at your Texas A&M University 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 at the conclusion of the examination with those members of your staff identified in the enclosed report.

In accordance with Title 10, Section 2.390 of the Code of Federal 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 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 Public Electronic Reading Room). The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. If 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/

Johnny H. Eads, Jr., Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-128

Enclosures:
1. Initial Examination Report No. 50-128/OL-11-02
2. Facility Comments with NRC Resolution
3. Written Exam with facility comments incorporated

cc: w/o enclosures: See next page

April 29, 2011

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Texas Engineering Experiment Station
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SUBJECT: EXAMINATION REPORT NO. 50-128/OL-11-02, TEXAS A&M UNIVERSITY

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DISTRIBUTION w/ encls:
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ADAMS Accession No: ML111100353

OFFICE	PRTB:CE		IOLB:LA	E	PRTB:BC
NAME	PYoung		CRevelle		JEads
DATE	4/26/11		4/27/11		4/29/11

OFFICIAL RECORD COPY

cc:

Mayor, City of College Station
P.O. Box Drawer 9960
College Station, TX 77840-3575

Governor's Budget and
Planning Office
P.O. Box 13561
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Bureau of Radiation Control
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Texas Commission on Environmental Quality
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Test, Research and Training
Reactor Newsletter
202 Nuclear Sciences Center
University of Florida
Gainesville, FL 32611

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

REPORT NO.: 50-128/OL-11-02

FACILITY DOCKET NO.: 50-128

FACILITY LICENSE NO.: R-83

FACILITY: Texas A&M University TRIGA Reactor

EXAMINATION DATES: April 12, 2011

SUBMITTED BY: **/RA/** 04/19/2011
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of April 18, 2011, the NRC administered operator licensing retake examinations to two Reactor Operator license candidates. Both Reactor Operator license candidates passed their required written retake examinations.

REPORT DETAILS

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

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	2/0	0/0	2/0
Operating Tests	0/0	0/0	0/0
Overall	2/0	0/0	2/02

3. Exit Meeting:
Phillip T. Young, Chief Examiner, NRC
Jerry Newhouse, Reactor Supervisor, Texas A&M University TRIGA Reactor

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

FACILITY COMMENTS WITH NRC RESOLUTION

Question A.006 – I believe the answer on the key was mistyped and should be “d” rather than “c.”
Question B.016 – I believe the answer on the key was mistyped and should be “c” rather than “b.”
Question C.005 - I know all you have to work with is the written word of the SAR, but I’d like to talk about this one. The sequence the dampers are listed in the SAR is arbitrary. It just happened that the writer chose to list them in that order; he could have chosen to list them in any other order without affecting the description of what they do. Maybe I’m weird, but the words “sequence of” makes it confusing for me and I don’t think they add anything to the question.
Question C.008 – Considering everything continuing to operate normally an automatic action in response to an alarm seems odd to me. “D” definitely is the correct answer, but perhaps it could be reworded “No automatic action,” or something like this.

Thanks,

Jerry Newhouse
Reactor Supervisor
Nuclear Science Center
Texas A&M University

NRC Resolution Question A.006: Comment accepted, answer key changed to reflect ‘d’ as the correct answer.

NRC Resolution Question B.016: Comment accepted, answer key changed to reflect ‘c’ as the correct answer.

NRC Resolution Question C.005: The intent of the question is to test the applicants’ knowledge of the flow path through the system. The wording to C.005 attached to this report is an attempt to clarify the question.

NRC Resolution Question C.008: The intent of the question is to test the applicants’ knowledge of the system response to a high radiation alarm signal from the Building Particulate Monitor. The wording to C.008 attached to this report is an attempt to clarify the question.

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

FACILITY: Texas A & M University

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 04/12/2011

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	100.0			TOTALS

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

_____
Candidate's Signature

ENCLOSURE 3

Section A - Reactor Theory, Thermo & Facility Operating Characteristics

Question A.001 (1.00 point) {1.0}
A thin foil target of 10% copper atoms and 90% atoms aluminum is in a thermal neutron beam. Given σs Al = 3.79 barns, σs Cu = 0.23 barns, σa Al = 7.90 barns and σa Cu = 1.49 barns, which ONE of the following reactions has the highest probability of occurring? A neutron …

a. scattering reaction with aluminum.

b. scattering reaction with copper.

c. absorption in aluminum.

d. absorption in copper.

