U. S. NUCLEAR REGULATORY COMMISSION REGION I
OPERATOR LICENSING EXAMINATION REPORT

REPORT NO:	50-157/90-03(OL)
FACILITY DOCKET NO:	50-157
FACILITY LICENSE NO:	R-80
LICENSEE:	Cornell University
FACILITY:	Cornell TRIGA Reactor
EXAMINATION DATES:	October 23 and 24, 1990
EXAMINERS:	David Silk, DRS, Region I (Chief Examiner) S. Guenther, HQ, OLB

SUBMITTED BY: David M Silk 11/19/90
David Silk, Senior Operations Engineer Date
PWR Section, Operations Branch
Division of Reactor Safety

APPROVED BY: for Larry E Briggs 11/19/90
Peter W. Eselgroth, Chief Date
PWR Section, Operations Branch
Division of Reactor Safety

SUMMARY:

Written and operating examinations were administered to two candidates. These candidates passed both portions of the examination and were issued licenses.

DETAILS

TYPE OF EXAMINATIONS: Replacement

EXAMINATION RESULTS:

Grading	RO Pass/Fail	SRO Pass/Fail	Total Pass/Fail
Written	1/0	1/0	2/0
Simulator	N/A	N/A	N/A
Operating	1/0	1/0	2/0
Overall	1/0	1/0	2/0

1. EXAMINER ON SITE:

   S. Guenther

2. OPERATING EXAMINATIONS:

   No generic deficiencies were noted during conduct of the operating tests.

3. WRITTEN EXAMINATIONS:

   The following is a summary of the generic deficiencies noted from the grading of the written examinations. (Note: A deficiency is considered to exist when all candidates lose points on the same question and/or the total number of points missed by the candidates on the same question is greater than 50% of the total possible points for that question). This information is being provided to aid the licensee in upgrading license and requalification training programs. No licensee response is required.

Question No.	Knowledge
B.3	Location of the primary evacuation assembly area
B.13	Authority for making temporary changes to operating procedures
C.13	Power level requiring diffuser operation

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C.13	Power level requiring diffuser operation

4. PERSONNEL PRESENT AT EXIT MEETING:

NRC Personnel:

S. Guenther

Cornell Personnel:

H. Aderhold
P. Craven

5. NRC COMMENTS AT EXIT MEETING:

It was evident during administration of the written examination and the operating tests that some of the reference material submitted to the NRC for exam preparation was out of date. The facility representatives were cautioned to ensure that the reference material provided for operator use in running the plant and to the NRC for exam preparation was current.

ATTACHMENTS:

1. Written Examination with Answer Key
2. Facility Comments on Written Examination
3. NRC Resolution of Facility Comments on Written Exam

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406

NOV 21 1990

Docket No. 50-157

Cornell University
ATTN: Dean W. B. Streett
College of Engineering
241 Carpenter Hall
Ithaca, New York 14853

Gentlemen:

SUBJECT: Examination Report No. 50-157/90-03

On October 23 and 24, 1990, the NRC administered initial examinations to one senior reactor operator (SRO) candidate and one reactor operator (RO) candidate who had applied for licenses to operate the Cornell TRIGA Reactor. This examination was conducted under Revision 6 to NUREG-1021, Examiner Standards. Under this revision, the SRO instant and the RO candidates were administered the same written examination while the operating examinations differentiated between the two types of licenses sought by the individuals. Both candidates passed all portions of the examination and were issued licenses.

At the conclusion of the examination, observations regarding the examination 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 enclosure will be placed in the NRC Public Document Room.

No reply to this letter is required. Should you have any question regarding this evaluation or the associated examinations, please contact the undersigned at 215/337-5291.

Sincerely,

Lee H. Bettenhausen, Chief,
Operations Branch
Division of Reactor Safety

Enclosure: Examination Report No. 50-157/90-03(OL)
w/Attachments 1, 2, and 3

cc w/encl.; w/o Attachments 1, 2, and 3:
Dr. D. D. Clark, Director, Ward Laboratory of
Nuclear Engineering
Dr. J. Crawford, Director of Environmental Health
Dr. William Vernetson, Director of Nuclear Facilities,
University of Florida
State of New York

cc w/encl. and Attachments 1, 2, and 3:
H. Aderhold, Reactor Supervisor, Ward Laboratory
Public Document Room (PDR)
Local Public Document Room (LPDR)
Nuclear Safety Information Center (NSIC)

bcc w/encl.; w/o Attachments 1, 2, and 3:
Region I Docket Room (with concurrences)
Management Assistant, DRMA (w/o encl.; w/o Attachments 1, 2, and 3)
Chief, OLB, DLPQE, NRR
Chief, Examination Development Section, OLB, NRR
F. Guenther, HQ, OLB
L. Bettenhausen, DRS
D. Haverkamp, DRP
DRP Section Chief
J. Johnson, DRP
W. Cook, SRI - Nine Mile Point
P. Eselgroth, DRS
D. Silk, DRS
OL Facility File
DRS Files (3)

bcc w/encl. and Attachments 1, 2, and 3:
Master Exam File

ATTACHMENT 1

Written Examination with Answer Key

MASTER

Nuclear Regulatory Commission
Operator Licensing
Examination

This document is removed from
Official Use Only category on
date of examination.

