May 10, 2004

Mr. Scott Bump, Manager
Vallecitos Nuclear Center
6705 Vallecitos Road
Sunol, CA 94586

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-073/OL-04-01

Dear Mr. Bump:

During the week of April 19, 2004, the NRC administered initial examinations to employees 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/

Patrick M. Madden, Section Chief
Research and Test Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-073

Enclosures: 1. Initial Examination Report No. 50-073/OL-04-01
2. Examination and answer key

cc w/encls:
Please see next page

cc:

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Test, Research, and Training
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cc w/encls:
Please see next page

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

DISTRIBUTION w/o encls.:
RNRP/R&TR r/f
WEresian
PMadden

ADAMS ACCESSION #: ML041180573 **TEMPLATE #: NRR-074**

OFFICE	RNRP:CE		IROB:LA		RNRP:SC	
NAME	WEresian		EBarnhill		PMadden	
DATE	04/ 30 /2004		05/ 7/2004		05/ 10 /2004	

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

REPORT NO.: 50-073/OL-04-01

FACILITY DOCKET NO.: 50-073

FACILITY LICENSE NO.: R-33

FACILITY: General Electric

EXAMINATION DATES: April 19-20, 2004

EXAMINER: Warren Eresian, Chief Examiner

SUBMITTED BY: **/RA/** 04/ 30 /2004
Warren Eresian, Chief Examiner Date

SUMMARY:

During the week of April 19, 2004, the NRC administered an operator licensing examination to one Senior Reactor Operator (Instant) candidate. The candidate passed the examination.

ENCLOSURE 1

REPORT DETAILS

1. Examiner: Warren Eresian, Chief Examiner

2. Results:

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

3. Exit Meeting:

Mr. Ed Ehrlich, Manager, NTR
Warren Eresian, NRC Chief Examiner

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

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

FACILITY: General Electric

REACTOR TYPE: Test Reactor

DATE ADMINISTERED: 04/19/2004

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% in each category 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	33.3	_____	____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
20	33.3	_____	____	B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
20	33.3	_____	____	C. FACILITY AND RADIATION MONITORING SYSTEMS
60		_____	_____% 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)

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

a. the generation time of prompt neutrons only.

b. the value of β_{eff}.

c. the generation time of delayed neutrons only.

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

QUESTION: 002 (1.00)

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. the neutron population is so low that xenon burnout does not occur.

QUESTION: 003 (1.00)

A reactor is operating at criticality. Instantaneously, all of the delayed neutrons are suddenly removed from the reactor. The K_{eff} of the reactor in this state would be approximately:

a. 1.007

b. 1.000

c. 0.993

d. 0.000

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

QUESTION: 004 (1.00)

The Inhour Equation relates reactivity insertion, ρ, to reactor period, T. Reactivity insertion A is +0.001 delta k/k, and reactivity insertion B is -0.001 delta k/k (i.e., the same magnitude.) The absolute value of the period will be:

a. smaller for A.

b. larger for A.

c. smaller for B.

d. the same for A and B.

QUESTION: 005 (1.00)

Elastic Scattering is the process whereby a neutron collides with a nucleus and:

a. recoils with the same kinetic energy it had prior to the collision.

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

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

d. recoils with a higher kinetic energy, with the nucleus emitting a gamma ray.

QUESTION: 006 (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 in the core.

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

QUESTION: 007 (1.00)

Neutrons released by fission are called fast neutrons because they:

a. appear immediately following the fission.

b. are responsible for fast fissions.

c. decay rapidly to stable levels.

d. are at a high kinetic energy level.

QUESTION: 008 (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. As neutron energy increases, neutron absorption in non-fuel materials increases exponentially.

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

d. The fuel temperature coefficient becomes positive as neutron energy increases.

QUESTION: 009 (1.00)

During fuel loading, which ONE of the following will have NO effect on the shape of the 1/C plot?

a. The order of fuel placement.

b. The source strength.

c. The location of the source in the core.

d. The location of the detector (or detectors) in the core.