Answer: A.001 c.
Reference: Glasstone, S. and Sesonske, 1991, § 2.108 – 2.114, pp. 77 – 80.

Question A.002 (1.00 point) {2.0}
The reactor is operating at 500 KW in steady-state and in manual mode. Which one of the following describes the stable reactor period if a control rod drops fully into the core and no operator action is taken?

a. -34 seconds due to the rapid decrease in prompt neutrons

b. -34 seconds due to the rapid decay of the short lived delayed neutron precursors

c. -80 seconds due to the slowing down length of prompt neutrons

d. -80 seconds due to the decay half life of the long lived delayed neutron precursors

Answer: A.002 d.
Reference: The amount of reactivity inserted by the blades much larger than beta; therefore,
maximum stable negative period of -80 seconds results.

Question A.003 (1.00 point) {3.0}
Which one of the following factors in the "six factor" formula is the most strongly affected by the Negative Temperature Coefficient?

a. The fast fission factor

b. The thermal utilization factor

c. The resonance escape probability

d. The thermal non-leakage probability

Answer: A.003 b.
Reference: Glasstone, S. and Sesonske, 1991, § 5.98, p. 264.

Question A.004 (1.00 point) {4.0}
Reactor power is increasing by a factor of 10 every minute. The reactor period is:

a. 65 seconds.

b. 52 seconds.

c. 26 seconds.

d. 13 seconds.

Answer: A.004 c.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, page 4-4.
$P/P_o = e^{t/T}$; $10 = e^{60/T}$; ln10 = 2.303 = 60/T ; T = 26 seconds

Question A.005 (1.00 point) {5.0}
During a reactor startup, the count rate is increasing on a straight line on a logarithmic scale, with no rod motion. This means that:

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

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

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

d. the reactor is supercritical.

Answer: A.005 d.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, page 5-25.

Question A.006 (1.00 point) {6.0}
Which ONE of the following statements correctly describes the influence of delayed neutrons during the neutron life cycle?

a. Delayed neutrons are more likely to cause fission after they become thermalized because they thermalize more quickly than prompt neutrons.

b. Delayed neutrons are produced some time after prompt neutrons and make up the majority of neutrons produced by fissions.

c. Delayed neutrons take longer to thermalize because they are born at a higher average energy than prompt neutrons.

d. Delayed neutrons increase the average neutron generation time.

Answer: A.006 c. d. is the correct answer per facility comment.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, page 3-27.

Question A.007 (1.00 point) {7.0}
The moderator-to-fuel ratio describes the relationship between the number of moderator atoms in a volume of core to the number of fuel atoms. A reactor which is:

a. undermoderated will have a negative moderator temperature coefficient.

b. undermoderated will have a positive moderator temperature coefficient.

c. overmoderated will have a constant moderator temperature coefficient.

d. overmoderated will have a negative moderator temperature coefficient.

Answer: A.007 a.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, page 6-8.

Question A.008 (1.00 point) {8.0}
A reactor is subcritical by 5% delta k/k with a count rate of 100 cps on the startup channel. Rods are withdrawn until the count rate is 1000 cps. Which ONE of the following is the condition of the reactor following the rod withdrawal?

a. Critical with k_{eff} = 1.000.

b. Subcritical with k_{eff} = 0.995.

c. Subcritical with k_{eff} = 0.950.

d. Supercritical with k_{eff} = 1.005.

Answer: A.008 b.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pages 3-23, 5-23.
$CR_1 (1-K_1) = CR_2 (1-K_2)$; $\rho = (K - 1)/K$; $-0.05 = (K - 1)/K$; $K = 0.952$.
$100(1 - 0.952) = 1000(1 - K_2)$; $K_2 = 0.995$.

Question A.009 (1.00 point) {9.0}
A reactor is operating at a constant power level with equilibrium xenon. Reactor power is then doubled. The equilibrium xenon level at the higher power level will be:

a. higher than its value at the lower power level, but not twice as high.

b. the same as at the lower power level.

c. more than twice as high.

d. twice as high.

Answer: A.009 a.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, page 8-8.

Question A.010 (1.00 point) {10.0}
Which ONE of the following statements correctly describes a characteristic of subcritical multiplication?

a. A constant neutron population is achieved when the total number of neutrons produced in one generation is equal to the number of source neutrons added in the next generation.

b. For equal reactivity additions, it requires less time for the equilibrium neutron population to be reached.

c. When the indicated count rate doubles, the margin to criticality has been reduced by approximately one-half.

d. The number of neutrons gained per generation doubles for each succeeding generation.

