July 14, 2000

Dr. B. Don Russell, Deputy Director
Texas Engineering Experiment Station
Texas A&M University System
Nuclear Science Center Bldg. 1095
College Station, Texas 77843-3575

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-128/OL-00-01

Dear Dr. Russell:

During the week of June 12, 2000, the NRC administered an initial examination to an employee of your facility who had applied for a license to operate your Texas A&M University TRIGA 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 be placed in the NRC Public Document Room.

Should you have any questions concerning this examination, please contact Paul Doyle via phone at (301)415-1058 or via E-mail at pvd@nrc.gov.

Sincerely,

/RA/

Ledyard B. Marsh, Chief
Events Assessment, Generic Communications
and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-128

Enclosures:
1. Initial Examination Report No. 50-128/OL-00-01
2. Facility comments with NRC resolution
3. Examination and answer key (RO/SRO)

cc w/encls:
Please see next page

cc:

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

Governor's Budget and Planning Office
P. O. Box 13561
Austin, TX 78711

Bureau of Radiation Control
State of Texas
1100 West 49th Street
Austin, TX 78756

Dr. Warren D. Reece, Director
Nuclear Science Station Center
Texas Engineering Experiment Station
Texas A&M University System
F. E. Box 89, M/S 3575
College Station, TX 77843

Facility Name: [illegible] Docket No. 50-128

[illegible]

REXB 3.2 Facility [illegible] Report

SHolmes

July 14, 2000

Office [illegible] Programs

DMatthews

TMichaels

ADAMS ACCESSION #: ML003729240

TEMPLATE #:NRR-074

OFFICE	REXB:CE	E	IOLB:LA	E	REXB:BC/DBC	
NAME	PDoyle:rdr		EBarnhill		LMarsh/JTappert	
DATE	07/ 03 /2000		07/ 07 /2000		07/ 13 /2000	

C = COVER

E = COVER & ENCLOSURE

OFFICIAL RECORD COPY

N = NO COPY

[illegible]

Mr [illegible] Operations Center (NSC)

1/0	1/0	1/0	RO PASS/FAIL
0/0	0/0	0/0	SRO PASS/FAIL
1/0	1/0	1/0	TOTAL PASS/FAIL

REPORT DETAILS

OPERATOR LICEN

Paul V. Doyle Jr., Chief Examiner

U. S. NUCLEAR

Paul Doyle, Chief Examiner

Texas A[illegible]

[illegible]/RA/

07/05/2

Date

FACILITY COMMENTS AND NRC RESOLUTION

ENCLOSURE 2

TEXAS ENGINEERING EXPERIMENT STATION

TEXAS A&M UNIVERSITY

COLLEGE STATION, TEXAS 77843-3575

NUCLEAR SCIENCE CENTER
409/845-7551

June 19, 2000 2000-0206

U.S. Nuclear Regulatory Commission
ATTN: Mr. Paul Doyle, Jr. REXB
Mail Stop 012-D3
Washington, D.C. 20555-0001

Dear Mr. Doyle,

After a thorough review of the operator licensing examination that was administered at the facility on June 13, 2000, I do not have any comments other than those discussed at the exit interview. It was a comprehensive and well-written examination.
Should you have any questions, please contact me at (979) 845-7551.

Sincerely,

Bill F. Asher
Manager of Operations

BFA/rmw

xc: 211/Central File
Dr. W. D. Reece
Dr. C. H. Kim

All comments accepted. Appropriate c

NRC RESOLUTION TO COMMENTS

TEXAS A&M UNIVERSITY

With Answer Key

UNITED STATES NUCLEAR REGULATORY COMMISSION

OPERATOR LICENSING
EXAMINATION
June 12, 2000

ENCLOSURE 3

d. c. b. a. What is the Six Factor formula?

