January 25, 2002

Mr. Edward Ehrlich
Nuclear Test Reactor Manager
General Electric Company
Vallecitos Nuclear Center
6705 Vallecitos Road
Sunol, CA 94586

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-073/OL-02-01

Dear Mr. Ehrlich:

During the week of November 12, 2001, the NRC administered a retake examination to an employee of your facility who had applied for a license to operate your General Electric Test 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. Warren Eresian at 301-415-1833 or internet e-mail wje@nrc.gov.

Sincerely,

/RA by Marvin Mendonca Acting for/

Patrick M. Madden, Section Chief
Non-Power Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-073

Enclosures: 1. Initial Examination Report No. 50-073/OL-02-01
2. Examination and answer key

cc w/encls:

Please see next page

cc:

Mr. Steve Hsu
Radiologic Health Branch
State Department of Health Service
P.O. Box 942732
Sacramento, CA 94234-7320

California Department of Health
ATTN: Chief, Environmental Radiation
Control Unit
Radiological Health Section
714 P Street, Room 498
Sacramento, CA 95814

Mr. Chuck Bassett, Manager
Regulatory Compliance
Vallecitos and Morris Operations
Vallecitos Nuclear Center
General Electric Company
6705 Vallecitos Road
Sunol, CA 94586

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

Mr. Chris Hamilton
Senior Licensing Engineer
Certified Six Sigma Green Belt
Vallecitos Nuclear Center
Sunol, CA 94586

Mr. Harold Neems
General Electric Company
Nuclear Energy Business Operations
175 Cutner Avenue
Mail Code 123
San Jose, CA 95125

January 25, 2002

Mr. Edward Ehrlich
Nuclear Test Reactor Manager
General Electric Company
Vallecitos Nuclear Center
6705 Vallecitos Road
Sunol, CA 94586

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-073/OL-02-01

Dear Mr. Ehrlich:

During the week of November 12, 2001, the NRC administered a retake examination to an employee of your facility who had applied for a license to operate your General Electric Test 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. Warren Eresian at 301-415-1833 or internet e-mail wje@nrc.gov.

Sincerely,
/RA by Marvin Mendonca Acting for/
Patrick M. Madden, Section Chief
Non-Power Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-073

Enclosures: 1. Initial Examination Report No. 50-073/OL-02-01
2. Examination and answer key

cc w/encls:
Please see next page

DISTRIBUTION w/encls.:
PUBLIC
MMendonca, PM
Facility File (EBarnhill O6-D17)

DISTRIBUTION w/o encls.:
RORP r/f
WEresian
PMadden
WBeckner

ADAMS ACCESSION #: ML020160504 **TEMPLATE #: NRR-074**
***Please see previous concurrence**

OFFICE	RORP:CE	E	IEHB:LA	E	RORP:SC	
NAME	*WEresian:rdr		*EBarnhill		PMadden	
DATE	01/ 17 /2002		01/ 22 /2002		01/ 24 /2002	

C = COVER **E = COVER & ENCLOSURE** **N = NO COPY**
OFFICIAL RECORD COPY

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

REPORT NO.: 50-073/OL-02-01

FACILITY DOCKET NO.: 50-073

FACILITY LICENSE NO.: R-33

FACILITY: General Electric - Vallecitos Nuclear Center

EXAMINATION DATES: November 14, 2001

EXAMINER: Warren Eresian, Chief Examiner

SUBMITTED BY: Paul V. Doyle, Acting for 12/21/2001
Warren Eresian, Chief Examiner Date

SUMMARY:

During the week of November 12, 2001, the NRC administered an operator licensing retake examination to one Reactor Operator candidate. The examination, consisting of Category A, was administered by the facility. The candidate passed the examination.

REPORT DETAILS

1. Examiner: Warren Eresian, Chief Examiner

2. Results:

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

3. Exit Meeting: None

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

FACILITY: General Electric

REACTOR TYPE: Test Reactor

DATE ADMINISTERED: 11/14/01

REGION: 4

CANDIDATE:______________________________

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% is required to pass the examination.