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

FACILITY: Cornell Univ.

REACTOR TYPE: TRIGA-II

DATE ADMINISTERED: 90/10/23

REGION: 1

CANDIDATE:

LICENSE APPLIED FOR:

INSTRUCTIONS TO CANDIDATE:

Answers are to be written on the exam page itself, or the answer sheet provided. Write answers one side ONLY. Attach any answer sheets to the examination. Points for each question are indicated in parentheses 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	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20.00	33.~~33~~ 9			A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS
~~20~~.00 19	~~33.33~~ 32.2			B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20.00	33.~~33~~ 9			C. PLANT AND RADIATION MONITORING SYSTEMS
~~60~~.00 59			%	TOTALS

FINAL GRADE

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 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. Use only the answer sheets provided. Credit will only be given for answers properly marked on these sheets. Follow the instructions for filling out the answer sheets.

7. Print your name in the upper right-hand corner of each answer sheet.

8. Partial credit will NOT be given on multiple choice questions.

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

10. When turning in your examination, assemble the completed examination with examination questions, examination aids and answer sheets. In addition, turn in all scrap paper.

11. To pass the examination, you must achieve at least 70% in each category.

12. There is a time limit of 3 hours for completion of the examination.

13. When you are done and have turned in your examination, leave the examination area as defined by the examiner. If you are found in this area while the examination is still in progress, your license may be denied or revoked.

EQUATION SHEET

$f = ma$

$w = mg$

$E = mC^2$

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$W = v\Delta P$

$\Delta E = 931\Delta m$

$\dot{Q} = \dot{m}C_p\Delta T$

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

$Pwr = W_f \dot{m}$

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

$P = P_o\ e^{t/T}$

$SUR = 26.06/T$

$T = 1.44\ DT$

$SUR = 26\left(\frac{\lambda_{eff}\rho}{\bar{\beta} - \rho}\right)$

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

$T = \ell^*/(\rho - \bar{\beta})$

$T = (\bar{\beta} - \rho)/\lambda_{eff}\rho$

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

$\rho = [\ell^*/TK_{eff}] + [\bar{\beta}/(1 + \lambda_{eff}T)]$

$P = I\phi V/(3 \times 10^{10})$

$\Sigma = N\sigma$

$v = s/t$

$s = v_o t + \frac{1}{2}at^2$

$a = (v_f - v_o)/t$

$v_f = v_o + at$

$\omega = \theta/t$

Cycle efficiency = $\frac{\text{Net Work (out)}}{\text{Energy (in)}}$

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

$\lambda = \ln 2/t_{\frac{1}{2}} = 0.693/t_{\frac{1}{2}}$

$t_{\frac{1}{2}}(eff) = \frac{(t_{\frac{1}{2}})(t_b)}{(t_{\frac{1}{2}} + t_b)}$

$I = I_o e^{-Ix}$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = 0.693/\mu$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = (1 - K_{eff})_0/(1 - K_{eff})_1$

$SDM = (1 - K_{eff})/K_{eff}$

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

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

$I_1 d_1 = I_2 d_2$

$I_1 d_1^2 = I_2 d_2^2$

$R/hr = (0.5\ CE)/d^2$ (meters)

$R/hr = 6hCE/d^2$ (feet)

WATER PARAMETERS

1 gal. = 8.345 lbm

1 gal. = 3.78 liters

1 ft^3 = 7.48 gal.

Density = 62.4 lbm/ft^3

Density = 1 gm/cm^3

Heat of vaporization = 970 Btu/lbm

Heat of fusion = 144 Btu/lbm

1 Atm = 14.7 psi = 29.9 in. Hg

1 ft. H_2O = 0.4335 lbf/in^2

MISCELLANEOUS CONVERSIONS

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

1 inch = 2.54 cm

$^oF = 9/5\,^oC + 32$

$^oC = 5/9\ (^oF - 32)$

QUESTION: 001 (1.00)

Which one of the following terms is described as the total number of fast neutrons compared to the number in the original group?

a. resonance escape probability

b. fast fission factor

c. fast non-leakage probability

d. reproduction factor

QUESTION: 002 (1.00)

Which one of the following factors is most easily varied by the reactor operator?

a. reproduction factor

b. fast fission factor

c. fast non-leakage probability

d. thermal utilization factor

QUESTION: 003 (1.00)

Which one of the following is the correct reason that delayed neutrons enhance control of the reactor?

a. More delayed neutrons are produced than prompt 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.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 004 (1.00)

Which one of the following conditions describes a reactor that is exactly critical?

a. Keff = 1; delta-K/K = 0

b. Keff = 1; delta-K/K = 1

c. Keff = 0; delta-K/K = 0

d. Keff = 0; delta-K/K = 1

QUESTION: 005 (1.00)

