April 3, 2007

Dr. Theresa A. Maldonado, 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-07-01, TEXAS A&M UNIVERSITY

Dear Dr. Maldonado:

During the week of February 26, 2006, the NRC administered an operator licensing examination at your Texas A&M University reactor. The examination was conducted according to NUREG-1478, "Non-Power Reactor Operator Licensing Examiner Standards," Revision 1. 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 10 CFR 2.390 of the Commission's 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 (the Public Electronic Reading Room) 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 Patrick Isaac at 301-415-1019.

Sincerely,

/RA/ Michael J. Case for

Johnny Eads, Chief
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-07-01
2. Facility comments with NRC resolution
3. Examination and answer key (RO/SRO)

cc w/enclosures:
Please see next page

cc:

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

Governor's Budget and
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Radiation Program Officer
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Susan M. Jablonski
Technical Advisor
Office of Permitting, Remediation & Registration
Texas Commission on Environmental Quality
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Austin, TX 78711-3087

Test, Research and Training
Reactor Newsletter
202 Nuclear Sciences Center
University of Florida
Gainesville, FL 32611

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DISTRIBUTION:
PUBLIC PRTB r/f JEads Facility File EBarnhill (O6-F2)

ADAMS ACCESSION #: ML070880029 **TEMPLATE #: NRR-074**
PACKAGE ACCESSION #: ML063470057

OFFICE	PRTB:CE		IOLB:LA		PRTB:BC	
NAME	PIsaac:cah		EBarnhill		JEads/MCase for	
DATE	03/29/2007		04/02/2007		004/03/2007	

OFFICIAL RECORD COPY

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

REPORT NO.: 50-128/OL-07-01

FACILITY DOCKET NO.: 50-128

FACILITY LICENSE NO.: R-76

FACILITY: Texas A&M University

EXAMINATION DATES: 02/27/2007 - 03/01/2007

EXAMINER: Patrick Isaac, Chief Examiner

SUBMITTED BY: ***/RA/*** 03/26/2007
Patrick Isaac, Chief Examiner Date

SUMMARY:

During the week of February 26, 2007, NRC administered Operator Licensing examinations to one Reactor Operator (RO) and two Senior Operator Upgrade (SROU) applicants. All the applicants passed the examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiner:

   Patrick Isaac, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**1/0**	**N/A**	**1/0**
Operating Tests	**1/0**	**2/0**	**3/0**
Overall	**1/0**	**2/0**	**3/0**

3. Exit Meeting:

   Personnel attending:

   John Hernandez, Reactor Supervisor
   Patrick Isaac, NRC

   The licensee commented on a fair and well balanced examination. There were no generic concerns raised by the examiner.

NRC RESOLUTIONS - WRITTEN EXAMINATION

Facility Comment B.8:

... the answer to question B.8 is incorrect.

The examination key states that the correct answer is “c”. The reference to the answer is SOP II, Reactor Operations, C.1. The SOP goes on to state that the Director may make changes to the minimum staff requirements provided the changes satisfy the requirements of the Technical Specifications.

On April 24, 2003, the Director initiated such a change allowing the requirement for the Duty HP to be waived provided that other conditions are met. This change is currently in effect and is practiced daily at the TAMU Nuclear Science Center. Therefore, answer “ c” is no longer valid for the NSC.

Answer b is correct. The reference for this answer is Technical Specification 4.3.2.a.

NRC Resolution B.8:

Comment accepted. The answer key will be modified to accept option "b" as correct.

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

FACILITY: TEXAS A&M

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 2/27/2007

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 paren-theses for each question. A 70% overall is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE		CATEGORY
20.00	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.	PLANT AND RADIATION MONITORING SYSTEMS

FINAL GRADE _____ _____ % TOTALS

ALL THE WORK DONE ON THIS EXAMINATION IS MY OWN. I HAVE NEITHER GIVEN NOR RECEIVED AID.