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

QUESTION: 010 (1.00)

A reactor is slightly supercritical, with the thermal utilization factor = 0.700. A control rod is inserted to bring the reactor back to critical. Assuming all other factors remain unchanged, the new value for the thermal utilization factor is:

a. 0.698

b. 0.700

c. 0.702

d. 0.704

QUESTION: 011 (1.00)

A reactor is operating at a constant power level of 100 kW. The fission rate of this reactor is approximately:

a. 1.562×10^{15} fissions/sec.

b. 3.124×10^{15} fissions/sec.

c. 6.248×10^{15} fissions/sec.

d. 1.562×10^{16} fissions/sec.

QUESTION: 012 (1.00)

Delayed neutron precursors decay by beta(-) decay. Which ONE reaction below is an example of beta(-) decay?

a. ${}_{35}Br^{87} \rightarrow {}_{36}Kr^{87}$

b. ${}_{35}Br^{87} \rightarrow {}_{36}Kr^{86}$

c. ${}_{35}Br^{87} \rightarrow {}_{35}Kr^{88}$

d. ${}_{35}Br^{87} \rightarrow {}_{35}Kr^{86}$

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

QUESTION: 013 (1.00)

A reactor is subcritical by 5% delta k/k with a count rate of 100 cps on the startup channel. Rods are withdrawn until the count rate is 1000 cps. Which ONE of the following is the condition of the reactor following the rod withdrawal?

a. Critical with k_{eff} = 1.000.

b. Subcritical with k_{eff} = 0.995.

c. Subcritical with k_{eff} = 0.950.

d. Supercritical with k_{eff} = 1.005.

QUESTION: 014 (1.00)

Reactivity may defined as a measure of the:

a. number of neutrons being produced in the core.

b. heat being produced due to neutron absorption by the fuel.

c. reactor's multiplication factor.

d. fractional change in neutron population between generations.

QUESTION: 015 (1.00)

Which ONE of the following describes the characteristics of a good moderator?

a. Low scattering cross section and high absorption cross section.

b. Low scattering cross section and low absorption cross section.

c. High scattering cross section and low absorption cross section.

d. High scattering cross section and high absorption cross section.

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

QUESTION: 016 (1.00)

Which ONE of the following is the major source of energy released during fission?

a. Prompt gamma rays.

b. Fission fragments.

c. Prompt neutrons.

d. Delayed neutrons.

QUESTION: 017 (1.00)

Which ONE of the reactions below is an example of a photoneutron 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. $_{4}Be^{9} + \alpha \rightarrow {}_{6}C^{12} + n$

QUESTION: 018 (1.00)

A reactivity coefficient describes how much reactivity is inserted when some physical parameter (temperature, pressure, void, etc.) is changed. A positive reactivity coefficient results when:

a. positive reactivity is inserted when the physical parameter decreases.

b. negative reactivity is inserted when the physical parameter increases.

c. negative reactivity is inserted when the physical parameter decreases.

d. reactor power increases when the physical parameter decreases.

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

QUESTION: 019 (1.00)

When the reactor is scrammed from full power, what is the main contributor to the constant -80 second period that results?

a. The amount of negative reactivity introduced into the core.

b. The decay constant of the longest-lived delayed neutron precursor.

c. The neutron population level prior to the scram.

d. The fission product population prior to the scram.

