July 28, 2006

Dr. David C. Hyland, Deputy Director
Texas Engineering Experiment Station
Texas A&M University
1095 Nuclear Science Center
College Station, TX 77843-3575

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-128/OL-06-01, Texas A&M University

Dear Dr. Hyland:

During the week of June 19, 2006, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your Texas A&M University reactor. The examination was conducted in accordance with NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1. At the conclusion of the examination, the examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosures will available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) http://www.nrc.gov/NRC/ADAMS/index.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Phillip T. Young at 301-415-4094 or internet e-mail pty@nrc.gov.

Sincerely,

Johnny Eads, Chief **/RA by Marvin Mendonca for/**
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-128

Enclosures:
1. Initial Examination Report No. 50-128/OL-06-01
2. Facility comments with NRC resolution
3. Examination and answer key (RO/SRO)

cc w/encls.: Please see next page

cc:

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Planning Office
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Austin, TX 78711

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Texas Engineering Experiment Station
Texas A&M University
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SUBJECT: INITIAL EXAMINATION REPORT NO. 50-128/OL-06-01, Texas A&M University

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DISTRIBUTION w/ encls.:
PUBLIC RNRP\R&TR r/f JEads AAdams Facility File (EBarnhill) O-6 F-2

ADAMS ACCESSION #: ML062000305 **TEMPLATE #:NRR-074**

OFFICE	PRTB:CE	IOLB:LA	PRTB:SC
NAME	PYoung:tls*	EBarnhill*	JEads:tls*
DATE	07/21/2006	07/27/2006	07/28/2006

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

REPORT NO.: 50-128/OL-06-01

FACILITY DOCKET NO.: 50-128

FACILITY LICENSE NO.: R-83

FACILITY: Texas A&M University

EXAMINATION DATES: June 21 & 22, 2006

EXAMINER: Phillip T. Young, Chief Examiner

SUBMITTED BY: /RA/ 07/28/2006
Phillip T. Young, Chief Examiner Date

SUMMARY:

During the week of June 19, 2006, the NRC administered operator licensing examinations to three Reactor Operator candidates. The candidates passed the examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiner: Phillip T. Young, Chief Examiner

2. Results:

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

3. Exit Meeting:

Mr. Jim Remlinger, Associate Director, Texas A&M University reactor

Phillip T. Young, NRC Chief Examiner

The NRC thanked the facility staff for their cooperation during the examination. There were no comments on the written examination. No generic concerns were noted.

Facility comments with NRC resolution NONE

Question: A.001 (1.00 points) {1.0}

An example of a fissile isotope which occurs naturally is:

a. Pu-239

b. U-238

c. U-235

d. Th-232

Answer: A.001 c.
Reference: Lamarsh, Introduction to Nuclear Engineering, 2nd Edition, pg. 104.

Question: A.002 (1.00 points) {2.0}

During a reactor power decreases, the delayed neutron fraction, β:

a. remains unchanged.

b. decreases because prompt neutrons are being produced at a slower rate.

c. decreases because delayed neutron precursors are being produced at a slower rate.

d. increases because delayed neutrons are being produced from precursors that were formed at the higher power level.

Answer: A.002 d.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 4-8.

Question: A.003 (1.00 points) {3.0}

When a reactor is prompt critical, the neutron multiplication rate is determined by:

a. the value of β_{eff}.

b. the generation time of prompt neutrons only.

c. the generation time of delayed neutrons only.

d. the half-life of the shortest-lived delayed neutron precursor.

Answer: A.003 b.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 4-3.

Question: A.004 (1.00 points) {4.0}

An operating reactor generates 10^{15} fissions per second. The power of the reactor is approximately:

a. 16 kW

b. 32 kW

c. 48 kW

d. 64 kW

Answer: A.004 b.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 2-51.
(10^{15} fissions/sec)x(200 Mev/fission)x(1.6×10^{-19} watt-sec/ev) = 32 kW.