_____
CANDIDATE'S SIGNATURE

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ____

002 a b c d ____

003 a b c d ____

004 a b c d ____

005 a b c d ____

006 a b c d ____

007 a b c d ____

008 a b c d ____

009 a b c d ____

010 a b c d ____

011 a b c d ____

012 a b c d ____

013 a b c d ____

014 a b c d ____

015 a b c d ____

016 a b c d ____

017 a b c d ____

018 a b c d ____

019 a b c d ____

020 a b c d ____

(***** END OF CATEGORY A *****)

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ___

002 a b c d ___

003 a ___ b ___ c ___ d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a b c d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

(***** END OF CATEGORY B *****)

A N S W E R S H E E T

Multiple Choice (Circle or X your choice)
If you change your answer, write your selection in the blank.

MULTIPLE CHOICE

001 a b c d ___

002 a b c d ___

003 a b c d ___

004 a b c d ___

005 a b c d ___

006 a b c d ___

007 a b c d ___

008 a b c d ___

009 a b c d ___

010 a b c d ___

011 a b c d ___

012 a b c d ___

013 a b c d ___

014 a ___ b ___ c ___ d ___

015 a b c d ___

016 a b c d ___

017 a b c d ___

018 a b c d ___

019 a b c d ___

(********** END OF EXAMINATION **********)

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 not received or 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.

6. Fill in the date on the cover sheet of the examination (if necessary).

7. Print your name in the upper right-hand corner of the first page of each section of your answer sheets.

8. The point value for each question is indicated in parentheses after the question.

9. Partial credit will NOT be given.

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

11. When you are done and have turned in your examination, leave the examination area as defined by the examiner.

EQUATION SHEET

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

$\dot{Q} = \dot{m}\, \Delta h$

$\dot{Q} = UA\, \Delta T$

$SCR = S/(1\text{-}Keff)$

$CR_1\,(1\text{-}Keff)_1 = CR_2\,(1\text{-}Keff)_2$

$$SUR = \frac{26.06\,(\lambda_{eff}\rho)}{(\beta - \rho)}$$

$$M = \frac{(1\text{-}Keff)_0}{(1\text{-}Keff)_1}$$

$SUR = 26.06/\tau$

$M = 1/(1\text{-}Keff) = CR_1/CR_0$

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

$SDM = (1\text{-}Keff)/Keff$

$P = P_0\, e^{(t/\tau)}$

$\dot{Pwr} = W_f\, \dot{m}$

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

$\ell^* = 1 \times 10^{-5}$ seconds

$\tau = (\ell^*/\rho) + [(\bar{\beta}-\rho)/\lambda_{eff}\rho]$

$\tau = \ell^*/(\rho-\beta)$

$\rho = (Keff-1)/Keff$

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

$\rho = \Delta Keff/Keff$

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

$DR_1 D_1^{\,2} = DR_2 D_2^{\,2}$

$DR = DR_o e^{-\lambda t}$

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

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 hp = 2.54×10^{3} BTU/hr

1 Mw = 3.41×10^{6} BTU/hr

1 BTU = 778 ft-lbf

$^\circ F = 9/5\,^\circ C + 32$

1 gal $H_2O \approx 8$ lbm

$^\circ C = 5/9\,(^\circ F - 32)$

QUESTION A.1 [1.0 point]

Core excess reactivity (ρ_{ex}) changes with …

a. fuel element burnup

b. control rod height

c. neutron energy level

d. reactor power level

QUESTION A.2 [1.0 point]

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

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

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

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

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

QUESTION A.3 [1.0 point]

A reactor startup is in progress. Each control rod withdrawal is inserting exactly EQUAL amounts of reactivity. Select the EXPECTED neutron population and count rate response as "Keff" approaches 1.0.

The change in neutron population per reactivity insertion is:

a. SMALLER, and it takes LESS time to reach a new equilibrium count rate

b. LARGER, and it takes LESS time to reach a new equilibrium count rate.

c. SMALLER, and it takes MORE time to reach a new equilibrium count rate.

d. LARGER, and it takes MORE time to reach a new equilibrium count rate.

QUESTION A.4 [1.0 point]

One of the conservative features of the NSCR :

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

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

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

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

QUESTION A.5 [1.0 point]

The term "*reactivity*" may be described as …

a. a measure of the core's fuel depletion.

b. negative when K_{eff} is greater than 1.0.

c. a measure of the core's deviation from criticality.

d. equal to $.50 when the reactor is prompt critical.