QUESTION: 020 (1.00)

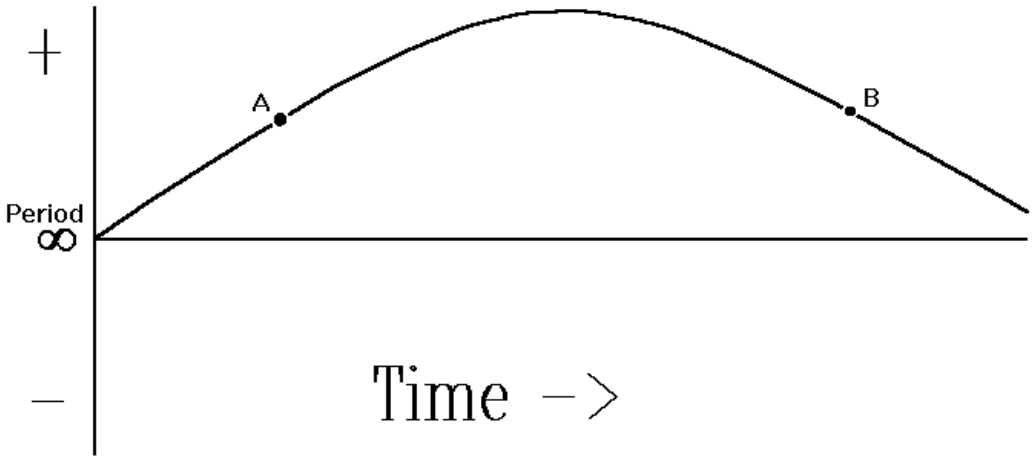
Shown below is a trace of reactor period as a function of time. Between points A and B, reactor power is:

a. continually increasing.

b. increasing, then decreasing.

c. continually decreasing.

d. constant.



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

QUESTION: 001 (1.00)

With regard to Radiation Work Permits (RWPs), which ONE of the following statements is not true?

a. An RWP is issued with the names of the individuals who will do the work.

b. The maximum duration of an RWP is seven consecutive days.

c. The RWP can be approved by a SRO.

d. No one is exempt from RWP requirements regardless of normal assigned work area or license status.

QUESTION: 002: (1.00)

With regard to visitors, which ONE of the following statements is true?

a. Visitors shall not work in posted Radiation Areas without a licensed RO or SRO present and an RWP.

b. Visitors to the control room who are not GE employees may be left unescorted while another escort is enroute to the control room.

c. Visitors need no film badge, direct-reading pocket dosimeter, training or in-vivo count, only if no posted Radiation Areas will be entered.

d. Visitors wearing dosimeters issued by their employer do not have to wear a VNC dosimeter.

QUESTION: 003 (1.00)

Which ONE of the following is the precaution to be taken in the event of a remote area radiation monitor failure?

a. No entries are allowed except to make the component operable.

b. Entries may be made after notification of Health Physics.

c. Entries in accordance with entry procedures are permitted only with continuous surveillance using portable monitoring instruments.

d. Entries are permitted with only continuous surveillance using portable monitors.

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

QUESTION: 004 (1.00)

When one of the safety-related pico-ammeters is inoperable:

a. the reactor cannot be operated until the pico-ammeter is operable.

b. the reactor can continue to operate with no action required.

c. the reactor can continue to operate only if the operator activates the reactivity testing pico-ammeter.

d. the reactor can continue to operate if the pico-ammeter is placed in the tripped condition.

QUESTION: 005: (1.00)

Which ONE of the following describes the basis for the Safety Limit applicable to reactor power level?

a. Limit potential reactivity insertion for cold water transient.

b. Limit gas pressure between the fuel and cladding.

c. Limit the DNB ratio in the hottest fuel element.

d. Limit power to preclude excessive radioactive material inventories.

QUESTION: 006 (1.00)

A licensed SRO does <u>not</u> need to be present during:

a. a facility change with a reactivity worth equal to $0.76.

b. recovery from an unscheduled shutdown.

c. an experiment with a reactivity worth of $1.76.

d. reactor fuel loading.

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

QUESTION: 007 (1.00)

Which ONE of the following is true regarding reactor coolant makeup to the primary system?

a. The amount of water added must be recorded.

b. Makeup is directly to the fuel loading tank.

c. Makeup requires permission of the Manager, Nuclear Safety.

d. Makeup requires concurrence of an SRO.