Question: A.005 (1.00 points) {5.0}

A 1/M curve is being generated as fuel is loaded into the core. After some fuel elements have been loaded, the count rate existing at that time is taken to be the new initial count rate, C_o. Additional elements are then loaded and the inverse count rate ratio continues to decrease. As a result of changing the initial count rate:

a. criticality will occur earlier (i.e. with fewer elements loaded.)

b. criticality will occur later (i.e. with more elements loaded.)

c. criticality will occur with the same number of elements loaded.

d. criticality will be completely unpredictable.

Answer: A.005 c.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 5-18.

Question: A.006 (1.00 points) {6.0}

A reactor power calibration is being performed by measuring the rate of temperature increase in the reactor pool. Which ONE of the following conditions would result in calculated power being LESS THAN actual power?

a. The measured final temperature is greater than the true temperature.

b. The measured final temperature is less than the true temperature.

c. The calculated volume of water in the pool is greater than the true volume.

d. The calculated rate of temperature increase is greater than the true rate.

Answer: A.006 b.
Reference: SOP Power Calibration.

Question: A.007 (1.00 points) {7.0}

Reactor A increases power from 10% to 20% with a period of 50 seconds. Reactor B increases power from 20% to 30% with a period of also 50 seconds. Compared to reactor A, the time required for the power increase of reactor B is:

a. longer than A.

b. shorter than A.

c. exactly the same as A.

d. approximately the same as A.

Answer: A.007 b.
Reference: The power for reactor A increases by a factor of 2, while the power for reactor B increases by a factor of 1.5. Since the periods are the same, power increase B takes a shorter time.

Question: A.008 (1.00 points) {8.0}

You perform two initial startups a week apart. Each of the startups has the same starting conditions, (core burnup, pool and fuel temperature, and count rate are the same). The only difference between the two startups is that during the SECOND one you stop for 10 minutes to answer the phone. For the second startup compare the critical rod height and count rate to the first startup.

	Rod Height	Count Rate
a.	Higher	Same
b.	Lower	Same
c.	Same	Lower
d.	Same	Higher

Answer: A.008 d.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 5.7, pp. 5-28 — 5-38.

Question: A.009 (1.00 points) {9.0}
K_{eff} for the reactor is 0.98. If you place an experiment worth +$1.00 into the core, what will the new K_{eff} be?

a. 0.982

b. 0.987

c. 1.013

d. 1.018

Answer: A.009 .b
Reference: SDM = $(1-k_{eff})/k_{eff}$ = (1-0.98)/0.98 = 0.02/0.99 = 0.02041 or 0.02041/.0075 = $2.72, or a reactivity worth (ρ) of -$2.72. Adding +$1.00 reactivity will result in a SDM of $2.72 - $1.00 = $1.72, or .0129081 ΔK/K
K_{eff} = 1/(1+SDM) = 1/(1 + 0.0129081) = 0.987

Question: A.010 (1.00 points) {10.0}

About two minutes following a reactor scram, period has stabilized, and is decreasing at a CONSTANT rate. If reactor power is 10^{-5} % full power what will the power be in three minutes.

a. 5×10^{-6} % full power

b. 2×10^{-6} % full power

c. 10^{-6} % full power

d. 5×10^{-7} % full power

Answer: A.010 c.
Reference: $P = P_0\, e^{-T/\tau} = 10^{-5} \times e^{(-180sec/80sec)} = 10^{-5} \times e^{-2.25} = 0.1054 \times 10^{-5} = 1.054 \times 10^{-6}$

Question: A.011 (1.00 points) {11.0}

Core excess reactivity changes with…

A.1.A Fuel burnup

A.1.B Neutron Level

A.1.C Control Rod Height

A.1.D Reactor Power Level

Answer: A.011 a.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 6.2 p. 6-1 — 6-4.

Question: A.012 (1.00 points) {12.0}

For most materials the neutron microscopic cross-section for absorption σ_a generally …

a. increases as neutron energy increases

b. decreases as neutron energy increases

c. increases as target nucleus mass increases

d. decreases as target nucleus mass increases

Answer: A.012 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 2.5.1 p. 2-36.

Question: A.013 (1.00 points) {13.0}

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

a. Kinetic energy of the fission neutrons.

b. Kinetic energy of the fission fragments.

c. Decay of the fission fragments.

d. Prompt gamma rays.

Answer: A.013 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 3.2.1, p. 3-4.