QUESTION A.6 [1.0 point]

The table provided lists data taken during a core loading. Estimate the number of fuel elements needed to go critical.

a. 24

b. 27

c. 30

d. 38

Count Rate	Number for Fuel Elements
842	2
886	7
1052	12
1296	17
4210	22

QUESTION A.7 [1.0 point]

During a startup you increase reactor power from 100 watts to 195 watts in a minute. Which ONE of the following is reactor period?

a. 30 seconds.

b. 60 seconds.

c. 90 seconds.

d. 120 seconds.

QUESTION A.8 [1.0 point]

The reactor has just been started up and has been at 100% power for 3 hours. The Reactor Operator notes that several small control rod withdrawals are required to maintain power at 100%. Which of the following is the reason for the rod withdrawals?

a. Fuel temperatures are decreasing.

b. Xenon is building in to equilibrium concentration.

c. Pool water temperatures are decreasing.

d. Samarium is burning out from equilibrium concentration.

QUESTION A.9 [1.0 point]

The Fast Fission Factor (ε) is defined as "The ratio of the number of neutrons produced by …

a. fast fission to the number produced by thermal fission.

b. thermal fission to the number produced by fast fission.

c. fast and thermal fission to the number produced by thermal fission.

d. fast fission to the number produced by fast and thermal fission.

QUESTION A.10 [1.0 point]

Given the data in the table to the right, which ONE of the following is the closest to the half-life of the material?

a. 11 minutes

b. 22 minutes

c. 44 minutes

d. 51 minutes

TIME	ACTIVITY
0 minutes	2400 cps
10 minutes	1757 cps
20 minutes	1286 cps
30 minutes	941 cps
60 minutes	369 cps

QUESTION A.11 [1.0 point]

The amount of radioactivity in any material can be determined by:

a. Measuring the dose coming from it using an accurate radiation detector.

b. Taking the results of a. above and multiplying by (4 x pi) to account for geometry.

c. Measuring the total number of radioactive emissions given off over time.

d. First figure out c. above, then multiply the results by the correct quality factor.

QUESTION A.12 [1.0 point]

An experienced reactor operator understands that:

a. The more neutrons multiply during startup the lower the rods are at critical.

b. There is no fixed relationship between neutron level and criticality.

c. Neutron multiplication during startup is just neutrons getting lost at a slower rate.

d. Without the Sb-Be source the reactor would not go critical.

QUESTION A.13 [1.0 point]

The reactor has been at 100% power for several hours when a reactor scram occurs. All systems have operated as designed, no experiments have been changed, and no fuel has been removed from the reactor. Several hours after the reactor scram, indicated reactor power will stabilize due to:

a. continuing decay of the shortest-lived delayed neutron precursor.

b. the decay of nuclear instrumentation compensation voltage at low power levels.

c. reaching the nuclear instrumentation minimum detectable level.

d. the continuing subcritical multiplication of source neutrons.

QUESTION A.14 [1.0 point]

A fissile material is one which will fission upon the absorption of a **THERMAL** neutron. Which ONE of following listed isotopes is not a fissile material?

a. Th^{232}

b. U^{233}

c. U^{235}

d. Pu^{239}

QUESTION A.15 [1.0 point]

The NSCR operates on the bottom of a 30 foot deep pool filled with 106, 000 gallons of water:

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

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

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

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

QUESTION A.16 [1.0 point]

The reactor is operating at 100 KW. The reactor operator withdraws the Regulating Rod allowing power to increase. The operator then inserts the same rod to its original position, decreasing power. In comparison to the rod withdrawal, the period due to the rod insertion will be …

a. longer due to long lived delayed neutron precursors.

b. shorter due to long lived delayed neutron precursors.

c. same due to equal amounts of reactivity being added.

d. same due to equal reactivity rates from the rod.

QUESTION A.17 [1.0 point]

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

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

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

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

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

QUESTION A.18 [1.0 point]

In order to make the maximum use of the NSCR reactor core:

a. Graphite reflectors are kept near the periphery edges.

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

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

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

QUESTION A.19 [1.0 point]

Identify the PRINCIPAL source of heat in the reactor after shutdown?

a. Stored energy from the reactor and core materials

b. Spontaneous fission within the core

c. Decay of fission products

d. Cosmic radiation causing fission

QUESTION A.20 [1.0 point]

Assume that the NSCR pool contains 106, 000 gallons at 90 degrees F and it heats up to 93 degrees F in two hours at indicated 400Kw. Assume no heat is removed from the pool. Based on your calculation results you should recommend to the SRO:

a. Make adjustment to correct the linear power channel indication.

b. Add more ice to the bath and wait two more hours.

c. Lower the reactor power to the steady state power calculated.

d. Maintain the power and wait for the ice bath to melt some more.