QUESTION: 008: (1.00)

Which ONE of the following is true regarding procedural controls for deviations from Standard Operating Procedures?

a. Deviations from SOPs are not allowed under any circumstances.

b. Deviations from SOPs can be authorized by an SRO to prevent injury to personnel or damage to the facility, if documented in the console logbook and reported to the Facility Manager.

c. Deviations from SOPs can only be authorized by an SRO under the provisions of the Emergency Plan when reported to the Emergency Operations Coordinator and documented in an Engineering Release.

d. Deviations from SOPs can be authorized at any time by a license operator without further action or notification.

QUESTION: 009 (1.00)

Which ONE of the following is true regarding the South Cell Door/Shutter Interlock/Alarm Control System?

a. The photocell alarm closes the shutter.

b. The door will automatically close if the shutter is opened.

c. If the shutter is open, the remote area monitor will sound an alarm on high radiation.

d. The door and shutter can be open simultaneously in the manual mode.

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

QUESTION: 010 (1.00)

Which ONE of the following is the reason that the primary coolant high core outlet temperature is limited by the Technical Specifications?

a. Prevent boiling on fuel element surfaces in the event of an analyzed accident or transient.

b. Prevent the expansion of tank water at high temperatures from reducing the moderating capability of the coolant.

c. Ensure that demineralizer resins are not damaged.

d. Ensure that the reactor will be shut down.

QUESTION: 011: (1.00)

Which ONE of the following is <u>true</u> regarding natural convection cooling?

a. During a complete loss of primary coolant flow without a reactor scram, fuel damage does not occur.

b. The primary coolant high core outlet temperature alarm is replaced with the primary coolant core delta temperature alarm.

c. Excess reactivity is limited to $0.50 or less to limit power excursions.

d. Reactor power can be raised to 10 kW with natural convection cooling.

QUESTION: 012 (1.00)

There is indication by the stack gas or particulate monitor that radioactive effluent release rate exceeded the alarm setpoint by a factor of 1000 to 2000 for a period > 10 minutes. In accordance with the Radiological Emergency Plan, this event would be classified as a(n):

a. Unusual Event.

b. Alert.

c. Site Area Emergency.

d. General Emergency.

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

QUESTION: 013 (1.00)

The reactor is operating at full power over the weekend, during which time the Reactor Operator (RO) in the control room becomes ill and is taken to a hospital. Only a Senior Reactor Operator (SRO) and an operator trainee remain in the facility. In accordance with the Technical Specifications, reactor operations:

a. must be discontinued because both an RO and SRO must be present in the facility.

b. must be discontinued because there is only one licensed person at the facility.

c. may continue since the SRO can operate the facility with a second knowledgeable person available.

d. may continue until a replacement RO can arrive at the facility, up to a maximum of 30 minutes.

QUESTION: 014: (1.00)

During reactor operation, an abnormal reactivity change occurs which reduces reactor power to a lower steady state level. The reactor operator should:

a. hold the power at the lower level until the cause of the change can be determined.

b. return power to its original level if the cause of the change is known.

c. shut down the reactor.

d. gradually increase power to try to determine if the cause is repeatable.

QUESTION: 015 (1.00)

In accordance with the Technical Specifications, which ONE of the following conditions is permissible when the reactor is operating, or about to be operated?

a. One control inoperable but fully inserted in the core.

b. Average scram time of four safety rods = 400 msec.

c. Excess reactivity = $1.00

d. Positive temperature coefficient of reactivity of primary coolant when coolant temperature = 120 degrees F.

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

QUESTION: 016 (1.00)

Which ONE of the following provides the minimum personnel requirements for insertion or withdrawal of a manual poison sheet? The manipulation will be done by a _____ and a _____ must be in the control room observing the nuclear instrumentation.

a. licensed operator; senior reactor operator

b. licensed operator; licensed operator

c. knowledgeable person; licensed operator

d. knowledgeable person; senior licensed operator

QUESTION: 017: (1.00)

In accordance with 10CFR20, the Annual Limit on Intake (ALI) refers to:

a. the amount of radioactive material taken into the body by inhalation or ingestion in one (1) year which would result in a committed effective dose equivalent of five (5) rems.

b. the concentration of a given radionuclide in air which, if breathed for a working year of 2000 hours, would result in a committed effective dose equivalent of five (5) rems.

c. the dose equivalent to organs that will be received from an intake of radioactive material by an individual through a one-year period following the intake.

d. limits on the release of effluents to an unrestricted environment.