Examination will be picked up one (1) hour after the examination starts.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20	100	______	____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
		______% FINAL GRADE		

All work done on this examination is my own. I have neither given nor received aid.

____
Candidate's Signature

ENCLOSURE 2

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. Print your name in the upper right-hand corner of the answer sheets.

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

8. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK. NOTE: 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. 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.

QUESTION: 001 (1.00)

A reactor is subcritical with a K_{eff} of 0.955. Seven dollars ($7.00) of positive reactivity is inserted into the core (β = 0.007). At this point, the reactor is:

a. subcritical.

b. exactly critical.

c. supercritical.

d. prompt critical.

QUESTION: 002 (1.00)

Which ONE of the following is true concerning the differences between prompt and delayed neutrons?

a. Prompt neutrons account for less than one percent of the neutron population while delayed neutrons account for approximately ninety-nine percent of the neutron population.

b. Prompt neutrons are released during fast fissions while delayed neutrons are released during thermal fissions.

c. Prompt neutrons are released during the fission process while delayed neutrons are released during the decay of fission products.

d. For small reactivity insertions, prompt neutrons are the dominating factor in determining the reactor period while delayed neutrons have little effect on the reactor period.

QUESTION: 003 (1.00)

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 the mass of the target nucleus increases.

d. decreases as the mass of the target nucleus increases.

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

QUESTION: 004 (1.00)

Which ONE of the following is the approximate time period during which the MAXIMUM amount of Xenon-135 will be present in the core?

a. 15 to 20 hours after a startup to 100% power.

b. 10 to 12 hours after a shutdown from 100% power.

c. 10 to 12 hours after a power decrease from 100% to 50% power.

d. 15 to 20 hours after a power increase from 50% to 100% power.

QUESTION: 005 (1.00)

During a reactor startup, the count rate is increasing linearly with time, with no rod motion. This means that:

a. the reactor is subcritical and the count rate increase is due to the buildup of delayed neutron precursors.

b. the reactor is critical and the count rate increase is due to source neutrons.

c. the reactor is subcritical and the count rate increase is due to source neutrons.

d. the reactor is critical and the count rate increase is due to the buildup of delayed neutron precursors.

QUESTION: 006 (1.00)

Which ONE of the reactions below is an example of a <u>photoneutron</u> source?

a. ${}_{51}Sb^{123} + n \rightarrow {}_{51}Sb^{124} + \gamma$

b. ${}_{92}U^{238} \rightarrow {}_{35}Br^{87} + {}_{57}La^{148} + 3n + \gamma$

c. ${}_{4}Be^{9} + \gamma \rightarrow {}_{4}B^{8} + n$

d. ${}_{4}Be^{9} + \alpha \rightarrow {}_{6}C^{12} + n$

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

QUESTION: 007 (1.00)

Which ONE of the following is the reason for operating with thermal neutrons rather than fast neutrons?

a. Probability of fission is increased since thermal neutrons are less likely to leak out of the core.

b. The absorption cross-section of U-235 is much higher for thermal neutrons.

c. The fuel temperature coefficient for fast neutrons is positive, whereas for thermal neutrons it is negative.

d. The beta fraction for thermal neutrons is lower, so that prompt criticality is not as likely.

QUESTION: 008 (1.00)

For a beta effective = 0.0074, a reactivity insertion of 20 cents corresponds approximately to:

a. 0.0010 delta k/k.

b. 0.0015 delta k/k.

c. 0.0020 delta k/k.

d. 0.0074 delta k/k.

QUESTION: 009 (1.00)

During the minutes following a reactor scram, reactor power decreases on a negative 80 second period, corresponding to the half-life of the longest lived delayed neutron precursor, which is approximately:

a. 20 seconds.

b. 40 seconds.

c. 55 seconds.

d. 80 seconds.