QUESTION B.1 [1.0 point]

An accessible area within the facility has general radiation levels of 325 mrem/hour. What would be the EXPECTED posting for this area?

a. "Caution, Very High Radiation Area"

b. "Danger, Airborne Radioactivity Area"

c. "Danger, High Radiation Area"

d. "Caution, Radiation Area"

QUESTION B.2 [1.0 point]

While working on an experiment, you receive the following radiation doses: 100 mrem (β), 25 mrem (γ), and 5 mrem (thermal neutrons). Which ONE of the following is your total dose?

a. 175 mrem

b. 155 mrem

c. 145 mrem

d. 130 mrem

QUESTION B.3 [2.0 points, ½ each]

Match type of radiation (1 thru 4) with the proper penetrating power (a thru d)

a. Gamma	1. Stopped by thin sheet of paper
b. Beta	2. Stopped by thin sheet of metal
c. Alpha	3. Best shielded by light material
d. Neutron	4. Best shielded by dense material

QUESTION B.4 [1.0 point]

10CFR50.54(x) states: *"A licensee may take reasonable action that departs from a license condition or a technical specification (contained in a license issued under this part) in an emergency when this action is immediately needed to protect the public health and safety and no action consistent with license conditions and technical specifications that can provide adequate or equivalent protection is immediately apparent."* Per 10CFR50.54(y), which one of the following is the minimum level of authorization for this action?

a. Reactor Operator licensed at the facility.

b. Senior Reactor Operator licensed at the facility.

c. Facility Manager (or equivalent at facility).

d. The U.S. Nuclear Regulatory Commission Project Manager

QUESTION B.5 [1.0 point]

Which ONE of the following conditions is NOT permissible when the reactor is operating, or about to be operated?

a. The reactivity worth of a single experiment = $1.00.

b. A control rod scram = 1.5 seconds.

c. An excess reactivity = $2.20.

d. The Continuous Air Radiation Monitor is inoperable due to maintenance.

QUESTION B.6 [1.0 point]

As permitted by 10 CFR 50.59, the NSCR may:

a. Modify systems and change the Technical Specifications (TS) if the NRC is notified afterwards.

b. Perform new and little understood experiments when they are for research.

c. Determine the affects of modifications and their impact on TS.

d. Redefine the boundaries of accidents previously analyzed in the Safety Analysis Report (SAR).

QUESTION B.7 [1.0 point]

Which ONE of the following is the 10 CFR 20 definition of **TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)**?

a. The sum of the deep does equivalent and the committed effective dose equivalent.

b. The dose that your whole body receives from sources outside the body.

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

d. The dose to a specific organ or tissue resulting from an intake of radioactive material.

QUESTION B.8 [1.0 point]

Prior to startup of the reactor there:

a. Must be a licensed member of management available.

b. Has to be a safety system Channel Test on record.

c. Must be a Senior HP or his designated representative in the facility.

d. Will be signatures of all required persons in the Reactor Startup log.

QUESTION B.9 [1.0 point]

A small radioactive source is to be stored in the reactor building. The source reads 2 R/hr at 1 foot. Assuming no shielding is to be used, a Radiation Area barrier would have to be erected from the source at least a distance of approximately:

a. 400 feet

b. 40 feet

c. 20 feet

d. 10 feet

QUESTION B.10 [1.0 point]

Which ONE of the following does not require the direct supervision (i.e., presence) of an SRO?

a. Movement of the reactor bridge.

b. Initiation of a pulse.

c. Removal of a control rod.

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

QUESTION B.11 [1.0 point]

"The reactor power level shall not exceed 1.3 megawatts under any condition of operation." This is an example of a:

a. safety limit.

b. limiting safety system setting.

c. limiting condition for operation.

d. surveillance requirement.

QUESTION B.12 [1.0 point]

An experiment with a reactivity worth of $0.20 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 secured.

c. the reactor must be subcritical by at least $0.40.

d. the reactor must be shutdown.