Answer: A.010 c.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, page 3-16.

Question A.011 (1.00 point) {11.0}
Given: Shutdown margin $4.50

Control Rod 1	$2.00
Control Rod 2	$2.00
Control Rod 3	$1.00

What is the <u>actual</u> excess reactivity (not the Tech. Spec. value) for this reactor?

a. $0.50

b. $1.50

c. $2.50

d. $5.00

Answer: A.011 a.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 6-3.

Question A.012 (1.00 point) {12.0}
Which ONE of the following conditions would INCREASE the shutdown margin of a reactor?

a. Lowering the moderator temperature, if the moderator temperature coefficient is negative.

b. Inserting an experiment which adds positive reactivity.

c. Depletion of burnable poison.

d. Depletion of uranium fuel.

Answer: A.012 d.
Reference: Anything which adds negative reactivity increases the shutdown margin.

Question A.013 (1.00 point) {13.0}
Elastic Scattering is the process whereby a neutron collides with a nucleus and:

a. recoils with the same kinetic energy it had prior to the collision.

b. is absorbed by the nucleus, with the nucleus emitting a gamma ray.

c. recoils with a lower kinetic energy, with the nucleus emitting a gamma ray.

d. recoils with a higher kinetic energy, with the nucleus emitting a gamma ray.

Answer: A.013 a.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 2-28.

Question A.014 (1.00 point) {14.0}
During fuel loading, which ONE of the following will have NO effect on the shape of the 1/M plot?

a. The source strength.

b. The order of fuel placement.

c. The location of the source in the core.

d. The location of the detector (or detectors) in the core.

Answer: A.014 a.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 5-18.

Question A.015 (1.00 point) {15.0}
A reactor pool contains 106, 000 gallons of water at 90 degrees F, and it heats up to 93 degrees F in two hours. Assuming no ambient losses, the calculated power level is:

a. 93 kW.

b. 259 kW.

c. 389 kW.

d. 777 kW.

Answer: A.015 c.
Reference: Power = mcΔT/Δt , where: m=106,000 gallons x 8.34 lbs/gal = 884,040 lb; c=1 Btu/°F-lb; ΔT/Δt = 1.5 degrees/hour. Power = 1,326,060 Btu/hour; 3413 Btu/hour = 1 kW. Power = 1,326,060/3413 = 389 kW

Question A.016 (1.00 point) {16.0}
The reactor is to be pulsed. The projected pulse will add **TWICE** as much reactivity as the last pulse performed. In relation to the last pulse, for the projected pulse peak power will be:

a. about four times larger and the energy released will be about four times larger.

b. about two times larger and the energy released will be about four times larger.

c. about four times larger and the energy released will be about two times larger.

d. about two times larger and the energy released will be about two times larger.

Answer: A.016 c.
Reference: TAMU SAR, Figure 3-21.

Question A.017 (1.00 point) {17.0}
The reactor is operating in the automatic mode at 50% power. A problem in the secondary cooling system causes the primary coolant temperature to increase by 5 degrees F. Given that the primary coolant temperature coefficient is -7.0×10^{-5} Δ k/k/deg. F and the differential rod worth of the regulating rod is 8.75×10^{-5} Δk/k/inch, the change in the position of the regulating rod will be:

a. eight (8) inches in.

b. eight (8) inches out.

c. four (4) inches in.

d. four (4) inches out.

Answer: A.017 d.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 8-10.
Since the coolant temperature increased, negative reactivity was added. Therefore, the rod must add positive reactivity, i.e. withdrawn. $7 \times 5 \times 10^{-5}/8.75 \times 10^{-5}$ = 4 inches.

Question A.018 (1.00 point) {18.0}
Which reaction below results in the formation of the N-16 produced in the reactor?

a. ${}_{5}B^{14}$ (α, n) ${}_{7}N^{16}$

b. ${}_{7}N^{15}$ (n, γ) ${}_{7}N^{16}$

c. ${}_{9}F^{17}$ (β, p) ${}_{7}N^{16}$

d. ${}_{8}O^{16}$ (n, p) ${}_{7}N^{16}$

Answer: A.018 d.
Reference: Standard NRC question

$${}_{8}O^{16} + {}_{0}n^{1} \longrightarrow {}_{7}N^{16} + {}_{1}p^{1}$$

Question A.019 (1.00 point) {19.0}
Which ONE of the following describes the general shape of a differential rod worth curve?

a. Parabolic shaped, with the maximums at the top and bottom of the core height.

b. S shaped, with the maximum at the top of the core height.

c. Cosine shaped, with the maximum at the middle of the core height.

d. Exponentially shaped, with the maximum at the bottom of the core height.