QUESTION: 018 (1.00)

A radiation survey of an area reveals a general radiation reading of 1 millirem/hour. However, a small section of pipe (point source) reads 10 millirem/hour at one (1) meter. Which ONE of the following is the posting requirement for the area in accordance with 10CFR20?

a. “CAUTION RADIATION AREA”

b. “CAUTION HIGH RADIATION AREA”

c. “CAUTION RADIOACTIVE MATERIAL”

d. “GRAVE DANGER, VERY HIGH RADIATION AREA”

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

QUESTION: 019 (1.00)

Which ONE of the following describes an Emergency Action Level?

a. Radiological dose rates, specific concentrations of airborne, waterborne or surface-deposited radioactive materials, specific observations, or specific instrument readings that may be used as thresholds for initiating specific emergency measures.

b. Measures taken in anticipation of or after an uncontrolled release of radioactive material, for the purpose of preventing or minimizing personnel radiation doses or dose commitments that would otherwise be likely to occur if the actions were not taken.

c. Projected radiation doses or dose commitments to individuals in the general population offsite that warrant protective action following a release of radioactive material.

d. Those actions taken during or after an accident to obtain and process information to decide whether to implement emergency measures.

QUESTION: 020: (1.00)

Which ONE of the following conditions is not allowed by the Technical Specifications when the reactor is operating or about to be operated?

a. Operation at 0.2 kW with reactor cell pressure at 1.0 inches of water negative pressure with respect to the control room.

b. Operation at 0.05 kW with the stack particulate monitor inoperable.

c. Shutdown margin = $0.76.

d. Core outlet temperature = 230 degrees F.

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

QUESTION: 001 (1.00)

Which ONE of the following describes the purpose of the poison sheets?

a. Insert on scram to shut down the reactor.

b. Provide neutron reflection.

c. Limit available reactivity or increase shutdown margin.

d. Provide neutron moderation.

QUESTION: 002 (1.00)

Which ONE of the following is true for the condition where all safety rods are full out and all control rods are full in?

a. Safety rod green lights are energized, and control rod yellow lights are energized.

b. Safety rod yellow lights are energized, and control rod yellow lights are energized.

c. Safety rod yellow lights are energized, and control rod green lights are energized.

d. Safety rod green lights are energized, and control rod green lights are energized.

QUESTION: 003 (1.00)

Which ONE of the following is the reason for the rod withdrawal permissive interlock if the pico-ammeter is not indicating above a preset minimum level? To ensure that:

a. safety and control rod magnets are energized.

b. instrumentation is detecting the neutron source for reactor startup.

c. control rods are not withdrawn before safety rods are all withdrawn.

d. the reactor can be shut down.

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

QUESTION: 004 (1.00)

The reactor cell ventilation air-monitoring system provides _____in the effluent and _____.

a. continuous indication for radioactive particulates and non-filterable gases ; alarms at the reactor console.

b. continuous indication for radioactive particulates and non-filterable gases ; scrams the reactor.

c. continuous indication for radioactive gases and non-filterable gases ; alarms at the reactor console.

d. continuous indication for radioactive gases and non-filterable gases; scrams the reactor.

QUESTION: 005 (1.00)

Which ONE of the following is true with regard to a potential leak in the primary to secondary heat exchanger?

a. Release of radioactive material during operations is possible, since the primary system pressure is higher than the secondary system pressure.

b. Secondary water drains to the site retention basin and is analyzed for contamination.

c. Automatic isolation and reactor scram are initiated by secondary system radiation monitoring system.

d. Secondary water is diverted to the holdup tank.