QUESTION B.13 [1.0 point]

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?

a. 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.

b. 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.

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

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

QUESTION B.14 [1.0 point]

In accordance with the Emergency Classification Guide, all alarms from the Facility Air Monitor System are classified as Operational Events with the exception of:

a. Stack Particulate Monitor.

b. Building Gas Monitor.

c. Fission Gas Monitor.

d. Stack Gas Monitor.

QUESTION B.15 [1.0 point]

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

a. 4

b. 6

c. 12

d. 40

QUESTION B.16 [1.0 point]

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. Detector Power Supply Failure

d. Fuel Element Temperature

QUESTION B.17 [1.0 point]

"The area within the operations boundary for the NSCR (defined as the reactor confinement building)."

Which one of the following terms matches the above definition?

a. Emergency Support Center (ESC)

b. Emergency Planning Zone (EPZ)

c. Site Boundary

d. Controlled Access Area (CAA)

QUESTION B.18 [1.0 point]

Which one of the following incidents should be classified as a "Notification of Unusual Event"?

A. Reactor pool level decreasing at a rate exceeding makeup capacity.

B. Stack gas monitor (Channel 3) is alarming.

C. Report of a tornado which could strike the facility.

D. Personnel injury with radiological complications.

QUESTION B.19 [1.0 point]

Which ONE of the following is a duty of the Reactor Operator (RO) during an emergency which requires a facility evacuation?

a. Verify that rope barriers are in place in the reception room.

b. Verify all persons are accounted for.

c. Verify all doors to the reactor building are closed.

d. Shutdown building air handling and exhaust systems.

QUESTION C.1 [1.0 point]

Mechanical stops prevent inadvertent movement of the NSCR closer than _____ from the irradiation cell window.

a. 12 ft

b. 8 ft

c. 18 inches

d. 3 inches

QUESTION C.2 [1.0 point]

According to SOP II-C, "Reactor Startup," which one of the following anticipated power levels would require placing the diffuser system in operation?

a. 5 Kw

b. 10 Kw

c. 100 Kw

d. 500 Kw

QUESTION C.3 [1.0 point]

The reactor is operating at max allowed power (per SOP IV-F, Neutron Radiography Beam Port #4) while located in the stall and positioned against the radiography reflector. Select the statement that describes the indication[s] the operator would see in the control room if the shield door to enter the cave were to be opened.

a. The C-2 device would cause the reactor to trip and an alarm would sound.

b. The C-2 device would sound an alarm in the control room.

c. The beamport No. 4 area radiation monitor would alarm.

d. No indication in the control room.

QUESTION C.4 [1.0 point]

Which one of the following choices correctly describes the capability of the emergency pool fill system, in case of a loss of beam port integrity?

a. Approximately 1200 GPM

b. Approximately 800 GPM.

c. Approximately 400 GPM.

d. Approximately 200 GPM.

QUESTION C.5 [1.0 point]

The emergency exhaust air filter system, installed between the exhaust fan and the exhaust stack, consists of:

a. TWO activated carbon filter banks, and ONE particulate filter bank.

b. TWO activated carbon filter banks, and TWO particulate filter banks.

c. ONE activated carbon filter bank, and TWO particulate filter banks.

d. ONE activated carbon filter bank, and ONE particulate filter bank.

QUESTION C.6 [1.0 point]

The reactor is being operated at 100 kw in the "Servo" mode of control. The compensating voltage to the Linear Power measuring channel suddenly begins to trend down due to a malfunction. Select the statement that describes reactor response with no operator action.

a. The regulating rod would move in, causing power to decrease

b. The regulating rod would move out, causing power to increase

c. All scram capable rods would insert

d. The regulating rod would shift back to manual due to a lower indicated reactor power.

QUESTION C.7 [1.0 point]

Select the statement that describes the method of selecting the amount of reactivity inserted for a pulse.

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

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

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

d. Adjustment of the position of the pneumatic cylinder.

QUESTION C.8 [1.0 point]

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.

QUESTION C.9 [1.0 point]

The primary purpose of the safety plate assembly is to:

a. Provide additional support to the reactor grid plate for the use of highly enriched FLIP fuel elements.

b. Insure that the maximum reactivity insertion for a pulse cannot be exceeded..

c. Retain a shim-safety rod fuel follower if it becomes detached from its mounting.

d. Retain any debris resulting from an accident which has directly involved the fuel elements.