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

QUESTION: 010 (1.00)

The fuel-to-moderator ratio describes the relationship between the number of fuel atoms in a volume of core to the number of moderator atoms. A reactor which is:

a. undermoderated will have a positive moderator temperature coefficient.

b. undermoderated will have a negative moderator temperature coefficient.

c. overmoderated will have a constant moderator temperature coefficient.

d. overmoderated will have a negative moderator temperature coefficient.

QUESTION: 011 (1.00)

You enter the control room and observe that the neutron instrumentation indicates a steady neutron level with no rods in motion. Which ONE condition below CANNOT be true?

a. The reactor is critical.

b. The reactor is subcritical.

c. The reactor is supercritical.

d. The neutron source is out of the core.

QUESTION: 012 (1.00)

Which factor in the six-factor formula is represented by the ratio:

$$\frac{\text{number of neutrons that reach thermal energy}}{\text{number of neutrons after fast leakage}}$$

a. Fast non-leakage probability.

b. Resonance escape probability.

c. Reproduction factor.

d. Thermal utilization factor.

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

QUESTION: 013 (1.00)

<u>Inelastic scattering</u> can be described as a process whereby a neutron collides with a nucleus and:

a. reappears with a lower kinetic energy, with the nucleus emitting a gamma ray.

b. reappears with the same kinetic energy it had prior to the collision.

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

d. reappears with a higher kinetic energy, with the nucleus absorbing a gamma ray.

QUESTION: 014 (1.00)

Two different neutron sources are used during two reactor startups. The source used in the first startup emits ten times as many neutrons as the source used in the second startup. Assume all other factors are the same for the two startups. Which ONE of the following describes the expected result at criticality.?

a. Neutron flux will be higher for the first startup.

b. Neutron flux will be higher for the second startup.

c. The first startup will result in the rods being further out of the core.

d. The second startup will result in the rods being further out of the core.

QUESTION: 015 (1.00)

Which ONE of the following is the major source of energy released due to thermal fission of a U-235 atom?

a. Gammas from fission product decay.

b. Kinetic energy of the fission neutrons.

c. Prompt gammas.

d. Kinetic energy of the fission fragments.

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

QUESTION: 016 (1.00)

Which ONE of the following describes the term prompt critical?

a. The instantaneous change in power level due to withdrawing a control rod.

b. A negative reactivity insertion which is greater than beta-effective.

c. A reactor which is critical on prompt neutrons only.

d. A positive reactivity insertion which is less than beta-effective.

QUESTION: 017 (1.00)

A thermal neutron is a neutron which:

a. experiences no net change in its energy after several collisions with atoms of the moderating medium.

b. has been produced several seconds after its initiating fission occurred.

c. is produced as a result of thermal fission.

d. possesses thermal energy rather than kinetic energy.

QUESTION: 018 (1.00)

During the neutron cycle from one generation to the next, several processes occur that may increase or decrease the available number of neutrons. Which ONE of the following factors describes an INCREASE in the number of neutrons during the cycle?

a. Thermal utilization factor.

b. Resonance escape probability.

c. Thermal non-leakage probability.

d. Fast fission factor.

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

QUESTION: 019 (1.00)

The moderator temperature coefficient of reactivity is -1.25×10^{-3} delta K/K/deg.C. When a control rod with an average rod worth of 0.1% delta K/K/inch is withdrawn 10 inches, reactor power increases and becomes stable at a higher level. At this point, the moderator temperature has:

a. increased by 8 deg C.

b. decreased by 8 deg C.

c. increased by 0.8 deg C.

d. decreased by 0.8 deg C.