Question: A.014 (1.00 points) {14.0}

As primary coolant temperature increases, rod worth:

a. increases due to higher reflector efficiency.

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

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

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

Answer: A.014 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 3.3.2, p. 3-18

Question: A.015 (1.00 points) {15.0}

Which one of the following factors has the LEAST effect on K_{eff}?

a. Xenon and samarium fission products.

b. Increase in moderator temperature.

c. Increase in fuel temperature.

d. Fuel burn-up.

Answer: A.015 c.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1982, § 3.3.2, p. 3-18.

Question: A.016 (1.00 points) {16.0}

Which ONE of the following is an example of neutron decay?

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

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

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

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

Answer: A.016 b.
Reference: Burn, R., Introduction to Nuclear Reactor Operations, © 1988, § 2.4.6, P. 2-23.

Question: A.017 (1.00 points) {17.0}

Which ONE of the following atoms will cause a neutron to lose the most energy in an elastic collision?

a. $Carbon^{12}$

b. $Uranium^{238}$

c. $Hydrogen^{2}$

d. $Hydrogen^{1}$

Answer: A.017 d.
Reference: Lamarsh, J.R., Introduction to Nuclear Engineering, 1983. § App II Table II.2, p. 643.

Question: A.018 (1.00 points)   {18.0}

When a reactor is scrammed, the xenon population starts to increase. This occurs primarily because:

a. Xe-135 is stable and does not decay.
b. the neutron population is so low that xenon burnout does not occur.
c. the half-life for the decay of I-135 is shorter than the half-life for the decay of Xe-135.
d. delayed neutrons are continuing to be produced and cause fissions, resulting in xenon production.

Answer: A.018 c.
Reference: R. R. Burn, Introduction to Nuclear Reactor Operations, pg. 8-10.

Question: A.019 (1.00 points)   {19.0}

The reactor is required to pulse from low power levels (less than one KW) to prevent exceeding the:

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

Answer: A.019 a.
Reference: TAMU Technical Specification 3.2.2 Basis

Question: A.020 (1.00 points)   {20.0}

The peak power produced in a fuel element during pulsing operations is greater in FLIP fuel than it is in Standard fuel because:

a. the U^{235} loading is greater in FLIP fuel.
b. the absolute temperature rise is smaller.
c. the burnable poison is the main factor limiting the power peak.
d. the neutron mean free path is longer allowing more time for moderation.

Answer: A.020 a.
Reference: SAR, III.C.2

END OF SECTION A Ɽ THEORY, THERMO & FAC. OPERATING CHARACTERISTICS

Section B Normal/Emergency Procedures and Radiological Controls

Question: B.001 (1.00 points) {1.0}

On Wednesday afternoon, an experimenter transfers a rabbit into the core, requiring the operator to fully insert the regulating rod from its 50% position and to insert shim rod #4 approximately half way from its 70% position to maintain a constant power level. What action is required?

e. Shutdown the reactor and notify the NSC Director. Removal of the experiment and restart of the reactor require NSC Director approval.

f. Make sure the experiment is secured before completing operation for the day. Notify the NSC Director and the experimenter of the change in experiment status.

g. Shutdown the reactor and evacuate the facility. Re-entry into the facility requires Emergency Director approval. Restart of the reactor requires NRC approval.

h. Withdraw the rods in sequence to restore them to the normal banked position; then remove the experiment from the core. Notify the Health Physicist so that he can monitor the sample movement.

Answer: B.001 a.

Reference: Tech Spec 3.6.1 (a) defines maximum reactivity for movable experiment as $1.0 2) from facility characteristics: worth of shim rod motion = approx ($4.7) (.7)/2 = approx. $1.6 worth of reg rod motion = approx ($0.8) (.5) = approx. $0.4 total = approx. $2.0
3) SOP II-N, Response to abnormal reactivity changes defines reactivity changes greater than $1.0 as reportable occurrences per Tech Specs 6.5.2, requiring shutdown and NSC Director approval for restart.