QUESTION: 006 (1.00)

Which ONE of the following is true with regard to the manual scram button/switch located on the reactor console, and the manual process scram button located in the reactor cell?

a. The reactor cell room manual process scram directly opens the circuit supplying power to the safety rod magnets, but the console manual scram does not.

b. The reactor console manual scram directly opens the circuit supplying power to the safety rod magnets, but the reactor cell room manual process scram does not.

c. They both open the circuit supplying power to the safety rod magnets.

d. They both open the circuit supplying power to the safety rod magnets and de-energize scram relays.

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

QUESTION: 007 (1.00)

Which ONE of the following provides primary coolant system over-pressurization protection?

a. An open vent line.

b. A surge tank.

c. A pressurizer.

d. A power to open, spring to close solenoid valve on top of the empty heater housing located between the heat exchanger and the primary pump.

QUESTION: 008 (1.00)

Which ONE of the following provides deceleration of the safety rods during scrams?

a. Holes in the rod guide to regulate fluid displacement.

b. Primary coolant flow.

c, Spiral springs.

d. Air dash pot shock absorber.

QUESTION: 009 (1.00)

Which ONE of the following is the function of the photo electric sensor for the South cell? Alerts the reactor operator to:

a. traffic to or from the cell.

b. cell door opening.

c. cell door closing.

d. shutter not closed.

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

QUESTION: 010 (1.00)

Which ONE of the following is false regarding the drive-in limit switches on the safety rods?

a. They interrupt the motor circuit at the fully inserted limit of stroke.

b. They are interlocked so that all safety rods must be withdrawn sequentially.

c. They energize green lights at the console.

d. They are interlocked to prevent energizing the electromagnets unless all control rods are fully inserted.

QUESTION: 011 (1.00)

With regard to a reactor scram without electrical power:

a. control rod and safety rod drives would not run in automatically.

b. the emergency un-interruptible power supply would provide instrumentation indication and lights.

c. the secondary coolant pump would stop.

d. the stack radiation monitors would fail high and scram the reactor.

QUESTION: 012 (1.00)

Which ONE of the following is the effect on the shutter for the horizontal facility in the South cell on a loss of facility air?

a. The shutter closes.

b. The shutter opens.

c. The shutter remains in its position at the time of the air supply failure.

d. The position of the shutter is unpredictable, depending on how fast the loss of facility air occurred.

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

QUESTION: 013 (1.00)

Which One of the following is true for the neutron source system?

a. The neutron source has continuous position indication.

b. The neutron source consists of antimony and beryllium.

c. The neutron source has the same interlocks as the control rods, including that all safety rods must be full out before the source can be withdrawn.

d. The neutron source automatically fully inserts following a scram.

QUESTION: 014 (1.00)

Primary coolant is regulated by:

a. throttling valve TV-101.

b. varying the speed of the primary pump.

c. throttling valve TV-103.

d. throttling valve V-204.

QUESTION: 015 (1.00)

The normal flow path for primary cooling water, starting at the reactor outlet, is:

a. hold-up tank, air trap, flow orifice, primary pump, reactor inlet.

b. primary pump, heat exchanger, flow orifice, air trap, reactor inlet.

c. flow orifice, heat exchanger, air trap, primary pump, reactor inlet.

d. flow orifice, hold-up tank, primary pump, heat exchanger, reactor inlet.

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

QUESTION: 016 (1.00)

Reactor instrumentation and the control rod drive motors receive power from:

a. a direct 220/115 VAC feed from the lighting distribution panel.

b. a 220/115 VAC feed through the instrument isolation transformer.

c. the 24 VDC power distribution circuit.

d. the reactor console power distribution circuit.

QUESTION: 017 (1.00)

Which ONE of the following rod drive operations is possible with the reactor keylock switch in the “OFF” position?

a. Bypassing the “all-in” interlock.

b. Driving rod motors using the “IN” pushbutton.

c. Rod withdrawal using the rod test and interlock circuit.

d. Overriding the scram insert signal on one rod at a time.