With Keff = 0.987, how much reactivity must be added to make the reactor critical?

a. 1.30% delta-K/K

b. 1.32% delta-K/K

c. 1.34% delta-K/K

d. 1.36% delta-K/K

QUESTION: 006 (1.00)

A subcritical reactor has an initial source range count rate of 150 cps with a shutdown reactivity of -2.0% delta-K/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

a. 0.5% delta-K/K

b. 1.0% delta-K/K

c. 1.5% delta-K/K

d. 2.0% delta-K/K

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 007 (1.00)

While withdrawing control rods during an approach to criticality, the count rate doubles. What will occur if the same amount of reactivity that caused the first doubling is added again?

a. count rate will increase slightly

b. count rate will double

c. the reactor will remain subcritical

d. the reactor will be critical or slightly supercritical

QUESTION: 008 (1.00)

Two identical reactors are operating at power. Reactor "A" is at 1 MW and reactor "B" is at 100 KW. If both reactors scram at the same time, xenon-135 will peak first in reactor _____ and the highest xenon-135 reactivity peak will occur in reactor _____.

a. "A"; "A"

b. "A"; "B"

c. "B"; "A"

d. "B"; "B"

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 009 (1.00)

Which one of the following statements correctly states how neutron flux is affected by the addition of a reflector around a reactor core?

a. With a reflector in place thermal flux is higher at the edge of the core.

b. With a reflector in place thermal flux is lower at the edge of the core.

c. With a reflector in place fast flux is higher at the edge of the core.

d. With a reflector in place fast flux is lower at the edge of the core.

QUESTION: 010 (1.00)

With the reactor at a power of 10 watts and a period of 20 seconds, how long will it take for power to reach 1 KW?

a. 41 seconds

b. 59 seconds

c. 92 seconds

d. 111 seconds

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 011 (1.00)

Which one of the following statements correctly describes a characteristic of a good moderator?

a. It slows down fast neutrons to thermal energy levels via a large number of collisions.

b. It slows down fast neutrons to thermal energy levels via a small number of collisions.

c. It slows down prompt neutrons to thermal energy levels via a small number of collisions.

d. It slows down prompt neutrons to thermal energy levels via a large number of collisions.

QUESTION: 012 (1.00)

The reactor is at a power of 0.1 watt and 25 cents of reactivity is added. What is the resulting stable reactor period? (Assume lamda-eff = 0.08 and Beff = 0.007)

a. 48 seconds

b. 36 seconds

c. 28 seconds

d. 22 seconds

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 013 (1.00)

The reactor is subcritical with a Keff of 0.96 and 30 cps indicated. After a fuel element is removed the count rate drops to 10 cps. No other changes have occurred. What is the Keff of the core with the fuel element removed?

a. 0.9733

b. 0.8800

c. 0.8400

d. 0.6666

QUESTION: 014 (1.00)

Which one of the following materials does the Cornell Triga use as its reflector?

a. water

b. zirconium

c. graphite

d. aluminum

QUESTION: 015 (1.00)

Which one of the following is a reason for using Graphite Dummy Elements in the TRIGA core?

a. to provide additional shielding

b. to absorb neutrons that would otherwise leak from the core

c. to reduce the fuel element requirements

d. to reduce the thermal flux at the core boundary

(****** CATEGORY A CONTINUED ON NEXT PAGE ******)

QUESTION: 016 (1.00)

Which one of the following statements describes a reactor's excess reactivity?

a. The amount of reactivity needed to achieve criticality.

b. The amount of reactivity required to shut the reactor down.

c. The amount of reactivity available above that which is required to keep the reactor subcritical.

d. The amount of reactivity available above that which is required to keep the reactor critical.

QUESTION: 017 (1.00)

Which one of the following is the reason that an installed neutron sources is required to conduct a reactor startup?

a. to provide overlap between neutron detector channels

b. to allow calibration of compensated ion chambers at low power

c. to permit controlled startups using accurate indication

d. to reduce uncertainty in the period meter after a long shutdown

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 018 (1.00)

Which one of the following statements correctly describes the effect of a fuel temperature increase on a fuel-moderator element?

a. The probability that a thermal neutron will lose energy in a collision with an excited state Hydrogen atom increases.

b. The probability that a neutron will escape from the element before being captured significantly increases.

c. The thermal neutron spectrum in the fuel element shifts to a lower average energy.

d. The mean free path for neutrons in the element is decreased appreciably.

QUESTION: 019 (1.00)

Which one of the following is the reason that power decreases on the same stable negative period following a reactor scram regardless of the initial power level?

a. The rate of power change is dependent on the mean lifetime of the longest lived delayed neutron precursor.

b. The rate of power change is dependent on the constant decay rate of prompt neutrons.