Answer: A.019 c.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, 1988, page 7-4.

Question A.020 (1.00 point) {20.0}
What is the kinetic energy range of a thermal neutron?

a. > 1 MeV

b. 100 KeV – 1 MeV

c. 1 eV – 100 KeV

d. < 1 eV

Answer: A020 d.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, 1988, page 2-36.

Section B - Normal / Emergency Procedures & Radiological Controls

Question B.001 [1.0 point, ¼ point each] {1.0}
Match the control rod configuration in Column I, with the number of control rods required to be operable in column II.

Column I	Column II
a. No more than six fuel bundles will be in the core unless at least	1) one scrammable control rod is operable
b. No more than nine fuel bundles will be in the core unless at least	2) two scrammable control rods are operable and the neutron source is inserted.
c. No more than twelve fuel bundles will be in the core unless at least	3) three scrammable control rod is operable.
d. No more than fifteen fuel bundles will be in the core unless at least	4) four scrammable control rod is operable.

Answer: B.001 a. = 1; b. = 2; c. = 3; d. = 4
Reference: SOP-II-I Reactor Core Manipulation

Question B.002 [1.0 point] {2.0}
An experiment with a reactivity worth of $0.40 is to be removed from the core. Prior to performing this operation:

a. reactor power must be less than 600 kW.
b. the reactor must be subcritical.
c. the reactor must be subcritical by at least $0.40.
d. the reactor must be shutdown.

Answer: B.002 d.
Reference: SOP Steady State Operation, Section II D - 6. Sample Movements.

Question B.003 [1.0 point] {3.0}
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.003 b.
Reference: SOP VII-E1 Personnel Dosimetry, C.1.a Expected High Dose Individual.

Question B.004 [1.0 point] {4.0}
Which ONE of the following conditions is permissible when the reactor is operating, or about to be operated?

a. A non-secured experiment worth $1.50.
b. Steady state power level of 1.2 megawatts for purposes of testing.
c. A fuel element is known to be damaged, but has been moved to the edge of the core.
d. The Continuous Air Radiation Monitor and the Exhaust Gas Radiation Monitor are inoperable due to maintenance and have been replaced with gamma sensitive instruments with alarms.

Answer: B.004 b.
Reference: TAMU Tech Spec's, Section 3.1.1.

Question B.005 [1.0 point] {5.0}
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.005 d.
Reference: SOP Power Calibration.

Question B.006 [1.0 point] {6.0}
"The total annual discharge of Argon-41 into the environment may not exceed 30 Ci per year unless permitted by the RSB." This is an example of a:

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

Answer: B.006 c.
Reference: TAMU Tech Spec's, Section 3.7.

Question B.007 [1.0 point, ¼ point each] {7.0}
Select the MODE from Column II when the Safety Channels from Column I are required to be operable. Modes may be used once, more than once, or not at all.

Column I (Safety Channel)	Column II (Mode)
a. Fuel Element Temperature	1. Steady State only
b. Preset timer	2. Both modes
c. Transient Rod Position	3. Pulse only
d. Log Power	

Answer: B.007 a. = 2; b. = 3; c. = 1; d. = 2
Reference: TAMU Tech Spec's, Table 1.

Question B.008 [1.0 point] {8.0}
A system or component is defined as "operable" by Technical Specifications if:

a. a channel check has been performed.
b. it is capable of performing its intended function.
c. it has no outstanding testing requirements.
d. a functional test has been performed.

Answer: B.008 b.
Reference: TAMU Tech Spec's, Section 1.18.

Question B.009 [1.0 point] {9.0}
Limiting Safety System Settings used to prevent exceeding a Safety Limit:

a. must actuate automatically before the limit is exceeded.
b. apply only in the steady state mode of operation.
c. can be changed by the Reactor Safety Board.
d. can be exceeded during transients.

Answer: B.009 a.
Reference: TAMU Tech Spec's, Section 2.2.

