July 18, 2013

Dr. Yassin Hassan
Head of Nuclear Engineering
Texas A&M University
Zachry Bldg. Room 337
College Station, TX 77843-3133

SUBJECT: EXAMINATION REPORT NO. 50-059/OL-13-01, TEXAS A&M UNIVERSITY AGN-201M REACTOR

Dear Dr. Hassan:

During the weeks of May 20 and June 17, 2013, the U.S. Nuclear Regulatory Commission (NRC) administered operator licensing examinations at your Texas A&M University AGN-201M 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 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. Mike Morlang, at 301-415-4092 or via internet e-mail Gary.Morlang@nrc.gov.

Sincerely,

/RA/

Gregory T. Bowman, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-059

Enclosures:
1. Examination Report No. 50-059/OL-13-01
2. Written examination

cc: Christopher Crouch, Reactor Supervisor
w/o encls.: See next page

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DISTRIBUTION w/ encls.:

PUBLIC	PROB r/f	RidsNrrDprPrlb
RidsNrrDprProb	Facility File (CRevelle) O-07 F-08	RidsNrrDprPrpb

ADAMS Accession Number: ML13198A569 **NRR-074**

OFFICE	NRR/DPR/PROB/CE	NRR/DPR/PROB/LA	NRR/DPR/PROB/BC
NAME	GMorlang	CRevelle	GBowman
DATE	7/18/13	7/16/13	7/18/13

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
Austin, TX 78711

Radiation Program Officer
Bureau of Radiation Control
Dept. Of State Health Services
Division for Regulatory Services
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Technical Advisor
Office of Permitting, Remediation & Registration
Texas Commission on Environmental Quality
P.O. Box 13087, MS 122
Austin, TX 78711-3087

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.: 50-059/OL-13-01

FACILITY DOCKET NO.: 50-059

FACILITY LICENSE NO.: R-23

FACILITY: TEXAS A&M UNIVERSITY AGN-201M Reactor

EXAMINATION DATES: May 20 and June 20, 2013

SUBMITTED BY: **/RA/** 07/18/13
Mike Morlang, Chief Examiner Date

SUMMARY:

The NRC administered an operator licensing examination to one Senior Reactor Operator (Instant) (SRO-I) candidate, one Senior Reactor Operator (upgrade) (SRO-U) and three Reactor Operator (RO) candidates. One reactor operator candidate failed section C of the written exam and all other candidates passed all portions of their respective examinations.

REPORT DETAILS

1. Examiner:
   Mike Morlang, Chief Examiner, NRC

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	2/1	1/0	2/0
Operating Tests	3/0	2/0	5/0
Overall	2/1	2/0	2/0

3. Exit Meeting:
   Mike Morlang, Chief NRC, Examiner
   Phillip Young, NRC Examiner
   Christopher Crouch, Reactor Supervisor, Texas A&M University

The chief examiner met with the facility staff to discuss the overall administration of the examination. The examiner noted the section C written exam failure and did not note any serious weaknesses on the part of the other candidates.

OPERATOR LICENSING EXAMINATION

TEXAS A&M UNIVERSITY AGN-201M
Week of May 20, 2013

ENCLOSURE 2

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

FACILITY: Texas A&M University AGN-201M Reactor

REACTOR TYPE: AGN-201M

DATE ADMINISTERED: 5/20/2013

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
15.00	33.3			B. Normal and Emergency Operating Procedures and Radiological Controls
10.00	33.3			C. Facility and Radiation Monitoring Systems
45.00	100.0			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 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.

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.