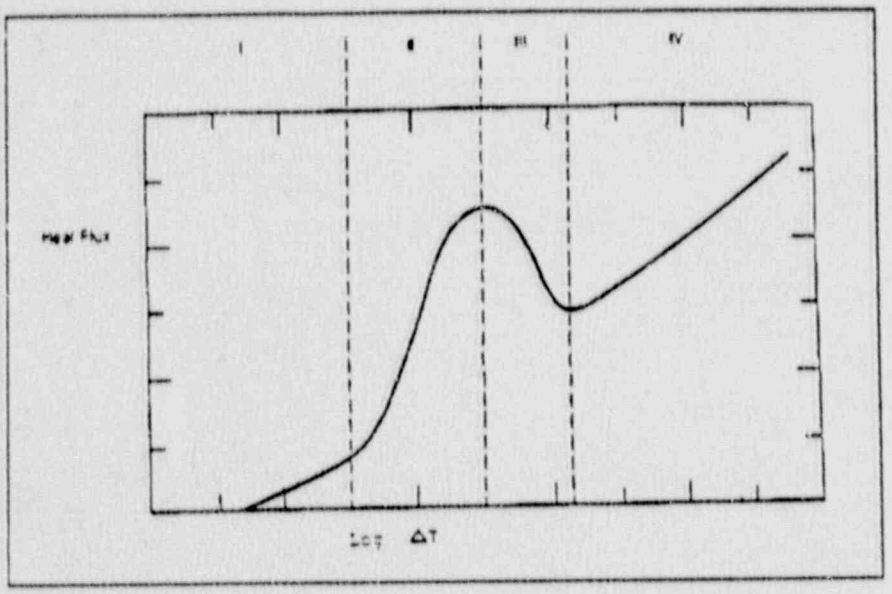
c. The rate of power change is dependent on the mean lifetime of the shortest lived delayed neutron precursor.

d. The rate of power change is dependent on the constant decay rate of prompt gamma emitters.

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

QUESTION: 020 (1.00)

Using the heat flux curve pictured below, select the region of the curve where the TRIGA reactor core cooling normally occurs.



a. region I

b. region II

c. region III

d. region IV

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

QUESTION: 001 (1.00)

An accessible area with a radiation level of 75 mrem/hr should be posted as a(n)_____.

a. restricted area

b. radiation area

c. high radiation area

d. radiologically controlled area

QUESTION: 002 (1.00)

While operating at a steady state power level of 300KW, the Log N power channel indication fails low. Which one of the following statements describes the actions that the reactor operator should take according to Cornell's Operating Procedures?

a. No action is required, since this channel does not provide a scram input.

b. Maintain power level and notify the RP on duty or the Reactor Supervisor.

c. Start reducing power to below 1 KW and notify the RP on duty or the Reactor supervisor.

d. Shutdown immediately and notify the RP on duty or the Reactor Supervisor.

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 003 (1.00)

Which one of the following is the primary assembly area in the event of an emergency requiring evacuation?

a. Upson Hall first floor lounge

b. Sidewalk in front of Ward Laboratory

c. Ward Laboratory lobby

d. Radiation Safety Office

QUESTION: 004 (1.00)

The Reactor Startup Checklist is required to be performed in which one of the following cases? (assume an 8:00 am - 4:00pm operating schedule)

a. prior to all reactor start ups

b. prior to each day's reactor operations

c. only prior to the start up of a.. eration expected to last more than 12 hours

d. only prior to the start up followi: g a shutdown of greater than 6 hours

QUESTION: 005 (1.00)

Water leakage is detected coming from the TRIGA pool. This is an example of which class of emergency according to the Ward Laboratory Emergency Plan?

a. Personnel Emergency

b. Emergency Alert

c. Reactor Emergency

d. Facility Emergency

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 006 (1.00)

Which one of the following rod withdrawal sequences is correct for a routine reactor start-up?

1 = regulating rod; 2 = safety rod; 3 = shim rod; 4 = transient rod

a. 2 - 4 - 3 - 1

b. 2 - 4 - 1 - 3

c. 4 - 2 - 3 - 1

d. 4 - 2 - 1 - 3

QUESTION: 007 (1.00)

According to the Routine Reactor Start-Up Procedure, once a response is observed on the LOG N Period Channel the operator can establish a period not shorter than _____ seconds to raise reactor power to the desired level.

a. 10

b. 15

c. 20

d. 25

QUESTION: 008 (1.00)

According to the Standard Operating Procedures which one of the following is the steady state power level from which the reactor should be pulsed?

a. 10 W

b. 100 W

c. 1 KW

d. 10 KW

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 009 (1.00)

Which one of the following is the reason that pool water temperature is limited to 130 degrees F?

a. To prevent thermally shocking the ion exchanger housing.

b. To reduce the amount of Ar-41 gas released to the Reactor Bay.

c. To prevent a breakdown of the ion exchanger resin.

d. To minimize corrosion of the fuel cladding.