Question B.010 [1.0 point] {10.0}
A Limited Access Worker must receive _____and is issued a _____badge.

a. General Employee Training; green
b. General Employee Training; orange
c. Radiation Worker Training and General Employee Training; blue
d. Radiation Worker Training and General Employee Training; yellow

Answer: B.010 b.
Reference: SOP NSC Access Control.

Question B.011 [1.0 point] {11.0}
An automatic scram signal which is **NOT** required by the Technical Specifications when operating in the steady state mode is:

a. short period.
b. high power level.
c. high fuel temperature.
d. loss of detector high voltage.

Answer: B.011 a.
Reference: TAMU Tech Spec's, Table 1.

Question B.012 [1.0 point] {12.0}
In accordance with 10CFR55, a licensed operator must:

a. pass a comprehensive requalification written examination and an annual operating test during a 24-month period.
b. complete a minimum of six hours of shift functions each month.
c. have a medical examination during the six-year term of the license.
d. notify the NRC within 30 days following an arrest.

Answer: B.012 a.
Reference: TAMU Requalification Program.

Question B.013 [1.0 point] {13.0}
A "Red Tag" can only be initiated by:

a. the SRO on duty.

b. any SRO.

c. any NSC staff member.

d. the Manager of Reactor Operations.

Answer: B.013 c.
Reference: SOP Red Tag Procedures.

Question B.014 [1.0 point, ¼ point each] {14.0}
Match each of the following actions in Column I with the correct term from the Technical Specifications in Column II: Channel Check, Channel Test, or Channel Calibration. (Only one term per action).

Column I	Column II
a. Immersing a thermometer in an ice bath, then in boiling water and noting the output.	1. Check
	2. Test
b. Placing a source next to a radiation detector and observing meter movement.	3. Calibration
c. Performing a determination of reactor power with a heat balance, then adjusting a power meter to correspond to the heat balance.	
d. Observing the overlap between two different neutron detectors as power increases.	

Answer: B.014 a. = 2; b. = 2; c. = 3; d. = 1
Reference: TAMU Tech Spec's, Section 1.0

Question B.015 [1.0 point] {15.0}
A person has received a serious injury which does not involve contamination. In accordance with the Emergency Plan, your first course of action is to:

a. notify the SRO on duty.

b. shutdown the reactor.

c. go to the injured person and assess the extent of the injury.

d. call for an ambulance, briefly describe the injury and explain the type of accident.

Answer: B.015 a.
Reference: SOP Implementing Procedure For A Personnel Injury.

Question B.016 [1.0 point] {16.0}
An Emergency Action Level is:

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

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

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

d. 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.

Answer: B.016 ~~b.~~ c. is the correct answer per facility comment.
Reference: Emergency Plan, pg. 9.

Question B.017 [1.0 point] {17.0}
The dose rate 10 feet from a point source is 25 mrem/hour. A person working for 1.5 hours at a distance of 3 feet from the source will receive a dose of:

a. 83 mrem.

b. 125 mrem.

c. 278 mrem.

d. 417 mrem.

Answer: B.017 d.
Reference: $DR_1d_1^2 = DR_2d_2^2$; (25)(100) = DR_2(9) ; DR_2 = 277 mrem/hour.
Total dose received = (277 mrem/hour)(1.5 hours) = 417 mrem.

Question B.018 [1.0 point] {18.0}
A startup checklist has been completed and a startup performed. The reactor is then shutdown (scheduled.) During the shutdown, the bridge is moved. When the reactor is again started up on the same day:

a. another complete checklist is required.
b. the scram circuits must be checked.
c. only section A of the checklist is required.
d. only section D of the checklist is required.

Answer: B.018 b.
Reference: SOP II-C.5, Reactor Startup.

Question B.019 [1.0 point] {19.0}
The area radiation monitor at the pool level is out of service for maintenance. As a result:

a. the reactor cannot be operated.
b. the reactor can continue to operate.
c. the reactor can continue to operate only if the monitor is replaced with a portable gamma instrument with its own alarm.
d. the reactor can continue to operate only if the alarm setpoints of the remaining area radiation monitors are lowered.

Answer: B.019 c.
Reference: TAMU Tech Spec's, Section 3.5.1.

