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

REPORT NO.:	50-073/OL-99-01
FACILITY DOCKET NO.:	50-073
FACILITY LICENSE NO.:	R-33
FACILITY:	General Electric Nuclear Test Reactor
EXAMINATION DATES:	September 20-21, 1999
EXAMINER:	Marvin M. Mendonca, Chief Examiner
SUBMITTED BY:	M. M. Mendonca — 10/5/99
	Marvin M. Mendonca, Chief Examiner — Date

SUMMARY:

During the week of September 20, 1999, NRC administered Operator Licensing Examinations to one Senior Reactor Operator Instant (SROI) candidate. The candidate passed.

Enclosure 1

REPORT DETAILS

1. Examiners:

   Marvin M. Mendonca, Chief Examiner

2. Results:

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

3. Exit Meeting:

   Personnel attending:

   Chuck Bassett, Manager Regulatory Compliance
   Marvin M. Mendonca, Chief Examiner

   There were no generic concerns raised by the chief examiner.

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

FACILITY: General Electric Nuclear Test Reactor

REACTOR TYPE: Tank

DATE ADMINISTERED: 08/17/99

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 begins.

CATEGORY VALUE	% OF TOTAL	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
20	33⅓	_____	_____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
20	33⅓	_____	_____	B. NORMAL/EMERGENCY PROCEDURES AND RADIOLOGICAL CONTROLS
20	33⅓	_____	_____	C. FACILITY AND RADIATION MONITORING SYSTEMS
60	100			

CANDIDATE'S SCORE _____

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.

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 001 (1.00)

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

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: 002 (1.00)

Element "X" is a 1/V absorber (microscopic cross section is inversely proportional to neutron velocity.) The absorption cross section of element X for 0.0253 eV neutrons is 100 barns. Which ONE of the following is the absorption cross section of element X for 0.0506 eV neutrons.

a. 50.0 barns.

b. 70.7 barns.

c. 100.0 barns.

d. 200.0 barns

QUESTION: 003 (1.00)

Two different neutron sources were used during two reactor startups. The source used in the first startup emits ten times as many neutrons per second as the source used in the second startup. Assume all other factors are the same for the second startup. Which ONE of the following states 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 a higher rod position (rods further out of the core).

d. The second startup will result in a higher rod position (rods further out of the core).

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 004 (1.00)

The effective neutron multiplication factor, K_{eff} , is defined as:

a. production/(absorption + leakage)

b. (production + leakage)/absorption

c. absorption + leakage)/production

d. absorption/(production + leakage)

QUESTION: 005 (1.00)

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

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

a. fast non-leakage probability

b. resonance escape probability

c. reproduction factor

d. thermal utilization factor

QUESTION: 006 (1.00)

INELASTIC SCATTERING can be generally described as a process whereby a neutron collides with a nucleus and:

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

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

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 007 (1.00)

For the same constant reactor period, which ONE of the following transients requires the SHORTEST time to occur? A power increase of:

a. 5% of rated power, from 1% to 6% of rated power.

b. 10% of rated power, from 10% to 20% of rated power.

c. 15% of rated power, from 20% to 35% of rated power.

d. 20% of rated power, from 40% to 60% of rated power.

QUESTION: 008 (1.00)

Which ONE of the following is the description of a thermal neutron?

a. A neutron possessing thermal rather than kinetic energy.

b. The primary source of thermal energy increase in the reactor coolant during reactor operation.

c. A neutron that has been produced in a significant time (on the order of seconds) after its initiating fission took place.

d. A neutron that experiences no net change in energy after several collisions with atoms of the diffusing media.

QUESTION: 009 (1.00)

A 1/M curve is being generated as fuel is loaded into the core. After some fuel elements have been loaded, the count rate existing at that time is taken to be the new initial count rate, C_o. Additional elements are then loaded and the inverse count rate ratio continues to decrease. As a result of changing the initial count rate:

a. predicted criticality will occur earlier (i.e., with fewer elements loaded.)

b. predicted criticality will occur later (i.e., with more elements loaded.)

c. predicted criticality will occur with the same number of elements loaded.

d. criticality will be completely unpredictable.

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 010 (1.00)

A reactor is subcritical with a K_{eff} of 0.955. A positive reactivity of 3.5% delta k/k is inserted into the core. At this point, the reactor is:

a. prompt critical.

b. exactly critical.

c. supercritical.

d. subcritical.

QUESTION: 011 (1.00)

Which ONE of the following is responsible for the constant rate of power change several minutes after a reactor scram from full power?

a. The decay of the longest-lived delayed neutron precursor.

b. The decay of the shortest-lived delayed neutron precursor.

c. The mean average decay of the delayed neutron precursors.

d. The decay of fission product gammas producing photo-neutrons.