QUESTION: 010 (1.00)

How long can you work in an area with a general background radiation level of 250 mr/hr before you would exceed the minimum 10 CFR 20 whole body quarterly limit?

a. 3.0 hours

b. 5.0 hours

c. 7.5 hours

d. 10.0 hours

QUESTION: 011 (1.00)

A point source of gamma radiation measures 50 mr/hr at a distance of 2 feet. Assuming 100% detector efficiency for gamma, what will the exposure rate be at a distance of 16 feet from the source?

a. 0.625 mr/hr

b. 0.78 mr/hr

c. 6.25 mr/hr

d. 7.8 mr/hr

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 012 (1.00)

How are the power level detectors on the Cornell TRIGA reactor calibrated?

a. By irradiating a gold foil, counting it to determine true power level and adjusting the detector positions to give proper indication.

b. By performing a heat balance on the pool at power to determine true power level and adjusting the detector positions to give proper indication.

c. By using a calibrated ion chamber to read reactor power and adjusting the gain of the other detectors to read the same power level.

d. By measuring the neutron flux in the beam port at power and adjusting the gain on the detectors to give proper indication.

QUESTION: 013 (1.00)

According to Technical Specifications, which one of the following individuals is authorized to make temporary changes to operating procedures?

a. RP on duty after conferring with the Reactor Supervisor

b. RP on duty after conferring with the Chief RP for the area covered by the procedure in question.

c. Chief RP for the area covered by the procedure

d. Reactor Supervisor

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 014 (1.00)

Question Deleted

Aside from a licensed RO at the console, which one of the following describes the additional personnel required to meet the minimum manning requirements when the Cornell TRIGA is being operated for "routine" operations?

a. A Senior Operator (Responsible Person) on duty and a second currently or previously licensed or certified operator both present in the laboratory building.

b. A Senior Operator (Responsible Person) on duty readily available on call and a second currently or previously licensed or certified operator present in the laboratory building.

c. A Senior Operator (Responsible Person) present in the laboratory building.

d. A Senior Operator (Responsible Person) readily available on call.

QUESTION: 015 (1.00)

The Technical Specification minimum pool level for operating the Cornell TRIGA reactor is _____ feet above the top of the core.

a. 14.5

b. 16.5

c. 18.5

d. 20.5

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 016 (1.00)

Which one of the following actual or threatened radiation doses defines an emergency according to the Ward Laboratory Emergency Plan?

a. > 0.1 rem whole body or > 0.5 rem thyroid to any person within the Ward Laboratory.

b. > 1 rem whole body or > 5 rem thyroid to any person within the Ward Laboratory.

c. > 5 mrem whole body or > 50 mrem thyroid to any person outside the Ward Laboratory.

d. > 20 mrem whole body or > 100 mrem thyroid to any person outside the Ward Laboratory.

QUESTION: 017 (1.00)

According to the Cornell TRIGA's Technical Specifications, the reactivity worth of any individual experiment shall not exceed _____, and the total absolute reactivity worth of all experiments in the reactor shall be less than _____.

a. $1.00; $2.00

b. $1.00; $3.00

c. $2.00; $3.00

d. $3.00; $4.00

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

QUESTION: 018 (1.00)

Which one of the following actions should the operator take immedidately after the nvt has read out on the linear-recorder (approximately seven seconds after the pulse) during pulse-mode operation?

a. return the mode-switch to the manual position

b. record pulse information in the log book

c. remove the pulse-mode operating key

d. scram the reactor

QUESTION: 019 (1.00)

Which one of the following surveillances is required to be performed semiannually, at intervals not to exceed 8 months?

a. control rod drop times

b. inspection, cleaning, and lubrication of the transient rod drive cylinder

c. visual inspection of control rods for corrosion and mechanical damage

d. channel calibration of the reactor power level measuring channel by the calorimetric method

QUESTION: 020 (1.00)

Which one of the following is the Technical Specification basis for the maximum steady state power level from which the reactor can be pulsed?

a. to prevent fuel cladding embrittlement

b. to prevent exceeding the pool temperature operating limit

c. to avoid a phase change in the fuel

d. to prevent exceeding the fuel temperature safety limit

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

QUESTION: 001 (1.00)

Which one of the following statements describes the automatic function provided by the pressure switch installed in the reactor pool water cooling system?

a. The chill water pump is secured if chill water pressure falls below 100 psi.

b. The chill water pump is secured if pool water pressure falls below 50 psi.

c. The pool water pump is secured if chill water pressure falls below 50 psi.

d. The pool water pump is secured if pool water pressure falls below 32 psi.