Question B.020 [1.0 point] {20.0}
Which ONE of the following is the MAXIMUM amount of explosive materials allowed in the building per Technical Specification 3.6.2?

a. 25 milligrams
b. 5 grams
c. 5 pounds
d. 25 pounds

Answer: B.020 c
Reference: TAMU Tech Spec 3.6.2

Section C: - Plant and Rad Monitoring Systems

Question C.001 [1.0 point] {1.0}
Which one of the following describes the yellow light associated with the beam port water shutters?

a. The yellow light tells the experimenter that the beam has been cut off.

b. The yellow light warns the experimenter of the commencement of a reactor startup.

c. An illuminated yellow light indicates that the shutter tube is evacuated and the beam is active.

3.

d. An illuminated yellow light indicates that a shutter flood permissive has been selected by the reactor operator.

Answer: C.001 .c
Reference: SOP IV-D.3.b.10

Question C.002 [1.0 point] {2.0}
Which ONE of the following is the purpose of the stainless steel liner that encircles the reactor pool?

a. Contain the water within the pool.

b. Reduce radiation exposure to people.

c. Support the biological shield structure.

d. Prevent outside contaminants from getting into the pool.

Answer: C.002 a.
Reference: SAR, page 4-9

Question C.003 [1.0 point] {3.0}
More than 95% of the facility's Ar-41 is produced in the:

a. beam ports.

b. reactor pool.

c. pneumatic system.

d. reactor building atmosphere.

Answer: C.003 b.
Reference: SAR, page 11-1

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Question C.004 [1.0 point] {4.0}
The Log Power Channel consists of a(n) _____ and provides an input to the _____.

a. Ion Chamber; period circuit.

b. Fission Chamber; servo controller.

c. Fission Chamber; 1 kW pulse interlock.

d. Compensated Ion Chamber; low count rate (2 cps) interlock.

Answer: C.004 c.
Reference: SAR, page 92.

Question C.005 [1.0 point] {5.0}
Which ONE of the following lists the correct flow path ~~sequence of locations~~ for the air handling system dampers?

a. Air inlet to all air handlers, exhaust stack, air inlet to central exhaust fan.

b. Air inlet to all air handlers, fresh air bypass to the exhaust fan, exhaust stack.

c. Fresh air bypass to the exhaust fan, air inlet to central exhaust fan, exhaust stack.

d. Air inlet to all air handlers, fresh air bypass to the exhaust fan, air inlet to central exhaust fan.

Answer: C.005 b.
Reference: SAR, page 6-2

Question C.006 [1.0 point] {6.0}
Which set of measurements are chosen by the reactor console thermocouple selector?

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

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

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

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

Answer: C.006 a.
Reference: SAR, page 7-4

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Question C.007 [1.0 point] {7.0}
Which ONE of the following situations will cause the reactor to automatically SCRAM?

a. Low safety detector voltage (<150 V).

b. Low pool water level (<90% of normal level).

c. High Radiation level at top of pool (>100 mrem/hr).

d. Low air pressure applied to the transient rod (<10 psi).

Answer: C.007 a.
Reference: SAR, page 7-4

Question C.008 [1.0 point] {8.0}
Which of the following actions best describes the response associated with a high radiation alarm signal from the Building Particulate Monitor? ~~What automatic action is associated with a high radiation alarm signal from the Building Particulate Monitor?~~

a. The air handler fans cease operation and all inlet dampers close.

b. The air handler fans continue to operate and all inlet dampers close.

c. The air handler fans cease operation and all inlet dampers remain open.

d. The air handler fans continue to operate and all inlet dampers remain open.

Answer: C.008 d.
Reference: SAR, page 6-2; SOP VII-B-10

Question C.009 [1.0 point] {9.0}
A 1-¾ inch diameter hole through the grid plate is located at the southwest corner of the four rod fuel assemblies. The purpose of these holes is to …

a. accommodate a fuel followed control rod.

b. provide a coolant flow path through the grid plate

c. provide a mounting location for in-core experiments.

d. allow for accurate repositioning of the reactor core which is essential for numerous experiments.

Answer: C.009 a
Reference: SAR page 14.

Section C: - Plant and Rad Monitoring Systems

Question C.010 [1.0 point] {10.0}
The gas used to move pneumatic tube "rabbit" samples into and out of the reactor is …

a. H_2
b. N_2
c. Air
d. CO_2

Answer: C.010 d.
Reference: SAR § VI.D.1, Figure 6-3 on page 85.

Question C.011 [1.0 point] {11.0}
The purpose of the diffuser above the core during operation is to …

a. better distribute heat throughout the pool.
b. ensure consistent water chemistry in the core.
c. reduce dose rate at the pool surface due to N^{16}.
d. enhance heat transfer across all fuel elements in the core.