Fast Fission Factor (ε) Resonance Escape Probability (p) Thermal Utilization Factor (f) Reproduction Factor (η)

[1.0 point] [1.0 point] [1.0 point]

4. 3. 2. 1. Column B

A neutron A neutron A neutron A neutron

Neutron Capture Radioactive Decay Radioactive Decay Radioactive Decay

d. c. b. a. Which of the following atoms [illegible]

Hydrogen Carbon Uranium 238 Reproduction [illegible]

Kr Se Br As 83

[1.0 point] [1.0 point] [1.0 point]

d. c. b. a. The term "pomp A.12hp" refers to [illegible]

a negative [illegible] in

1.05 1.005 0.9995 0.995

[1.0 point] [1.0 point] [1.0 point]

d. c. b. a. [illegible]

[illegible] N_f 0.1 cm^{-1} The fission reaction [illegible] 2.5×10^{12} neutrons/cm^2/sec. and the mac[illegible]

To prev[illegible]

[1.0 point] [1.0 point] [1.0 point]

d. c. b. a. Stand [illegible] in a [illegible]

the [illegible]

[1.0 point] [1.0 point]

FWHM: [illegible]

Temp.T

d. c. b. a. listed [illegible] ding from [illegible]

550 [illegible] correct [illegible]

[illegible] a channel

or a

[2.0 points, 0.5 each] [2.0 points, 0.5 each]

4. 3. 2. 1.

Very High [illegible] Area

d. c. b. a. the [illegible]

100 mrem 75 mrem 50 mrem 25 mR/hr

The [illegible]

[1.0 point] [1.0 point] [1.0 point] 10CFR50.54(y) states that

TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)

(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

d. c. b. a. Technical Specification B.10 6.22 is the Technical Specification B.10 5.5 requires

25 pounds 5 grams 25 milligrams 0.95 0.90 0.85 0.80

MAXIMUM

amount of explosive materials allowed in the building per

[1.0 point]

[1.0 point]

[1.0 point]

d. c. b. a. distance [illegible]

10 feet 20 feet 40 feet 400 feet

General Notification [illegible]

[1.0 point] [1.0 point] [1.0 point]

Reactor Startup

requires

d. c. b. a. 10% QUESTION 17 [illegible]

A [illegible]

[1.0 point]

c. b. a. Matching Detector Type in column 3 b. The gas filled proportional counter can be "cabin" a. Matching Detector Type

Safety Linear Power Reversing Chamber Channel Air H BP 8 BP 7 BP 6 BP 5 BP 4 BP 3 BP 2 BP 1

5. 4. 3. 2. 1.

[2.0 points, each] [1.0 point] Removal Detector Radiation Type

4. 1. 3. 2.

Uncompensated Ion Chamber Fission Compensated Ion Chamber

d. c. b. a. 90% QUESTION C. 6 b. a. [illegible]

pool [illegible]

[1.0 point] [1.0 point]

d. c. b. a. [illegible]

Weeks Days Hours Minutes Instru[illegible]

[1.0 point] [1.0 point]

d. c. b. a. level [illegible]

Skim [illegible] Detector [illegible]

[1.0 point] [1.0 point]

d. c. b. a. [illegible]

The [illegible]

[1.0 point] [1.0 point] [1.0 point]

caut

d. c. b. a. Why is Sir Antiochus

to act as a [illegible]

REF.16 R = (2.5 x 10 $^{-8}$) x 0.1 = 2.5 x 10 $^{-11}$

REF.15 REF.14 REF.13 REF.12 REF.11 REF.10 reactor

TAMU Technical Specifications

Introduction to Nuclear Engineering, 1983. § 5.1, pp. 189–19

Introduction to Nuclear Reactor Operations, © 1988, §

Introduction to Nuclear Engineering, 1983. § 7.1, pp. 1283–239

Introduction to Nuclear Reactor Operations, © 1988, §

Introduction to Nuclear Engineering, 1983. § 7.4, pp. 316–1923

Introduction to Nuclear Reactor Operations, © 1988, §

Introduction to Nuclear Engineering, 1983. § 1.2, pp. 643.