EQUATION SHEET

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

$$P_{max} = \frac{(\beta - \rho)^2}{(2\alpha \ell)}$$

$$\lambda_{eff} = 0.1 \sec^{-1}$$

$$P = P_0 \; e^{t/\mathrm{T}}$$

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

$$\ell^* = 1 \times 10^{-4} \sec$$

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

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

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

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

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

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

$$M = \frac{1 - K_{eff_1}}{1 - K_{eff\,2}}$$

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

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

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

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

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

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

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

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

$$DR = \frac{6 \, Ci \, E(n)}{R^2}$$

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

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

1 Curie = 3.7 x 10^{10} dis/sec | **1 kg = 2.21 lbm**

1 Horsepower = 2.54 x 10^3 BTU/hr | **1 Mw = 3.41 x 10^6 BTU/hr**

1 BTU = 778 ft-lbf | **°F = 9/5 °C + 32**

1 gal (H_2O) ≈ 8 lbm | **°C = 5/9 (°F - 32)**

C_p= 1.0 BTU/hr/lbm/°F | **c_p = 1 cal/sec/gm/°C**

Section A- Reactor Theory, Thermodynamics and Facility Operating Characteristics

Question A.001 [1.0 point] (1.0)
Which of the following is the largest effect on the reactivity worth of a control rod?

a. Overall reactor power.

b. Drop time of the control rod.

c. Axial and radial flux shape.

d. Delayed neutron fraction value.

Question A.002 [1.0 point] (2.0)
Which ONE of the following describes the difference between a moderator and reflector?

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

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

c. A reflector decreases the neutron production factor and a moderator decreases the fast non-leakage factor.

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

Question A.003 [1.0 point] (3.0)
The delayed neutron fraction changes over core life primarily due to the:

a. buildup of Pu^{241} which increases the delayed neutron fraction.

b. buildup of Pu^{239} which decreases the delayed neutron fraction.

c. depletion of U^{235} which decreases the delayed neutron fraction.

d. depletion of U^{238} which increases the delayed neutron fraction.

Section A- Reactor Theory, Thermodynamics and Facility Operating Characteristics

Question A.004 [1.0 point] (4.0)
Select the answer that describes the inherent **safety feature** provided by the temperature coefficient of reactivity.

a. Its negative value causes reactivity to increase as moderator temperature increases.
b. Its negative value causes reactivity to decrease as moderator temperature increases.
c. Its positive value causes reactivity to increase as moderator temperature increases.
d. Its positive value causes reactivity to decrease as moderator temperature increases.

Question A.005 [1.0 point] (5.0)
The reactor is initially shut down with count rate at 8 counts per second (cps) and K_{eff} = 0.975. Control rods are inserted, changing K_{eff} to 0.995. Select the stable count rate you would expect.

a. 15 cps
b. 25 cps
c. 40 cps
d. 90 cps

Question A.006 [1.0 point] (6.0)
Which one of the following is the correct reason that delayed neutrons allow human control of the reactor?

a. Fewer prompt neutrons are produced than delayed neutrons.
b. Delayed neutrons increase the mean neutron lifetime.
c. Delayed neutrons take longer to thermalize than prompt neutrons.
d. Delayed neutrons are born at higher energies than prompt neutrons.

Question A.007 [1.0 point] (7.0)
What is the kinetic energy range of a thermal neutron?

a. > 1 MeV
b. 100 KeV – 1 MeV
c. 10 eV – 100 KeV
d. < 1 eV

Section A- Reactor Theory, Thermodynamics and Facility Operating Characteristics

Question A.008 [1.0 point] (8.0)
Which ONE of the following is the type of neutron source that is used at the Texas A&M University AGN-201?

a. Radium - Beryllium
b. Plutonium - Beryllium
c. Americium - Plutonium
d. Neptunium – Beryllium

Question A.009 [1.0 point] (9.0)
Which ONE of the following elements will produce the greatest energy loss per collison?

a. Plutonium
b. Graphite
c. Hydrogen
d. Uranium 238

Question A.010 [1.0 point] (10.0)
Excess reactivity is the amount of reactivity:

a. associated with experiments.
b. needed to achieve prompt criticality.
c. available above that which is required to keep the reactor critical.
d. available above that which is required to make the reactor subcritical.

Question A.011 [1.0 point] (11.0)
In the AGN - 201, the largest thermal neutron microscopic cross section is:

a. Xenon-135 capture.
b. Uranium-235 fission.
c. Uranium-238 fission.
d. Plutonium 240 absorption.