QUESTION: 018 (1.00)

The secondary coolant solenoid cutoff valve SV-203 opens when:

a. inlet pressure at the heat exchanger exceeds 35 psig.

b. the reactor console power switch is ON.

c. the primary coolant high temperature relay energizes.

d. a high alarm level occurs in the fuel loading tank.

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

QUESTION: 019 (1.00)

Which ONE of the following is false with regard to the core reel assembly and drive mechanism system?

a. It supports and positions each fuel assembly.

b. It rotates to position fuel with respect to the loading chute.

c. It indicates orientation of the reel assembly.

d. It is motor-operated through a shaft and two keyed pinion gears.

QUESTION: 020 (1.00)

Which ONE of the following describes why two special sections of the graphite reflector moderator are removable?
To allow:

a. experiment insertion.

b. manual neutron monitoring.

c. movement of poison sheets.

d. inspection of the fuel container.

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

A. REACTOR THEORY, THERMODYNAMICS AND FACILITY OPERATING CHARACTERISTICS

ANSWER: 001 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 002 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section F, Fission Product Poisoning.

ANSWER: 003 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section C, The Nuclear Fission Process.

ANSWER: 004 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 005 (1.00)
A.
REFERENCE:
Reactor Physics Training Manual, Section B, Types of Nuclear Reactions.

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

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

ANSWER: 008 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section E, Neutron Slowing Down Theory.

ANSWER: 009 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 010 (1.00)
A.
REFERENCE:
Reactor Theory Training Manual, Section D, Neutron Multiplication Factors.

ANSWER: 011 (1.00)
B.
REFERENCE:
100 kW = 6.248×10^{17} Mev/sec. (From Equation Sheet)
(6.248×10^{17} Mev/sec)/(200 Mev/fission) = 3.124×10^{15} fissions/sec.

ANSWER: 012 (1.00)
A.
REFERENCE:
Reactor Theory Training Manual, Section C, The Nuclear Fission Process.

ANSWER: 013 (1.00)
B.
REFERENCE:
Reactor Theory Training Manual, Section H, Subcritical Multiplication.
$\rho_1 = (K_1 - 1)/K_1$ (From Equation Sheet). $K_1 = 0.952$.
$CR_1(1 - K_1) = CR_2(1 - K_2)$ (From Equation Sheet) ; $100(1 - 0.952) = 1000(1 - K_2)$; $K_2 = 0.995$

ANSWER: 014 (1.00)
D.
REFERENCE:
Reactor Theory Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 015 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section E, Neutron Slowing Down Theory.

ANSWER: 016 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section C, The Nuclear Fission Process.

ANSWER: 017 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 018 (1.00)
C.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 019 (1.00)
B.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

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

B. NORMAL/EMERGENCY PROCEDURES AND RADIOLOGICAL CONTROLS

ANSWER: 001 (1.00)
D.
REFERENCE:
SOP 7.9, Sections 6.2, 7.2, 8.2 and 9.

ANSWER: 002 (1.00)
A.
REFERENCE:
SOP 9.9, Sections 6.2, 6.8, 6.9, and 6.10.

ANSWER: 003 (1.00)
C.
REFERENCE:
SOP 7.2, Section 4.

ANSWER: 004 (1.00)
D.
REFERENCE:
SOP 2.4, Section 5.1.

ANSWER: 005 (1.00)
C.
REFERENCE:
Technical Specifications, Section 2.1.4.

ANSWER: 006 (1.00)
A.
REFERENCE:
Technical Specifications, Section 6.1.3.2.

ANSWER: 007 (1.00)
D.
REFERENCE:
SOP 1.2., Section 5.1.

ANSWER: 008 (1.00)
B.
REFERENCE:
SOP 9.2, Section 7.1.

ANSWER: 009 (1.00)
D.
REFERENCE:
Procedure 7.10, Section D.2.