Introduction to Nuclear Reactor Operations, © 1988, §

Introduction to Nuclear Reactor Operations, © 1988, §

Introduction to Nuclear Reactor Operations, © 1988, §

Introduction to Nuclear Reactor Operations, © 1988, §

SAR, III.B.2 Concrete Casting Support Beam

c SOP IX § A c Emergency Classification Procedure

Reactor Startup

Startup Following a Scheduled Shutdown. Also NRC exam administered 11/1995.

Definitions

b, 3; b, LSSS

b, check;

c, 3;

d, 4 c, che

$$\frac{DR_1}{X_2^2} = \frac{DR_2}{X_1^2} \qquad X_2^2 = \frac{DR_1}{DR_2} X_1^2$$

$$X_2^2 = \frac{2000}{5} \times 1^2 = 400 ft^2 \qquad X_2 = 20 ft$$

SOP § II-d.2.b, pp. 1 -

REF:17 REF:16 REF:15 REF:14 REF:13 REF:12 REF:11 REF:10 REF:9 REF:8 REF:7 REF:6 REF:5 REF:4 REF:3 REF:2 REF:1 Section C

SAR p. 50 SAR, p. 93 SAR pg 73 SAR § 15.0.4 ¶ 8.4 ...

d

answer corrected per facility comment at ex; meeting 6/18/20 (Typ

b, 3; b, 2;

Also NRC examination administered, 3/95. c, 2;

c

c, PULSE;

d, BOTH

All work done on this examination is my own. I [illegible]

Category

60.00 20.00 20.00 20.00 Value

33.3 33.3 33.3 Total % of

CARDINAL MINISTER

REDACTED:

Candidates

Score

NON-POWER INITIAL

% of

U. S. NUCLEAR RE

FINAL GRADE

Value Category

% C. B. A. Category

Candidate's Signature Radiological Control Facility Non-Radiation Training Systems Procedures Ra

IV Texas A&M Univ

TRIGA-FOR

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. After the examination has been completed, you must sign the statement on the cover sheet indicating that the work is your own and you have neither received nor given assistance in completing the examination. This must be done after you complete the examination.

3. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

4. Use black ink or dark pencil <u>only</u> to facilitate legible reproductions.

5. Print your name in the blank provided in the upper right-hand corner of the examination cover sheet and each answer sheet.

6. Mark your answers on the answer sheet provided. USE ONLY THE PAPER PROVIDED AND DO NOT WRITE ON THE BACK SIDE OF THE PAGE.

7. The point value for each question is indicated in [brackets] after the question.

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

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

10. Ensure all information you wish to have evaluated as part of your answer is on your answer sheet. Scrap paper will be disposed of immediately following the examination.

11. To pass the examination you must achieve a grade of 70 percent or greater in each category.

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

13. When you have completed and turned in you examination, leave the examination area. If you are observed in this area while the examination is still in progress, your license may be denied or revoked.

EQUATION SHEET

$$\dot{Q} = \dot{m}c_p\,\beta T = \dot{m}\,\beta H = UA\,\beta T \qquad P_{max} = \frac{(\beta-\beta)^2}{2\beta(k)\ell} \qquad \ell^* = 1 \times 10^{-4}\ seconds$$

$$\beta_{eff} = 0.1\ seconds^{-1} \qquad SCR = \frac{S}{-\beta} \approx \frac{S}{1-K_{eff}} \qquad CR_1(1-K_{eff_1}) = CR_2(1-K_{eff_2})$$

$$CR_1(-\beta_1) = CR_2(-\beta_2)$$

$$SUR = 26.06\left[\frac{\beta_{eff}\beta}{\beta-\beta}\right] \qquad M = \frac{1-K_{eff_0}}{1-K_{eff_1}} \qquad M = \frac{1}{1-K_{eff}} = \frac{CR_1}{CR_2}$$

$$P = P_0\ 10^{SUR(t)} \qquad P = P_0\ e^{\frac{t}{\beta}} \qquad P = \frac{\beta(1-\beta)}{\beta-\beta}\ P_0$$