QUESTION: 012 (1.00)

A reactor contains four control rods. Which ONE of the following would result in a determination of the excess reactivity of the reactor?

a, The reactor is critical at a low power level, with three rods full out and the fourth rod at some position. The reactivity remaining in the fourth rod (i.e., its rod worth from its present position to full out) is the excess reactivity.

b. All four rods are full in. The rods are withdrawn until the reactor becomes critical. The total rod worth withdrawn (i.e., the rod worth from full in to the present positions) is the excess reactivity.

c. The reactor is at full power. The total rod worth withdrawn (i.e., the rod worth from full in to the present positions) is the excess reactivity.

d. The reactor is at full power. The total rod worth remaining in all rods (i.e., their rod worths from their present positions to full out) is the excess reactivity.

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 013 (1.00)

Which ONE of the following describes the response of the subcritical reactor to equal insertions of positive reactivity as the reactor approaches criticality at low power? Each reactivity insertion causes:

a. a SMALLER increase in the neutron flux, resulting in a LONGER time to reach equilibrium.

b. a LARGER increase in the neutron flux, resulting in a LONGER time to reach equilibrium.

c. a SMALLER increase in the neutron flux, resulting in a SHORTER time to reach equilibrium.

d. a LARGER increase in the neutron flux, resulting in a SHORTER time to reach equilibrium.

QUESTION: 014 (1.00)

Which ONE statement below describes a negative temperature coefficient?

a. When temperature decreases, negative reactivity is added.

b. When temperature increases, positive reactivity is added.

c. When temperature decreases, reactor power decreases.

d. When temperature decreases, positive reactivity is added.

QUESTION: 015 (1.00)

The Rx is shutdown by 5% $\Delta K/K$ with a count rate of 100 cps on the start up channel. Rods are withdrawn until the count rate is 1000 cps. Which ONE of the following is the condition of the reactor after the rods are withdrawn?

a. Critical with $K_{eff} = 1.0$

b. Subcritical with $K_{eff} = 0.995$

c. Subcritical with $K_{eff} = 0.950$

d. Supercritical with $K_{eff} = 1.005$

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 016 (1.00)

Which ONE of the following elements will slow down fast neutrons LEAST quickly, i.e., produces the smallest energy loss per collision?

a. Oxygen-16

b. Uranium-238

c. Hydrogen-1

d. Boron-10

QUESTION: 017 (1.00)

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

a. delayed neutrons continue 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-136 is stable and does not decay.

d. the half-life for the decay of Nd-149 is shorter than the half-life for the decay of Pm-149.

QUESTION: 018 (1.00)

The term "prompt critical" refers to:

a. the instantaneous jump in power due to a rod withdrawal.

b. a reactor which is super-critical using only prompt neutrons.

c. a reactor which is critical using both prompt and delayed neutrons.

d. a reactivity insertion which is less than Beta-effective.

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

QUESTION: 019 (1.00)

The reactor is operating at 50 kilowatts. Which one of the following is the INITIAL reactor period which would result from a 10°F decrease in moderator temperature? The following data is provided:

$\lambda_{eff} = 0.1\ sec^{-1}$ $\beta_{eff} = 0.0075$ $\alpha_T = -1.5 \times 10^{-4}\ \Delta K/K/°F$ $\ell^* = 5 \times 10^{-5}$ sec

a. 25 seconds

b. 30 seconds

c. 40 seconds

d. 50 seconds

QUESTION: 020 (1.00)

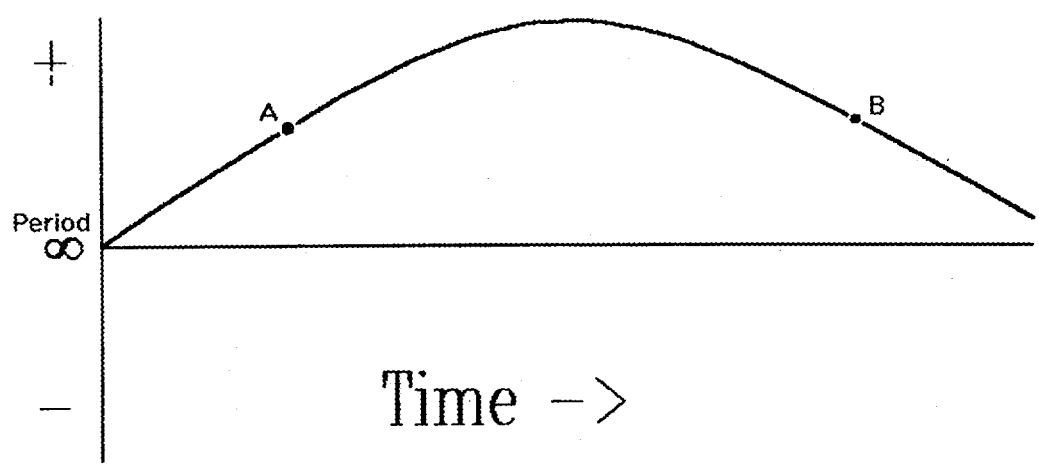
Shown below is a trace of reactor period as a function of time. Between points A and B, **reactor power** is:

a. continually decreasing.

b. increasing, then decreasing.

c. continually increasing.

d. constant.



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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 001 (1.00)

Which ONE of the following is FALSE?