Answer: C.011 c.
Reference: SAR Table V on page 100.

Question C.012 [1.0 point] {12.0}
During reactor operation, a leak develops in the primary to secondary heat exchanger. Which ONE of the following conditions correctly describes how the system will react?

a. Cooling tower basin level increase due to leakage from the primary, pool level will decrease.

b. Cooling tower basin level will decrease due to leakage from the secondary, pool level will increase.

c. Cooling tower level will increase due to leakage from the primary, automatic level control will maintain level in the primary.

d. Pool level will increase due to leakage from the secondary, the automatic level control will maintain level in the secondary.

Answer: C.012 a.
Reference: SAR § IV.B.2 p. 65, and figure 4-6.

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Question C.013 [1.0 point] {13.0}
In the event of a failure of the pool cooling system, the heat capacity of the reactor pool is sufficient to cool the reactor for several _____, with the reactor operating at 1 Megawatt.

a. Days

b. Hours

c. Minutes

d. Seconds

Answer: C.013 b.
Reference: SAR, p. 112.

Question C.014 [1.0 point] {14.0}
Which one of the following describes the MINIMUM action an operator would have to take, to prevent excessive loss of pool water in the event of a catastrophic rupture of the primary side of the cooling system heat exchanger? **NOTE**: *PW-1 = Coolant extraction (pump suction) line valve. PW-2 and PW-3 = Coolant (pool) return line valves.*

a. Manually shut PW-1, PW-2, and PW-3, in the valve pit of the heat exchanger room.

b. Remotely shut PW-1, PW-2, and PW-3, using the control switches on the auxiliary panel of the reactor console.

c. No action needed; PW-1, PW-2, and PW-3 will shut automatically when pool water level reaches a preset low level.

d. Manually shut PW-1 in the valve pit of the heat exchanger room; PW-2 and PW-3 may remain open due to the check valve installed downstream of the heat exchanger.

Answer: C.014 d.
Reference: SAR, pp. 63-66, 112, Fig.4-6

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Question C.015 [1.0 point] {15.0}
Which one of the following describes the circuitry associated with the Log power channel?

a. Detector - Amplifier - Scaler - Bistable trips

b. Detector - Preamp - Amplifier - Period meter

c. Detector - picoammeter - power recorder - Digital power meter

d. Detector - integrator - digital power display - visicorder power indication

Answer: C.015 b.
Reference: SAR pg. 91; Figs. 7-1 through 7.3, Fig. 7-5

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. Skimmer pump trip.

c. Purification pump trip.

d. Recirculation pump trip.

Answer: C.016 d.
Reference: SAR, § G.1, p. 112.

Question C.017 [1.0 point] {17.0}
The design basis for the confinement system ensures that:

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

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

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

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

Answer: C.017 c.
Reference: SAR pg. 73

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Question C.018 [1.0 point] {18.0}
Why is Erbium added to TRIGA-FLIP fuel?

a. to act as a burnable poison only (allowing more fuel to be added).

b. to act as a resonance absorber only, (enhancing prompt negative temperature coefficient).

c. to improve the overall heat transfer coefficient, which is necessary due to higher temperatures generated when pulsing FLIP fuel.

d. to act as both a burnable poison, (allowing more fuel to be added), and as a resonance absorber, (enhancing prompt negative temperature coefficient).

Answer: C.018 d
Reference: SAR p. 50.

Question C.019 [1.0 point] {19.0}
Which ONE of the following controls the amount of reactivity that is inserted by the transient rod during pulse operations?

a. The preset pulse timer setting that vents the pneumatic piston.

b. The pressure of the air applied to the pneumatic piston.

c. The reactivity of the reactor prior to firing the pulse.

d. The position of the cylinder.

Answer: C.019 d.
Reference: SOP II E, Pulsing Operation.

Question C.020 [1.0 point] {20.0}
When a compensated ion chamber is used for neutron detection at low power levels, how is the gamma flux accounted for?

a. Pulse height discrimination is used to eliminate the gamma flux.

b. The gamma flux is cancelled by creating an equal and opposite gamma current.

c. The gamma flux is proportional to neutron flux and is counted with the neutrons.

d. The gamma flux passes through the detector with no interaction because of detector design.

Answer: C.020 b.
Reference: SOP III C Linear Power Measuring Channel Maintenance Surveillance.