Question: B.002 (1.00 points) {2.0}

Which ONE of the following describes the relationship between the Safety Limit (SL) and the Limiting Safety System Setting (LSSS)?

a. The SL is a maximum operationally limiting value that prevents the LSSS from being reached during normal runs.

b. The SL is a maximum setpoint for instrumentation response. The LSSS is the minimum number of channels required to be operable.

c. The SL is a parameter that ensures the integrity of the fuel cladding. The LSSS initiates protective action to preclude reaching the SL.

d. The LSSS is a parameter that ensures the integrity of the fuel cladding. The SL initiates protective action to preclude reaching the LSSS.

Answer: B.002 c.

Reference: Tech Spec, 1.13 and 1.35

Question: B.003 (1.00 points) {3.0}

Which ONE of the following is NOT part of the calculated Shutdown Margin?

a. regulating rod worth

b. most reactive rod worth

c. transient rod pulse stop worth

d. highest non-secured experiment worth

Answer: B.003 c.

Reference: Tech Spec, 3.1.3; SOP III-M, NSC Form 576

Section B Normal/Emergency Procedures and Radiological Controls

Question: B.004 (1.00 points) {4.0}

A CHANNEL CHECK is:

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

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

c. a temporary modification to the channel circuits to allow signals to be bypassed such that inadvertent protective action is precluded.

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

Answer: B.004 b.

Reference: Technical Specifications, 1.3.3

Question: B.005 (1.00 points) {5.0}

Which ONE of the following reactor safety system channels is required to be operable in BOTH the steady state and pulse modes of operation?

a. Low Power Interlock

b. Log Power 1 KW Interlock

c. Fuel Element Temperature

d. Detector Power Supply Failure

Answer: B.005 c.

Reference: Technical Specifications, Sect. 3.2.2, Table 1

Question: B.006 (1.00 points) {6.0}

Work is to be performed near a source of radiation emitting a field of 2 Mev gamma measuring 500 Mrem/hr. Considering linear attenuation coefficients of 1.15 $in.^{-1}$ and 0.575$in.^{-1}$, respectively, estimate the thickness of lead and steel (separately) in inches to reduce the radiation level to 5 Mrem/hr.

	lead	steel
a.	2 inches	4 inches
b.	4 inches	8 inches
c.	2 inches	10 inches
d.	4 inches	20 inches

Answer: B.006 b.

Reference: $D = D_o e^{-\mu x}$ ± $\ln D/D_o = -\mu x$ ± $x = -4.605/-\mu$ -or-
2 tenth thickness required
tenth thickness for lead is 2 inches
tenth thickness for steel is 4 inches

Question: B.007 (1.00 points) {7.0}

Which ONE of the following areas is defined as " ... any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem in 1 hour at 30 centimeters from the radiation source...

a. Radiation Area

b. Restricted Area

c. High Radiation Area

d. Airborne Radioactivity Area

Answer: B.007 c.

Reference: 10CFR20, Part 20.1003

Section B Normal/Emergency Procedures and Radiological Controls

Question: B.008 (1.00 points) {8.0}

What is the half life of the isotope contained in a sample which produces the following count rates?

Time, Minutes	Counts per Minute
initial count	900
30	740
60	615
90	512
180	294

a. 551 minutes

b. 312 minutes

c. 111 minutes

d. 88 minutes

Answer: B.008 c.

Reference: $A = A_o e^{\lambda t}$

$294 = 900e^{-180\lambda}$, $180\lambda = -\ln 0.327$, $\lambda = 0.00623\ min^{-1}$

$t_{1/2} = 0.693 / \lambda$, $= 0.693 / 0.00623\ min^{-1}$, = 111 minutes

Question: B.009 (1.00 points) {9.0}

You wish to store a small radioactive source temporarily in the reactor building. The source strength is estimated to be 500 millicuries and it emits gamma rays of an average energy of 1.3 Mev. Approximately how far from the source would you have to erect a "CAUTION - HIGH RADIATION AREA" barrier?

a. 780 feet

b. 39 feet

c. 15 feet

d. 6 feet

Answer: B.009 d.

Reference: High radiation area - 100 mr per hour.