QUESTION: 020 (1.00)

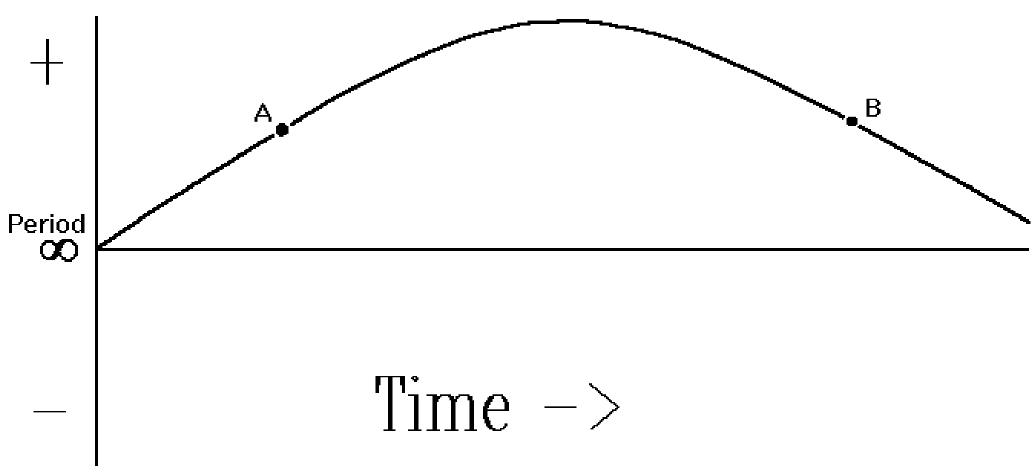
Shown below is a trace of reactor period as a function of time. Between points A and B, reactor power is:

a. continually increasing.

b. increasing, then decreasing.

c. continually decreasing.

d. constant.



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

A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS

ANSWER: 001 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.
Shutdown reactivity = (K-1)/K = -0.047 delta K/K. $7.00 added = 7(0.007) = +0.049 delta K/K.
-0.047 + 0.049 = + 0.002, i.e. supercritical.

ANSWER: 002 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section C, The Nuclear Fission Process.

ANSWER: 003 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section E, Neutron Slowing Down Theory.

ANSWER: 004 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section F, Fission Product Poisoning.

ANSWER: 005 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 006 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 007 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section E, Neutron Slowing Down Theory.

ANSWER: 008 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.
delta k/k = reactivity($) x beta = 0.20 x 0.0073 = 0.0015

ANSWER: 009 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section D, Neutron Multiplication Factors.

ANSWER: 010 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 011 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section D, Neutron Multiplication Factors.

ANSWER: 012 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section D, Neutron Multiplication Factors.

ANSWER: 013 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section B, Types of Nuclear Reactions.

ANSWER: 014 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 015 (1.00)
D.
REFERENCE:
Reactor Physics Training Manual, Section C, The Nuclear Fission Process.

ANSWER: 016 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 017 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 018 (1.00)
D.
REFERENCE:
Reactor Physics Training Manual, Section D, Neutron Multiplication Factors.

ANSWER: 019 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 020 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS

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 *****)

EQUATION SHEET

$Q = m\, c_p\, \Delta T$	$CR_1\,(1\text{-}Keff)_1 = CR_2\,(1\text{-}Keff)_2$
$SUR = 26.06/\tau$	$P = P_0\, 10^{SUR(t)}$
$P = P_0\, e^{(t/\tau)}$	$\tau = (\ell^*/\rho) + [(\beta-\rho)/\lambda_{eff}\rho]$
$\lambda_{eff} = 0.1$ seconds^{-1}	$DR_1D_1^2 = DR_2D_2^2$
$DR = DR_o e^{-\lambda t}$	$DR = 6CiE/D^2$
$\rho = (Keff-1)/Keff$	1 eV = $1.6\text{x}10^{-19}$ watt-sec.
1 Curie = $3.7\text{x}10^{10}$ dps	1 gallon water = 8.34 pounds
1 Btu = 778 ft-lbf	$^\circ F = 9/5^\circ C + 32$
1 Mw = $3.41\text{x}10^6$ BTU/hr	$^\circ C = 5/9\,(^\circ F - 32)$