Section A- Reactor Theory, Thermodynamics and Facility Operating Characteristics

Question A.012 [1.0 point] (12.0)
Which ONE of the following causes reactor period to stabilize shortly after a reactor scram from full power? Assume normal system/component operation and no maintenance activity.

a. Xenon removal by decay at a constant rate.

b. Longest lived delayed neutron precursor..

c. Decay of compensating voltage at low power levels.

d. Power level dropping below the minimum detectable level.

Question A.013 [1.0 point] (13.0)
Which ONE of the following samples when placed individually into the reactor experimental facilities will have a POSITIVE reactivity affect?

a. Gold wire

b. Indium foils

c. Cadmium foils

d. Polyethylene disk

Question A.014 [1.0 point] (14.0)
What is the definition of a cross section?

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

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

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

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

Question A.015 [1.0 point] (15.0)
<u>Inelastic scattering</u> 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. recoils with a lower kinetic energy, with the nucleus emitting a gamma ray.

c. is absorbed by the nucleus, with the nucleus emitting a beta ray.

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

Section A- Reactor Theory, Thermodynamics and Facility Operating Characteristics

Question A.016 [1.0 point] (16.0)
A step insertion of positive reactivity to a critical reactor causes a rapid increase in the neutron population known as a prompt jump. Which ONE of the following explains the cause of this occurrence?

a. immediate increase in the prompt neutron population.

b. shift in the prompt neutron lifetime on up-power maneuvers.

c. rapid negative reactivity insertion due to the fuel temperature coefficient (Doppler) feedback.

d. magnitude of the reactivity insertion exceeding the value of the average effective delayed neutron fraction.

Question A.017 [1.0 point] (17.0)
Which of the following power manipulations would take the longest to complete assuming the same period is maintained?

a. 100 mW to 400 mW

b. 400 mW to 500 mW

c. 2 W to 3.5 W

d. 3.5 W to 4.5 W

.

Question A.018 [1.0 point] (18.0)
The AGN-201 is designed to produce a fission rate within the thermal fuse that is approximately twice the average of the core. Which ONE of the following describes how this higher reaction rate is accomplished?

a. The non-uniform fuel loading in the upper fuel disc increases the thermal flux in fuse area.

b. The polystyrene media used in the thermal fuse is a better moderator, raising the thermal flux in the fuse area.

c. The fuel density used in the thermal fuse is twice that of the balance of the core resulting in a higher fission rate in the fuse area.

d. The fuel enrichment used in the thermal fuse is twice that of the balance of the core resulting in a higher fission rate in the fuse area.

Section A- Reactor Theory, Thermodynamics and Facility Operating Characteristics

Question A.019 [1.0 point] (19.0)
At the beginning of a reactor startup, Keff is 0.90 with a count rate of 30 CPS. Power is increased to a new, steady value of 60 CPS. The new Keff is:

a. 0.92

b. 0.925

c. 0.95

d. 0.975

Question A.020 [1.0 point] (20.0)
Of the approximately 200 Mev of energy released per fission event, the largest amount appears in the form of:

a. Alpha radiation

b. Gamma radiation

c. Prompt and delayed neutrons

d. Kinetic energy of the fission fragments

END OF SECTION A

Section B. - Normal & Emerg Operating Procedures & Radiological Controls

Question B.001 [1 point] (1.0)
Temporary procedures which do NOT change the intent of the original procedure or involve an un-reviewed safety question may be approved as a MINIMUM by the:

a. Reactor Operator.

b. Reactor Supervisor.

c. Reactor Safety Committee.

d. Dean of the College of Engineering.

.

Question B.002 [1 point] (2.0)
The Technical Specification basis for the MAXIMUM core temperature limit is to prevent:

a. breakdown of the graphite reflector.

b. instrument inaccuracies.

c. release of fission products.

d. boiling of the shield water.

.