$R/hr = 6E / d^2$, $d^2 = (6)(.5)(1.3) / 0.1 = 39$, d = 6.25 feet

Section B Normal/Emergency Procedures and Radiological Controls

Question: B.010 (1.00 points) {10.0}

Shortly after an evacuation of the reactor building, an NSC management representative arrives at the facility. Which ONE of the statements below describes a situation that warrants his/her assumption of the Emergency Director responsibilities?

a. The management representative immediately assumes the responsibilities of the Emergency Director in all cases.

b. The management representative assumes the responsibilities of the Emergency Director when the health and safety of the public are in jeopardy.

c. The management representative assumes the responsibilities of the Emergency Director only in cases where the SRO requests to be relieved.

d. The management representative assumes the responsibilities of the Emergency Director at the point where interaction with outside support organizations becomes necessary.

Answer: B.010 b.

Reference: SOP IX-B, Sect. j

Question: B.011 (1.00 points) {11.0}

How does the critical position of the shim/safety rods during a startup for steady state operation compare with a startup prior to pulsing operations?

a. The critical position will be lower during a startup for pulsing since pulsing adds positive reactivity.

b. The critical position will be the same since pulsing is conducted at a power level above the critical level.

c. The critical position will be higher during a startup for pulsing since the transient rod is initially left fully inserted in the core.

d. The critical position will be higher during a startup for pulsing to compensate for negative reactivity response of the fuel due to temperature increases during the pulse.

Answer: B.011 c.

Reference: SOP II-C.4.b

Question: B.012 (1.00 points) {12.0}

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.012 d.

Reference: SOP II-F; Technical Specifications, 1.24, 1.25. 1.27. and 1.28

Question: B.013 (1.00 points) {13.0}

Which ONE of the following describes the yellow light associated with the beam port water shutters?

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

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

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

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

Answer: B.013 b.

Reference: SOP IV-D.3.b.10

Question: B.014 (1.00 points) {14.0}

A Channel Test of each of the reactor safety system channels is required ___________________:

(Ignore exceptions cited in Technical Specifications)

a. daily

b. weekly

c. monthly

d. annually

Answer: B.014 a.

Reference: Technical Specifications, 4.3.2.a

Question: B.015 (1.00 points) {15.0}

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.015 b.

Reference: SOP II-D.4

Section B Normal/Emergency Procedures and Radiological Controls

Question: B.016 (2.0 points, 0.5 each) {17.0}

Match the type of radiation in column A with its associated Quality Factor (10CFR20) from column B.

Column A	Column B
a. alpha	1
b. beta	2
c. gamma	5
d. neutron (unknown energy)	10
	20

Answer: B.016 a. = 20; b. = 1; c. = 1; d. = 10

Reference: 10CFR20.100x

Question: B.017 (1.00 points) {18.0}

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

a. 25 mR/hr

b. 50 mR/hr

c. 75 mr/hr

d. 100 mr/hr

Answer: B.017 b.

Reference: Nuclear Power Plant Health Physics and Radiation Protection

Question: B.018 (1.00 points) {19.0}

Your Reactor Operator license expires after _____ years.

a. 2
b. 4
c. 6
d. 8

Answer: B.018 c.

Reference: 10CFR55.55(a)

Question: B.019 (1.00 points) {20.0}

Startups following unscheduled shutdowns:

a. Need to be approved by the NRC if a safety limit was exceeded.
b. Caused by power failures require complete pre-startup checks.
c. Need to be preceded by a scram check of all rods from 10%.
d. When not reportable can be initiated with SRO review in progress.

Answer: B.019 a.

Reference: SOP II, REACTOR OPERATIONS, C.6, and 10 CFR 50.36

END OF SECTION B NORMAL/EMERGENCY PROCEDURES AND RADIOLOGICAL CONTROLS

Section C Facility and Radiation Monitoring Systems

Question: C.001 (1.00 points) {1.0}

When the reactor is being controlled by the servo controller:

a. the period scram is bypassed.
b. the regulating rod moves in response to the linear channel signal.
c. the regulating rod moves in response to the log power channel signal.
d. the regulating rod moves out following a scram to try to maintain constant power.

Answer: C.001 b.
Reference: SAR, page 93.