QUESTION: 002 (1.00)

The pool water cooling system temperature controller controls pool water temperature automatically by adjusting which one of the following components?

a. a modulating control valve in the chill water return line

b. a modulating control valve on the pool water pump discharge line

c. the speed of the chill water pump

d. the speed of the pool water pump

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 003 (1.00)

Which one of the following statements best describes the purpose of the diffuser on the Cornell TRIGA?

a. it enhances the natural circulation flow in the pool

b. it creates turbulence in the pool to dissolve N-16 before it rises to the pool surface

c. it provides additional decay time for N-16 before it rises to the pool surface

d. it deaerates the pool water to reduce the formation of Ar-41

QUESTION: 004 (1.00)

Which one of the folowing materials is used as the neutron absorber in the safety, shim, and regulating rods?

a. aluminum oxide

b. graphite powder

c. boron carbide

d. zirconium hydride

QUESTION: 005 (1.00)

While operating the Cornell TRIGA reactor at 50 KW the operator accidentally pushes and immediately releases the MAGNET pushbutton for the REG rod. Which one of the following is the correct response of the reactor control system?

a. all rods scram

b. only the REG rod scrams

c. the REG rod drives inward

d. the "on" light momentarily goes out but the REG rod will not move

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 006 (1.00)

While the Cornell TRIGA reactor is operating in the automatic mode, the actual power input used by the servo system to adjust power to the demanded level is provided by _____.

a. the Log n and Period Channel

b. Power-level Channel No. 1

c. Power-level Channel No. 2

d. the highest reading channel

QUESTION: 007 (1.00)

Loss of the gamma compensating signal to a compensated ion chamber will result in which one of the following?

a. a sudden increase in indicated power at low power

b. a sudden decrease in indicated power at low power

c. a sudden increase in indicated power at high power

d. a sudden decrease in indicated power at high power

QUESTION: 008 (1.00)

Which one of the following power channels provides accurate power information from source level to full power?

a. count rate channel

b. log n channel

c. power channel No. 1

d. power channel No. 2

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 009 (1.00)

Which one of the following describes how gamma compensation is accomplished in power channel No. 2?

a. A pulse height discriminator is used to eliminate the gamma signal.

b. A Campbelling circuit is used to eliminate the gamma signal.

c. A compensated ion chamber is used to eliminate the gamma signal.

d. Compensation is not required at the power levels monitored by this channel.

QUESTION: 010 (1.00)

In the pulse mode all neutron channels are eliminated except which one of the following?

a. count rate channel

b. log n and period channel

c. power channel No. 1

d. power channel No. 2

QUESTION: 011 (1.00)

Which one of the following devices is used to reduce the bottoming impact of a control rod after a reactor scram?

a. a water dashpot device

b. an air dashpot device

c. a mechanical shock absorber

d. the rod compression spring

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 012 (1.00)

Which one of the following conditions will cause an automatic scram of the Cornell Triga reactor during steady state operation?

a. Log n channel reading 110%

b. reactor period of 5 seconds

c. fission chamber power supply failure

d. fuel temperature reading 400 degrees C

QUESTION: 013 (1.00)

The reactor has just reached criticality and the operator is raising power to 500 kW. According to Operating Procedures, at which one of the following power levels should pool water flow be diverted to the diffuser?

a. 50 kW

b. 100 kW

c. 200 kW

d. 250 kW

QUESTION: 014 (1.00)

Operation of the diffuser will reduce the radiation levels above the TRIGA pool by which one of the following factors?

a. 0.1

b. 0.25

c. 0.33

d. 0.5

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 015 (1.00)

How does the rod control system adjust power in the automatic mode of operation?

a. By movements of the regulating, shim, and safety control rods.

b. By movements of the regulating and safety control rods.

c. By movements of the regulating and shim control rods.

d. By movement of the regulating control rod only.

QUESTION: 016 (1.00)

At a steady state power level of 100 kW, how much radiation would you expect to measure one foot above the surface of the pool?

a. 0.5 mr/hr

b. 1.5 mr/hr

c. 3.0 mr/hr

d. 6.0 mr/hr

QUESTION: 017 (1.00)

The in-pile terminus of the pneumatic transfer system is located in which one of the following fuel-element positions?

a. the inner ring

b. the outer ring

c. the C-ring

d. the D-ring

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

QUESTION: 018 (1.00)

Which one of the following detector types is used by the area radiation monitors in the reactor bay?

a. Geiger counter

b. scintillation detector

c. proportional counter

d. ionization chamber

QUESTION: 019 (1.00)

Which one of the following is the approximate worth of the shim rod?

a. $1.00

b. $1.50

c. $2.25

d. $3.00

QUESTION: 020 (1.00)

Which one of the following statements correctly describes the automatic actions that will occur if the exhaust stack monitor reaches 900 cpm?

a. an alarm will sound in the control room

b. an alarm will sound and the reactor bay ventilation fans will be secured

c. an alarm will sound, the reactor bay ventilation fans will secure, and the reactor bay isolation valves will shut

d. the reactor will scram, an alarm will sound, the reactor bay ventilation fans will secure and the reactor bay isolation valves will shut

(***** END OF CATEGORY C *****)
(********** END OF EXAMINATION **********)

ANSWER: 001 (1.00)

b

REFERENCE:

GA Reactor Training Manual (p. VI-3)

ANSWER: 002 (1.00)

d

REFERENCE:

GA Reactor Training Manual (p.VI-8,9)

ANSWER: 003 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-10)

ANSWER: 004 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9)

ANSWER: 005 (1.00)

b

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9)

ANSWER: 006 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-16)

ANSWER: 007 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9,16)