Question B.003 [1 point] (3.0)
To prevent damage to the reactor or excessive release of radioactive materials in the event of an experiment failure, experiments containing corrosive materials shall:

a. be doubly encapsulated.

b. be limited to less than 10 grams.

c. not be inserted into the reactor or stored at the facility.

d. have a TEDE of less than 500 mrem over two hours from the beginning of the release.

.

Section B. - Normal & Emerg Operating Procedures & Radiological Controls

Question B.004 [1 point] (4.0)
According to Technical Specifications the reactor is considered Shutdown when:

a. the reactor is subcritical.

b. the reactor console key switch is in the "OFF" position.

c. no experiments worth more than 0.25¢ are being moved or serviced

d. all safety and control rods are withdrawn and the key is removed from the console with the key switch in "OFF

Question B.005 [1 point] (5.0)
The shutdown margin, required by Technical Specifications, with the most reactive safety or control rod fully inserted and the fine control rod fully inserted shall be at least:

a. 0.29 % $\Delta k/k$

b. 0.65 % $\Delta k/k$

c. 1.00 % $\Delta k/k$

d. 1.25 % $\Delta k/k$

Question B.006 [1 point] (6.0)
Which ONE of the following would satisfy the MINIMUM Technical Specification staffing requirements whenever the reactor is NOT Shutdown?

a. One authorized operator at the reactor console, a licensed RO in the reactor room.

b. One licensed RO in the reactor control room and an authorized operator in the reactor room.

c. One authorized operator at the reactor console, a licensed RO in the reactor control room and a licensed SRO on call.

d. One licensed RO in the control room, a certified observer in the reactor control room and a licensed SRO on call one half hour away.

;

Question B.007 [1 point] (7.0)
What is the exposure rate at 1 ft from 2-curie Co-60 source? Co-60 emits two gamma photons per decay with energies of 1.17 Mev and 1.33 Mev.

a. 3 R/hr

b. 5 R/hr

c. 6 R/hr

d. 30 R/hr

Question B.008 [1 point] (8.0)
Identify each of the following surveillances as a channel check (**CHECK)**, a channel test (**TEST)**, or a channel calibration (**CAL)**.

a. During performance of the Daily Checklist, you depress the “Test Rate Meter” to verify the Channel #1 reading

b. During reactor operation, you compare the readings of Channel 1 and Channel 2

c. Drive the source to the inner limit and verify that the “IN” light is illuminated

d. Adjust the Log Power channel in accordance with recent data collected on the reactor power calibration

Question B.009 [1 point] (9.0)
An area in which radiation levels could result in an individual receiving a dose equivalent of 120 mRem/hr at 30 cm is defined as:

a. Radiation area

b. Unrestricted Area

c. High Radiation Area

d. Very High Radiation Area

Section B. - Normal & Emerg Operating Procedures & Radiological Controls

Question B.010 [1 point] (10.0)
During a reactor startup the low level scram on Channel #1 ensures:

a. protection for a rod drop event.

b. an operating neutron monitor channel.

c. protection for a temperature excursion.

d. the minimum number of period trips are available for startup.

Question B.011 [1 point] (11.0)
Safety and control rod reactivity worths shall be measured:

a. semi-annually

b. annually

c. every two years

d. every five years

Question B.012 [1 point] (12.0)
A reactor sample has a disintegration rate of 2×10^{12} disintegrations per second and emits a 0.6 Mev γ. The expected dose rate from this sample at a distance of 10 feet would be approximately: (Assume a point source)

a. 100 mR/hr

b. 325 mR/hr

c. 2 R/hr

d. 7.5 R/hr

Section B. - Normal & Emerg Operating Procedures & Radiological Controls

Question B.013 [1 point] (13.0)
A channel test of the seismic displacement interlock is required by Technical Specifications to be performed:

a. daily
b. quarterly
c. semiannually
d. annually

.