ANSWER: 010 (1.00)
D.
REFERENCE:
Technical Specifications, Section 3.2.4.

ANSWER: 011 (1.00)
A.
REFERENCE:
Technical Specifications, Section 3.3.4.

ANSWER: 012 (1.00)
B.
REFERENCE:
Radiological Emergency Plan, Section 5.2.

ANSWER: 013 (1.00)
C.
REFERENCE:
Technical Specifications, Section 6.1.3.1.

ANSWER: 014 (1.00)
C.
REFERENCE:
SOP 8.3, Section 5.4.

ANSWER: 015 (1.00)
D.
REFERENCE:
Technical Specifications, Section 3.1.3.5.

ANSWER: 016 (1.00)
B.
REFERENCE:
SOP 3.5, Section 2.4.3.

ANSWER: 017 (1.00)
A.
REFERENCE:
10CFR 20.1003

ANSWER: 018 (1.00)
B.
REFERENCE:
For a point source, 10 millirem at 100 cm (1 meter) = 111.1 mrem at 30 cm.

ANSWER: 019 (1.00)
A.
REFERENCE:
Radiological Emergency Plan, Section 5.

ANSWER: 020 (1.00)
D.
REFERENCE:
Technical Specifications, Table 3-1.

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER: 001 (1.00)
C.
REFERENCE:
SAR Section 7.5.

ANSWER: 002 (1.00)
C.
REFERENCE:
SAR Section 4.2.2.

ANSWER: 003 (1.00)
B.
REFERENCE:
SAR Section 7.1.

ANSWER: 004 (1.00)
A.
REFERENCE:
SAR Section 6.3.

ANSWER: 005 (1.00)
B.
REFERENCE:
SAR Section 5.3.

ANSWER: 006 (1.00)
B.
REFERENCE:
SAR Sections 7.3.1 and 7.3.2.

ANSWER: 007 (1.00)
A.
REFERENCE:
SAR Section 5.2.

ANSWER: 008 (1.00)
D.
REFERENCE:
SAR Section 4.2.2.

ANSWER: 009 (1.00)
A.
REFERENCE:
SAR Sections 4.3, 7.2.

ANSWER: 010 (1.00)
B.
REFERENCE:
SAR Section 4.2.2.

ANSWER: 011 (1.00)
A.
REFERENCE:
SAR Section 13.3.1.

ANSWER: 012 (1.00)
C.
REFERENCE:
SAR Section 9.6.

ANSWER: 013 (1.00)
D.
REFERENCE:
SAR Section 4.2.4.

ANSWER: 014 (1.00)
A.
REFERENCE:
SOP 1.1.

ANSWER: 015 (1.00)
C.
REFERENCE:
SAR Figure 5-1.

ANSWER: 016 (1.00)
D.
REFERENCE:
SAR Section 8.1.

ANSWER: 017 (1.00)
B.
REFERENCE:
SAR Figure 7-2.

ANSWER: 018 (1.00)
B.
REFERENCE:
SOP 1.5.

ANSWER: 019 (1.00)
D.
REFERENCE:
SAR Section 4.2.5.

ANSWER: 020 (1.00)
D.
REFERENCE:
SAR Section 4.2.3.

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 *****)

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

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 B *****)

C. FACILITY AND RADIATION MONITORING SYSTEMS

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 *****)

EQUATION SHEET

$Q = m\ c_p\ \Delta T$

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

$SUR = 26.06/\tau$

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

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

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

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

$DR_1D_1^2 = DR_2D_2^2$

$DR = DR_oe^{-\lambda t}$

$DR = 6CiE/D^2$

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

$1\ eV = 1.6x10^{-19}$ watt-sec.

$1\ Curie = 3.7x10^{10}$ dps

1 gallon water = 8.34 pounds

1 Btu = 778 ft-lbf

$°F = 9/5°C + 32$

$1\ Mw = 3.41x10^6$ BTU/hr

$°C = 5/9\ (°F - 32)$