QUESTION C.10 [1.0 point]

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

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

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

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

d. All six control rods will scram.

QUESTION C.11 [1.0 point]

Under emergency conditions, the master control panel located in the reception room may be used to:

a. scram the reactor.

b. operate the air handling systems.

c. operate the emergency pool fill system.

d. operate the emergency lighting system.

QUESTION C.12 [1.0 point]

De-energizing the solenoid valve which controls the supply of air to the pneumatic transient rod drive unit will cause ...

a. the piston and the transient rod to drive upward until the piston reaches its upper limit stop.

b. the pneumatic piston to drop to its lower limit and the transient rod to remain in the full down position.

c. the air pressure to remain at an operating level for several hours maintaining the transient rod in its original position.

d. the transient rod to remain at its original position and a low pressure alarm to initiate in the control room.

QUESTION C.13 [1.0 point]

A reactor scram has occurred from an initial shim-safety rod position of 50.0%. Which one of the following correctly describes the indications for shim-safety rod #3 immediately following the scram? Assume no operator action.

a. ENGAGED light off, ROD DOWN light energized, CARR DOWN light off, digital indication 0.0%.

b. ENGAGED light off, ROD DOWN light energized, CARR DOWN light energized, digital indication 50.0%.

c. ENGAGED light off, ROD DOWN light energized, CARR DOWN light off, digital indication 50.0%.

d. ENGAGED light energized, ROD DOWN light off, CARR DOWN light off, digital indication 0.0%.

QUESTION C.14 [2.0 point]

Match the nuclear instrumentation channel in column B that satisfies the control function in column A. (the items in column B may be used once, more than once or not at all; and only a single answer may occupy one answer space in column A)

Column A (control function)	**Column B** (nuclear instrument)
a. Energizes interlock that prevents start-ups when less than 2 cps	1. Log power channel
b. Energizes interlock that prevents pulsing operations when greater than 1 kw	2. Linear power channel
	3. Safety channel(s)
c. Inputs reactor scram signal when power is greater than 125%	
d. Inputs reactor scram signal in the event of a reactor period of 3 seconds or less	

QUESTION C.15 [1.0 point]

Which ONE of the following is the method you should use (as the console operator) to sound the ventilation alarm if the solenoid valve was inadvertently left shut in the reception room?

a. The normal switch on the control panel should still work.

b. Open a "bypass" valve located in the control room.

c. Open a "bypass" valve located just inside the door leading out of containment.

d. Override the solenoid signal via a switch located in the back of the reactor console.

QUESTION C.16 [1.0 point]

Which one of the following choices is correct regarding the minimum equipment required to achieve confinement of the reactor building? Assume no maintenance is in progress.

a. Central exhaust fan available.

b. Central exhaust fan in operation and the ventilation system controls in the reception room available.

c. The ventilation system and the Radiation Monitoring Channels in operation.

d. Central exhaust fan and the Radiation Monitoring Channels in operation.

QUESTION C.17 [1.0 point]

Which ONE of the following alarms requires the air handlers to be shut down as part of immediate action?

a. stack particulate monitor

b. stack gas monitor

c. building particulate monitor

d. building gas monitor

QUESTION C.18 [1.0 point]

Assuming the reactor is shutdown and all systems in a normal line-up, which one of the following pressures at the primary pump would indicate a full reactor pool?

A. 47 psig

B. 42 psig

C. 33 psig

D. 15 psig

QUESTION C.19 [1.0 point]

Thermocouples in the instrumented fuel element measure temperature at the:

a. interior surface of the cladding.

b. center of the zirconium rod.

c. outer surface of the fuel.

d. interior of the fuel.

Answer Key

A.1 a
REF: Reactor Training Manual - *Core Excess and Shutdown Margin.*

A.2 a
REF: Reactor Training Manual - *Cross Section*.

A.3 d
REF: Reactor Training Manual - *Introduction To Nuclear Physics*

A.4. c
REF: NSCR SAR, CHAP II, IV

A.5 c
REF: Reactor Training Manual - *Reactivity*

A.6 a
REF: Standard NRC question

A.7 c
REF: $P = P_0 e^{t/\tau}$ —> $\tau = t/\ln(P/P_0)$ $\tau = 60/\ln(195/100) = 60/\ln(1.95) = 89.84 \approx 90$ sec.