Question B.014 [1 point] (14.0)
Which ONE of the following is the definition of site boundary for the TAMU AGN-201M reactor facility?

a. Reactor room (Room 61B) only

b. Reactor room and Accelerator room

c. Entire Zachary Engineering building

d. Nuclear Engineer laboratory areas 60/61 and 133/134/135

Question B.015 [1 point] (15.0)
The special unit for absorbed dose "Rem" is defined in 10 CFR Part 20 in terms of a dose equivalent. What does the term dose equivalent relate to?

a. It is derived by accounting for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in one year

b. It is equal to the absorbed dose (rad) multiplied by the quality factor (Q) of the radiation

c. It is equal to the absorbed dose (rad) divided by the quality factor (Q) of the radiation

d. It is the equivalent dose one would receive during the 50-year period following intake

END OF SECTION B

Section C – Facility and Radiation Monitoring Systems

Question C.001 [1 point] (1.0)
Which one of the following detectors is used for Nuclear Instrumentation Channel #1?

a. BF_3 filled Proportional Counter

b. BF_3 filled Ionization Chamber

c. BF_3 filled Geiger-Muller tube

d. U^{235} lined Fission Chamber

Question C.002 [1 point] (2.0)
The MAIN purpose of the thermal fuse is to:

a. measure the temperature of fuel core

b. measure any gases released from the fuel core

c. separate the reactor core to prevent exceeding the Safety Limit (SL)

d. send a scram signal to the Nuclear Safety # 2 if Limiting Safety System Setting (LSSS) is exceeded

Question C.003 [1 point] (3.0)
Which ONE of the following statements describes the control rod interlocks?

a. The safety rods cannot be inserted unless the course control rod is "DISENGAGED".

b. The fine control rod cannot be inserted until the safety rods are "FULLY INSERTED".

c. The fine control rod cannot be inserted unless the course control rod is "DISENGAGED".

d. The safety rods must be fully inserted before their drive motors will operate in the "LOWER" position.

Section C – Facility and Radiation Monitoring Systems

Question C.004 [1 point] (4.0)
Which ONE of the following statements describes the design/operation of the control rod drive assemblies?

a. The dashpots consist of a foam cushion to reduce rod impact following a scram.

b. The fine control rod does not have a dashpot since it does not scram.

c. The course control rod dashpot uses magnetic force to slow the rod down before impact on a scram.

d. Dashpots are only associated with the safety rods since these rods have been raised against spring tension to assist in driving these rods down on a scram.

Question C.005 [1 point] (5.0)
Each ONE of the following would be considered an advantage of using fueled control rods over poison rods, EXCEPT:

a. larger reactor size.

b. more symmetrical flux distribution at power.

c. no critical mass assembled when shutdown.

d. simplification of calculations for a homogeneous reactor.

Question C.006 [1 point] (6.0)
The shield tank is designed to provide shielding from:

a. the glory hole area.

b. high energy β radiation.

c. high energy γ radiation.

d. fast neutron radiation.

Question C.007 [1 point] (7.0)
The shield tank water temperature interlock prevents reactor operation:

a. during periods of high thermal stress.

b. in the event of a high temperature condition.

c. during a condition that will produce excess radiation levels.

d. from a reactivity addition due to a temperature decrease.

Question C.008 [1 point] (8.0)
The shield tank water level trip will occur if water level drops below:

a. 8 inches

b. 9.5 inches

c. 12 inches

d. 20 inches

Question C.009 [1 point] (9.0)
The reactor Access Ports pass through the steel tank:

a. up to the reflector.

b. then the lead shield, up to the reflector.

c. then the lead shield, the graphite reflector and then back out again.

d. then the lead shield, graphite reflector, and the core and then back out again.

Section C – Facility and Radiation Monitoring Systems

Question C.010 [1 point] (10.0)
Which ONE of the following does NOT automatically cause a reactor scram?

a. Reactor period.

b. Radiation level.

c. Water level.

d. Power failure.

END OF SECTION C

END OF WRITTEN EXAMINATION

Answer: A.001 c.
Reference: Nuclear Reactor Theory, LaMarsh

Answer: A.002 d.
Reference: Glasstone & Sesonke, Nuclear Reactor Engineering, Chapter 1, Section 1.51 & 1.52

Answer: A.003 b.
Reference: Glasstone & Sesonke, Nuclear Reactor Engineering, Chapter 5, Section 5.170, Chapter 2, Table 2.10.