Question: C.002 (1.00 points) {2.0}

The reactor is in the "PULSE" mode when the TR fire button is depressed. As a result, the solenoid valve is:

a. energized, admitting air to the cylinder.
b. de-energized, admitting air to the cylinder.
c. de-energized, removing air from the cylinder.
d. energized, removing air from the cylinder.

Answer: C.002 a.
Reference: SAR, page 38.

QUESTION: C.003 (1.00 points) {3.0}

For a control rod, the "CARR UP" light is OFF, the "CARR DOWN" light is OFF, and the "ENGAGED" light is ON. This indicates that:

a. the rod and drive are in contact, and are both full in.
b. the rod and drive are in contact, and are both full out.
c. the rod and drive are in contact, and are somewhere between full in and full out.
d. the rod and drive are not in contact, and the rod and drive are somewhere between full in and full out.

Answer: C.003 c.
Reference: SAR, page 26.

Section C Facility and Radiation Monitoring Systems

QUESTION: C.004 (1.00 points) {4.0}

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.004 d.
Reference: SOP II E, Pulsing Operation.

QUESTION: C.005 (1.00 points) {5.0}

The reactor is operating at 800 kW, with power being controlled by the servo control system. An experiment is inadvertently inserted into the core, causing reactor power to drop to 600 kW. As a result:

a. the reactor scrams.

b. regulating rod control shifts back to manual.

c. the regulating rod moves into the core to maintain power at 600 kW.

d. the regulating rod moves out of the core in an effort to restore power to 800 kW.

Answer: C.005 a.
Reference: SAR, page 93.

QUESTION: C.006 (1.00 points) {6.0}

The chemical feed system controls the chemical characteristics of the:

a. purification system.

b. secondary cooling loop.

c. pool water cooling system.

d. pool water transfer system.

Answer: C.006 b.
Reference: SAR, page 65.

Section C Facility and Radiation Monitoring Systems

QUESTION: C.007 (1.00 points) {7.0}

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 proportional to neutron flux and is counted with the neutrons.

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

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

Answer: C.007 c.
Reference: SOP III C Linear Power Measuring Channel Maintenance Surveillance.

QUESTION: C.008 (1.00 points) {8.0}

Which ONE of the following is the method used for to generate the signal for the control rod position digital read outs on the control console?

a. A two channel encoder/decoder system produces 100 pulses per revolution.

b. A series of reed switches open/close as the rod moves generating a signal proportional to rod position.

c. A lead screw on the control rod varies the impedance between the two windings of a transformer generating a signal proportional to rod position.

d. A syncro transmitter within the control rod drive sends a signal to a servo receiver in the console, which generates the signal proportional to rod position.

Answer: C.008 a.
Reference: Modification Authorization M-46

QUESTION: C.009 (1.00 points) {9.0}

Which one of the following statements concerning Beam Port #4 is *False*?

e. A 2 inch diameter pipe connects the beam port to the central exhaust system.

f. Positioning of samples for real-time radiography requires that the neutron beam be shut off.

g. To clear the interlock for evacuation of the water shutter, the movable shield block shall be in the closed position.

h. With the reactor positioned within the east rail stop, a “C-2" device causes a reactor scram when the sample preparation room door is opened.

Answer: C.009 d.
Reference: SOP IV-F

Section C Facility and Radiation Monitoring Systems

QUESTION: C.010 (1.00 points) {10.0}

Which one of the following statements describes the moderating properties of Zirconium Hydride?

a. The hydride mixture is very effective in slowing down neutrons with energies below 0.025 eV.

b. The ratio of hydrogen atoms to zirconium atoms affects the moderating effectiveness for slow neutrons.

c. The probability that a neutron will return to the fuel element before being captured elsewhere is a function of the temperature of the hydride.

d. The elevation of the hydride temperature increases the probability that a thermal neutron will escape the fuel-moderator element before being captured.

Answer: C.010 d.
Reference: GA - 3886 (Rev. A) TRIGA Mark III Reactor Hazards Analysis, Feb. 1965.

QUESTION: C.011 (1.00 points) {11.0}

In the event of a building ventilation isolation, the emergency exhaust system can be operated in a manual mode from:

a. the Supervisor's Console in the control room.

b. the Air Handling Control Panel in the reception room.

c. the Emergency Operating Panel in the central mechanical chase.

d. the Radiation Release Monitoring Panel in the Health Physicist's Office.