$$SDM = \frac{(1-K_{eff})}{K_{eff}} \qquad \beta = \frac{\ell^*}{\beta - \bar{\beta}} \qquad \beta = \frac{\ell^*}{\beta} + \left[\frac{\bar{\beta}-\beta}{\beta_{eff}\beta}\right]$$

$$\beta\beta = \frac{K_{eff_2} - K_{eff_1}}{k_{eff_1} \times K_{eff_2}} \qquad T_{½} = \frac{0.693}{\beta} \qquad \beta = \frac{(K_{eff}-1)}{K_{eff}}$$

$$DR = DR_0\ e^{-\beta t} \qquad DR = \frac{6CiE(n)}{R^2} \qquad DR_1 d_1^2 = DR_2 d_2^2$$

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

$$\frac{(\beta_2-\beta)^2}{Peak_2} = \frac{(\beta_1-\beta)^2}{Peak_1}$$

1 Curie = 3.7 x 10^{10} dis/sec
1 Horsepower = 2.54 x 10^3 BTU/hr
1 BTU = 778 ft-lbf
1 gal (H_2O) ≈ 8 lbm
c_P = 1.0 BTU/hr/lbm/°F

1 kg = 2.21 lbm
1 Mw = 3.41 x 10^6 BTU/hr
°F = 9/5 °C + 32
°C = 5/9 (°F - 32)
c_p = 1 cal/sec/gm/°C

Section A

A.1a	1	2	3	4	___	A.9	a	b	c	d	___
A.1b	1	2	3	4	___	A.10	a	b	c	d	___
A.1c	1	2	3	4	___	A.11	a	b	c	d	___
A.1d	1	2	3	4	___	A.12	a	b	c	d	___
A.2	a	b	c	d	___	A.13	a	b	c	d	___
A.3	a	b	c	d	___	A.14	a	b	c	d	___
A.4	a	b	c	d	___	A.15	a	b	c	d	___
A.5	a	b	c	d	___	A.16	a	b	c	d	___
A.6	a	b	c	d	___	A.17	a	b	c	d	___
A.7	a	b	c	d	___	A.18	a	b	c	d	___
A.8	a	b	c	d	___	A.19	a	b	c	d	___

Section B No

B.1a SL LSSS LCO ___

B.1b SL LSSS LCO ___

B.1c SL LSSS LCO ___

B.1d SL LSSS LCO ___

B.2a Check Test Cal ___

B.2b Check Test Cal ___

B.2c Check Test Cal ___

B.2d Check Test Cal ___

B.3a 1 2 3 4 ___

B.3b 1 2 3 4 ___

B.3c 1 2 3 4 ___

B.3d 1 2 3 4 ___

B.4 a b c d ___

B.5 a b c d ___

B.6 a b c d ___

B.7 a b c d ___

B.8 a b c d ___

B.9 a b c d ___

B.10 a b c d ___

B.11 a b c d ___

B.12 a b c d ___

B.13 a b c d ___

B.14 a b c d ___

B.15 a b c d ___

B.16 a b c d ___

B.17 a b c d ___

Section C Fa

C.1a 1 2 3 4 5 ___

C.1b 1 2 3 4 5 ___

C.1c 1 2 3 4 5 ___

C.1d 1 2 3 4 5 ___

C.1e 1 2 3 4 5 ___

C.1f 1 2 3 4 5 ___

C.1g 1 2 3 4 5 ___

C.1h 1 2 3 4 5 ___

C.2 a b c d ___

C.3a 1 2 3 4 ___

C.3b 1 2 3 4 ___

C.3c 1 2 3 4 ___

C.4a SS PULSE Both ___

C.4b SS PULSE Both ___

C.4c SS PULSE Both ___

C.4d SS PULSE Both ___

C.5 a b c d ___

C.6 a b c d ___

C.7 a b c d ___

C.8 a b c d ___

C.9 a b c d ___

C.10 a b c d ___

C.11 a b c d ___

C.12 a b c d ___

C.13 a b c d ___

C.14 a b c d ___

C.15 a b c d ___

C.16 a b c d ___

C.17 a b c d ___