Answer: A.004 b.
Reference: Basic Reactor Theory

Answer: A.005 c.
Reference: Basic Reactor Theory

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

Answer: A.007 d.
Reference: Standard NRC Question

Answer: A.008 b.
Reference: Safety Analysis Report

Answer: A.009 c.
Reference: Glasstone & Sesonske, Nuclear Reactor Engineering, Chapter 3, Section 3.66, Table 3.3, p 134.

Answer: A.010 c.
Reference: Glasstone, Nuclear Reactor Engineering, Chapter 5, Section 5.172

Answer: A.011 a.
Reference: Glasstone & Sesonke, Nuclear Reactor Engineering, Chapter 5, Section 5.62;

Answer: A.012 b.
Reference: Nuclear Reactor Theory, LaMarsh

Answer: A.013 d.
Reference: Nuclear Reactor Theory, LaMarsh

Answer: A.014 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 3rd Edition, page 55

Answer: A.015 b.
Reference: Lamarsh, Introduction to Nuclear Engineering, 3rd Edition, page 64.

Answer: A.016 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 3rd Edition, page 340.

Answer: A.017 a.
Reference: Lamarsh, Introduction to Nuclear Engineering, 3rd Edition, page 346

Answer: A.018 c.
Reference: Safety Analysis Report.

Answer: A.019 c.
Reference: Lamarsh, Introduction To Nuclear Engineering, 3rd Edition.
$(CR_2/CR_1) = (1-K_{eff0})/(1-K_{eff1})$ $(60/30) = (0.90)(1-K_{eff1})$ Keff1 = 0.95

Answer: A.020 d.
Reference: Lamarsh, Introduction to Nuclear Engineering, 3rd Edition, page 88.

Answer: B.001 b.
Reference: Technical Specifications, 6.6

Answer: B.002 c.
Reference Technical Specifications, 2.1

Answer: B.003 a.
Reference: Technical Specifications, 3.3.a

Answer: B.004 d.
Reference: Technical Specification, 1.22

Answer: B.005 c.
Reference: Technical Specifications, 3.1.b,

Answer: B.006 d.
Reference: Technical Specifications, 6.1.11

Answer: B.007 d
Reference: R/hr = 6CE = 6 x 2 x 1*(1.17+1.33) = 30 R/hr

Answer: B.008 a. Test b. Check c. Test d. Cal
Reference: Technical Specifications 1.0

Answer B.009 c.
Reference 10 CFR 20

Answer: B.010 b.
Reference: Technical Specifications 3.2

Answer: B.011 b.
Reference: Technical Specifications 4.1

Answer: B.012 c.
Reference: Glasstone & Sesonke, Sect 9.41, p 525.
DR = 6CE/f*2 R/hr, =6(2 X 10*12/3.7X10*10)(0.6)/10*2, =1.9459 R/hr

Answer: B.013 d.
Reference: Technical Specifications 4.2.d

Answer: B.014 d
Reference: Emergency Plan

Answer: B.015 b
Reference: 10CFR20.1003

Answer: C.001 a.
Reference TAMU AGN-201M Safety Analysis Report § 7.2.3.

Answer: C.002 c.
Reference: TAMU AGN-201M Safety Analysis Report § 4.5.3

Answer: C.003 c
Reference: TAMU AGN-201M Safety Analysis Report § 4.3.2

Answer: C.004 b.
Reference: TAMU AGN-201M Safety Analysis Report

Answer: C.005 a.
Reference: TAMU AGN-201M Safety Analysis Report .

Answer: C.006 d.
Reference: Technical Specifications 5.1.d.

Answer: C.007 d.
Reference: Technical Specifications 3.2.

Answer: C.008 b.
Reference: Technical Specifications 3.2.e.

Answer: C.009 c.
Reference: TAMU AGN-201M Safety Analysis Report

Answer: C.010 b.
Reference: TAMU AGN-201M Safety Analysis Report