Answer: C.011 b.
Reference: SAR V.B.3, VIII-A; Modification Authorization M-14

QUESTION: C.012 (1.00 points) {12.0}

Which one of the following Facility Air Monitoring System channels initiates a shutdown of the air handling system and building isolation on receipt of an alarm?

a. building gaseous monitor

b. building particulate monitor

c. stack gaseous monitor

d. stack particulate monitor

Answer: C.012 d.
Reference: SAR IX-F

Section C Facility and Radiation Monitoring Systems

QUESTION: C.013 (1.00 points) {13.0}

Which one of the following areas is NOT directly monitored by a channel of the Area Radiation Monitoring System?

a. Reception area

b. Demineralizer room

c. Research Lab No. 1

d. Material handling area

Answer: C.013 a.
Reference: SAR IX-G, Fig. 9.3

QUESTION: C.014 (1.00 points) {14.0}

Which of the following is NOT an option provided by the Radioactive Liquid Waste Disposal System?

a. draining liquid waste to the creek

b. storing liquid waste for radioactive decay

c. evaporation and solidification of liquid waste

d. diluting liquid waste to comply with 10CRF20 limits

Answer: C.014 c.
Reference: SAR IX-B.2

QUESTION: C.015 (1.00 points) {15.0}

The reactor is at 50 watts in "SERVO" control when gamma compensating voltage for the Linear Power measuring NI channel is lost. What effect would this have on regulating rod position, and why?

a. Rod will drive in slightly, because indicated power will increase with demand remaining the same.

b. Rod will drive out slightly, because indicated power will decrease with demand remaining the same.

c. Rod will remain as is, because input to the control circuit is from the log power amplifier.

d. Rod will scram, due to a large increase in indicated power.

Answer: C.015 a.
Reference: SAR VII figure 7-2.

Section C Facility and Radiation Monitoring Systems

QUESTION: C.016 (1.00 points) {16.0}

Which one of the following provides a reactor scram in any mode of operation?

a. Low pool level.
b. High power level.
c. High fuel temperature.
d. Loss of supply voltage to high power level detector

Answer: C.16 c
Reference: SAR, Table V pg. 100

QUESTION: C.017 (1.00 points) {17.0}

The FLIP fuel elements:

a. are about 70% enriched uranium with stainless steel clad and erbium burnable poison.
b. are about 20% enriched uranium with stainless steel clad and no burnable poison.
c. are about 20% enriched uranium with aluminum clad and erbium burnable poison.
d. are about 70% enriched uranium with aluminum clad and no burnable poison.

Answer: C.017 a.
Reference: SAR III-B.4

QUESTION: C.018 (1.00 points) {18.0}

The pneumatic sample system has several design features including:

a. An override so the control room can return a sample from the reactor to its origin.
b. Automatic return override if the samples get more exposure than expected.
c. The use of dry compressed CO_2 to minimize moisture in the system.
d. Control room permissive for each remote sample station.

Answer: C.018 d.
Reference: SOP IV-C

QUESTION: C.019 (1.00 points) {19.0}

Looking at three element fuel bundles from above:

a. Individual element identification numbers are visible.

b. The bundle identification number should be visible.

c. You should see the locking bolt oriented North.

d. The bundle doesn't have any shims.

Answer: C.019 d.
Reference: SOP II H.1 and 2.

QUESTION: C.020 (1.0 points) {20.0}

Which ONE of the following statements correctly describes system response for a pool level drop to less than 90%?

a. Two float switches actuate. Each stopping the pool water recirculation pump and energizing an alarm at the University Communications Room.

b. Two float switches actuate. One stopping the pool water recirculation pump and one energizing an alarm at the University Communications Room.

c. One float switch actuates. This switch both stops the pool water recirculation pump and energizes an alarm at the University Communications Room.

d. One float switch actuates. This switch energizes an alarm at the University Communications Room. The pool water recirculation pump continues to operate.

Answer: C.020 c.
Reference: SAT § VIII-G.1

END OF SECTION C FACILITY AND RADIATION MONITORING SYSTEMS

END OF EXAMINATION