A.8 b
REF: Reactor Training Manual - *Reactor Physics and Kinetics*

A.9 c
REF: Reactor Training Manual - *Neutron Life Cycle*

A.10 b
REF: Reactor Training Manual - *Reactivity*

A.11 c
REF: Glasstone, 1958, CHAP 5, LAMARSH, 1983, CHP2.8

A.12 b
REF: Glasstone, 1958, CHAP 14

A.13 d
REF: Reactor Training Manual - *Introduction to Nuclear Physics*

A.14 a
REF: Glasstone and Sesonske, *Third Ed. § 1.45*

A.15 b
REF: License Amendment Submittal, 7/15/96, pp 23

A.16 a
REF: Reactor Training Manual - *Reactor Physics and Kinetics*

A.17 b
REF: Burn, Introduction to Nuclear Reactor Operations

Answer Key

A.18. a
REF: Reactor Training Manual - *Reactor Physics and Kinetics*

A.19 c
REF: LaMarsh, pgs 318 - 320

A.20. a
REF: Q=mc(Tfin-Tini) where: m=106,000 gal.x 8lbm/gal=848,000 lbm; c=1 BTU/°F-lbm; Tfin=93 and Tini=90. Q=848,000 lbmx1BTU/°F-lbmx1.5°F=1.0272E6 BTU/hr x 2.93E-4 = 373Kw]

Answer Key

B.1 c
REF: Reactor Training Manual - *10CFR20*

B.2 d
REF: Reactor Training Manual - *Ionizing Radiation*

B.3 a, 4; b, 2; c, 1; d, 3
REF: Reactor Training Manual - *Health Physics*

B.4 b
REF: 10CFR50.54(y).

B.5 b
REF: Technical Specifications, Section 3.2.3.

B.6 c
REF: SOP I & 10 CFR 50.59

B.7 a
REF: 10 CFR 20.1003 *Definitions*

B.8 b
REF: SOP II, REACTOR OPERATIONS, C.1.

B.9 c
REF:

$$\frac{DR_1}{X_2{}^2} = \frac{DR_2}{X_1{}^2} \qquad X_2{}^2 = \frac{DR_1}{DR_2} X^2 \qquad X^2 = \frac{2000}{5} \times 1^2 = 400\, ft^2 \qquad X = 20\, ft$$

B.10 d
REF: SOP II-G Step 1 - SOP II-I Step 1,a - SOP II-E Step g - SOP II-J

B.11 c
REF: T.S. 3.1.1

B.12 a
REF: SOP II-D Step 6

B.13 c
REF: Reactivity inserted ($1.6 (shim) + $0.4 (reg) = $2.0
SOP II-N, TS 6.5.2 require shutdown and NSC Director approval for restart.

B.14 c
REF: Emergency Classification Guide, pg. 2

B.15 b
REF: 10CFR55.53(f)(2))

Answer Key

B.16 d
REF: TS 3.2.2, Table 1

B.17 b
REF: Emergency Preparedness Plan Section 6.0

B.18 c
REF: Emergency Classification Guide

B.19 d
REF: SOP IX § B Step f

Answer Key

C.1 b
REF: SOP IV-E; SAR pg. 87

C.2 d
REF: SOP II-C, p. 2.

C.3 a
REF: SAR p. 89, and SOP IV F p.2

C.4 c
REF: SAR, p. 112.

C.5 c
REF: SAR, p. 79.

C.6 a
REF: SOP III-C

C.7 d
REF: SAR p.38, SOP II-E step 4

C.8 d
REF: SOP II-J; Step 4.c

C.9 c
REF: SAR, p. 14.

C.10 c
REF: SAR, Figure 7-3.

C.11 b
REF: SAR, page 76.

C.12 b
REF: SAR p.38

C.13 c
REF: SAR, pp. 26-29.

C.14 a. 1 b. 1 c. 3 d. 1
REF: SAR pp 91-93

C.15 b
REF: SOP III-R

C.16 b
REF: TS 3.3.2.

Answer Key

C.17 a
REF: SOP VII-A4.c.2

C.18 d
REF: SOP IX-E-1 p. 2

C.19 d
REF: SAR, p 18.