ANSWER: 008 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (p.VI-27)

ANSWER: 009 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (p. VI-7)

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

ANSWER: 010 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (p. VI-15)

ANSWER: 011 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p.VI-6)

ANSWER: 012 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-15)

ANSWER: 013 (1.00)

b

REFERENCE:

GA Reactor Operator Training Manual (p. VI-16)

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

ANSWER: 014 (1.00)

c

REFERENCE:

CURL-2 (p.1-4)

ANSWER: 015 (1.00)

c

REFERENCE:

GA Reactor Operator Training Manual (VI-18)

ANSWER: 016 (1.00)

d

REFERENCE:

GA Reactor Operator Training Manual (p. VI-9, VI-18)

ANSWER: 017 (1.00)

c

REFERENCE:

CU Question Bank D.003
GA Reactor Operator Training Manual (VI-16)

ANSWER: 018 (1.00)

b

(***** CATEGORY A CONTINUED ON NEXT PAGE *****)

REFERENCE:

GA Reactor Operator Training Manual (p. VI-19)

ANSWER: 019 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (p. VI-15)

ANSWER: 020 (1.00)

a

REFERENCE:

CURL-2 (p.1-6)
GA Reactor Operator Training Manual (VI-29, VI-31)

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

ANSWER: 001 (1.00)

b

REFERENCE:

10 CFR 20.202

ANSWER: 002 (1.00)

d

REFERENCE:

CU TRIGA Operations (p.6)

ANSWER: 003 (1.00)

c

REFERENCE:

CU Emergency Response 7.4.1 (p.15)

ANSWER: 004 (1.00)

b

REFERENCE:

CU TRIGA Operations (p.5)

ANSWER: 005 (1.00)

c

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

REFERENCE:

Ward Laboratory Emergency Plan (p.9)

ANSWER: 006 (1.00)

d

REFERENCE:

CU TRIGA Operations (p.6)

ANSWER: 007 (1.00)

c

REFERENCE:

CU TRIGA Operations (p.6)

ANSWER: 008 (1.00)

a

REFERENCE:

CU TRIGA Pulsed-Mode Operations (p.3)

ANSWER: 009 (1.00)

c

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

REFERENCE:

CU Technical Specifications (p.12)
CU Question Bank B.002

ANSWER: 010 (1.00)

b

REFERENCE:

10 CFR 20.101

ANSWER: 011 (1.00)

b

REFERENCE:

CU Question Bank B.022

ANSWER: 012 (1.00)

b

REFERENCE:

CU TRIGA Power Calibration Procedure

ANSWER: 013 (1.00)

a

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

REFERENCE:

CU Technical Sp{ecifications (p.23)

ANSWER: 014 (1.00) Deleted

a

REFERENCE:

CU TRIGA Operations (p. 2)

ANSWER: 015 (1.00)

c

REFERENCE:

CU Technical Specifications (p.12)

ANSWER: 016 (1.00)

b

REFERENCE:

Ward Laboratory Emergency Plan (p. 12)

ANSWER: 017 (1.00)

c

REFERENCE:

Cornell TRIGA Technical Specifications (p.10)

(***** CATEGORY B CONTINUED ON NEXT PAGE *****)

ANSWER: 018 (1.00)

d

REFERENCE:

CU TRIGA Pulse-Mode Operations (p.4)
CU Question Bank B.050

ANSWER: 019 (1.00)

b

REFERENCE:

CU TRIGA Technical Specifications 4.0
CU Question bank D.031

ANSWER: 020 (1.00)

d

REFERENCE:

CU Technical Specifications (p.7)
CU Question Bank D.009

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

ANSWER: 001 (1.00)

c

REFERENCE:

CURL-2 Supplement 1 (p.5-3)

ANSWER: 002 (1.00)

a

REFERENCE:

CU Reactor Pool Water Cooling System Operating Procedures (figure 1)

ANSWER: 003 (1.00)

c

REFERENCE:

CU Question Bank C.003

ANSWER: 004 (1.00)

c

REFERENCE:

CURL-2 (p. 5-5)

ANSWER: 005 (1.00)

b

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

REFERENCE:

CURL-2 (p. 5-4)

ANSWER: 006 (1.00)

b

REFERENCE:

Curl-2 (p.5-3)

ANSWER: 007 (1.00)

a

REFERENCE:

GA Reactor Operator Training Manual (II-53)
CU Question Bank D.008

ANSWER: 008 (1.00)

c

REFERENCE:

CURL-2 (p.5-2)

ANSWER: 009 (1.00)

d

REFERENCE:

CURL-2 (p.5-2, fig. 5-3)

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

ANSWER: 010 (1.00)

d

REFERENCE:

CURL-2 (p.5-8)

ANSWER: 011 (1.00)

a

REFERENCE:

CURL-2 (p. 5-6)

ANSWER: 012 (1.00)

b

REFERENCE:

CURL-2 (p. 5-4)

ANSWER: 013 (1.00)

b

REFERENCE:

CU Reactor Pool Water Cooling System Operating Procedure (p.2)

ANSWER: 014 (1.00)

d

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

REFERENCE:

CURL-2 (Supplement 1) (p.7-3)
CU Question Bank B.017

ANSWER: 015 (1.00)

a

REFERENCE:

CURL-2 (p. 5-3)

ANSWER: 016 (1.00)

d

REFERENCE:

CURL-2 Supplement 1 (p. 7-3)
CU Question Bank B.016

ANSWER: 017 (1.00)

b

REFERENCE:

CURL-2 (p. 1-2)

ANSWER: 018 (1.00)

d

(***** CATEGORY C CONTINUED ON NEXT PAGE *****)

REFERENCE:

CURL-2 Supplement 1 (p. 5-2)
CU Question Bank C.005

ANSWER: 019 (1.00)

c

REFERENCE:

CURL-2 (p. 1-6)

ANSWER: 020 (1.00)

c

REFERENCE:

CU Question bank C.006

(***** END OF CATEGORY C *****)
(********** END OF EXAMINATION **********)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your selection in the blank.

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 *****)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your selection in the blank.

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~~	_____ deleted
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 B *****)

ANSWER SHEET

Multiple Choice (Circle or X your choice)

If you change your answer, write your selection in the blank.

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

A N S W E R K E Y

001	b
002	d
003	b
004	a
005	b
006	b
007	d
008	c
009	a
010	c
011	b
012	b
013	b
014	c
015	c
016	d
017	c
018	b
019	a
020	a

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

ANSWER KEY

001	b
002	d
003	c
004	b
005	c
006	d
007	c
008	a
009	c
010	b
011	b
012	b
013	a
~~014~~	~~a~~ Deleted
015	c
016	b
017	c
018	d
019	b
020	d

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

ANSWER KEY

001	c
002	a
003	c
004	c
005	b
006	b
007	a
008	c
009	d
010	d
011	a
012	b
013	b
014	d
015	d
016	d
017	b
018	d
019	c
020	c

(***** END OF CATEGORY C *****)
(********** END OF EXAMINATION **********)

ATTACHMENT 2

Facility Comments on Written Examination

NUCLEAR SCIENCE & ENGINEERING
Cornell University
Ward Laboratory
Ithaca, NY 14853-7701
607/255-3480

October 30, 1990

U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

ATTN: David Silk
SUBJECT: Reactor Operator License Examiniation

Gentlemen:

The purpose of this letter is to provide comments and recommendations regarding the written examinations for John Mercier and Steven Ripley administered on October 23, 1990.

First, we wish to express our appreciation for the administration of the exams in a time frame suitable to our operationing schedule.

Following a review of the written exam questions and answer key by our operating staff, we have the following comment and recommendation on one of the questions:

a. NRC question, answer and reference:

B. Normal/Emer Procedures & Rad Con Page 18

Question: 014 (1.00)

Aside from a licensed RO at the console, which one of the following describes the additional personnel required to meet the minimum manning requirements when the Cornell TRIGA is being operated for "routine" operations?

a. A Senior Operator (Responsible Person) on duty and a second currently or previously licensed or certified operator both present in the laboratory building.

b. A Senior Operator (Responsible Person) on duty readily available on call and a second currently or previously licensed or certified operator present in the laboratory building.

c. A Senior Operator (Responsible Person) present in the laboratory building.

d. A Senior Operator (Responsible Person) readily available on call.

Answer: 014 (1.00)

a

Reference:

CU TRIGA Operations (p.2)

b. Facility comment/recommendation:

In reviewing the above question, answer and reference material, we find that the question is ambiguous. Our interpretation of Section B.2 of "TRIGA Operations" permits a minimum of 2 persons present in the laboratory building during routine TRIGA operations, the RO at the console and an SRO (Responsible Person) present in the building.

Because the question is ambiguous our recommendation is to disqualify the question.

c. Reference (to support facility comment):

CU TRIGA Operations (p. 2)

Thank you for your consideration in this matter. If you have any questions regarding this letter, please contact me at (607)255-3480.

Sincerely,

Howard C. Aderhold
Reactor Supervisor

cc: Fred Guenther, Chief Examiner
Dean K. B. Cady, College of Engineering

ATTACHMENT 3

NRC Resolution of Facility Comments on Written Exam

NRC Resolution of Facility Comments on Written Exam

Section A - Reactor Theory, Thermodynamics and Facility Operating Characteristics

No comments.

Section B - Normal and Emergency Operating Procedures and Radiological Controls

Question 14

NRC Resolution: Comment accepted. A review of the discussion of "Personnel Requirements and Responsibilities" on page 2 of the TRIGA Operations instruction supports the facility licensee's assertion that the question is ambiguous. The requirement, specified on page 8 of the instruction, that the identity of the Senior Operator on Duty, the Operator and the "Second Person" be entered in the reactor Logbook serves to further confuse the question. This question was deleted from the examination.

Section C - Plant and Radiation Monitoring Systems

No comments.