Potential excess reactivity includes

a. Experimental reactivity worth.

b. Maximum credible primary coolant temperature reactivity change.

c. Xenon and Samarium poison reactivity worth.

d. Reactivity that can be added by remote manipulation of the rods.

QUESTION: 002 (1.00)

With regard to Radiation Work Permits (RWPs), which ONE of the following statements is FALSE?

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

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

c. The RWP can be approved by a SRO.

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

QUESTION: 003 (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 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.

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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 004 (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.

QUESTION: 005 (1.00)

Which ONE of the following applies 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: 006 (1.00, O.25 PER CORRECT MATCH)

Match each of the following actions in Column A with the correct term from the Technical Specifications in Column B. Only one term from Column B may be used for each action in Column A.

Column A	Column B
a. Placing a source next to a radiation detector and observing meter movement.	1. Channel Check
b. Immersing a thermometer in an ice bath, then in boiling water and noting the readings.	2. Channel Test
c. Performing a determination of reactor power with a heat balance, then adjusting a power meter to correspond to the heat balance.	3. Channel Calibration
d. Observing the overlap between two different neutron detectors as power increases.	

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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 007 (1.00)

"The average scram time (inflight time) of the four safety rods shall not exceed 300 msec." This preceding sentence is an example of a:

a. safety limit.

b. limiting safety system setting.

c. limiting condition for operation.

d. surveillance requirement.

QUESTION: 008 (1.00)

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

a. Limit potential reactivity insertion for cold water transient to less than 0.76$.

b. Limit gas pressure between the fuel and cladding to maintain fuel cladding integrity.

c. Limit the Departure from Nuclear Boiling Ratio in the hottest fuel element and preclude fuel damage due to a rise in surface temperature.

d. Limit power to assumptions used for experiment accident analyses to preclude radioactive material inventories greater than assumed.

QUESTION. 009 (1.00, 0.25 PER CORRECT MATCH)

Match the 10 CFR Part 55 requirements listed in Column A for an actively licensed operator with the correct time period from Column B. Column B answers may be used once, more than once, or not at all.

	Column A	Column B	
a.	License Expiration	1.	1 year
b.	Medical Examination	2.	2 years
c.	Requalification Written Examination	3.	3 years
d.	Requalification Operating Test	4.	6 years

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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 010 (1.00)

A survey instrument with a window probe is used to measure the beta-gamma dose rate from an irradiated experiment. The dose rate is 100 mrem/hour with the window open and 60 mrem/hour with the window closed. The gamma dose rate is:

a. 40 mrem/hour.

b. 60 mrem/hour.

c. 100 mrem/hour.

d. 160 mrem/hour.

QUESTION: 011 (1.00)

in accordance with 10 CFR 20, 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: 012 (1.00)

Which ONE of the following is FALSE with regard to Technical Specifications?

A licensed Senior Reactor Operator shall be present at the NTR Facility 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 equal to 1.76$.

d. reactor fuel loading.

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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 013 (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 10 CFR 20?

a. "CAUTION RADIATION AREA"

b. "CAUTION HIGH RADIATION AREA"

c. "CAUTION RADIOACTIVE MATERIAL"

d. "GRAVE DANGER, VERY HIGH RADIATION AREA"

QUESTION 014 (1.00)

Which ONE of the following is TRUE for 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 015 (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 specific emergency measures.

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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 016 (1.00)

Which ONE of the following is TRUE with regard to 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 a licensed senior reactor operator 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 licensed senior reactor operator 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 an licensed operator without further action or notification.

QUESTION: 017 (1.00)

Which ONE of the following is TRUE with regard to 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.

QUESTION: 018 (1.00)

Which ONE of the following conditions is NOT allowed by Technical Specifications when the reactor is operating?

a. Operation at 0.1 kilowatt with reactor cell pressure at 1.0 inch of water negative pressure with respect to the control room.

b. Operation at 0.1 kilowatt with the stack particulate monitor inoperable.

c. Shutdown Margin equal to 0.76$.

d. Core outlet temperature equal to 230 degrees F.

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

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

QUESTION: 019 (1.00)

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

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

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

c. To ensure that de-mineralizer resins are not damaged.

d. To ensure that the reactor will be shut down.

QUESTION: 020 (1.00)

Which ONE of the following statements is TRUE regarding the 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 0.5$ or less to limit power excursions.

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

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 001 (1.00)

Which ONE of the following locations has the larger typical radiation level while the reactor is operating at full power and with the north and south cell horizontal cavity shield shutters open?

a. Outside end of removable plug in east wall of the reactor cell.

b. The reactor console.

c. South cell roof.

d. North cell room.

QUESTION: 002 (1.00)

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

a. Insert on scram to shutdown the reactor.

b. Provide neutron reflection.

c. Limit available reactivity or increase shutdown margin.

d. Provide neutron moderation.

QUESTION: 003 (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 rods yellow lights are energized.

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

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

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

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 004 (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?

a. To ensure that safety and control rod magnets are energized.

b. To ensure that instrumentation is seeing the neutron source for reactor startup.

c. To ensure that control rods are not withdrawn before safety rods are all withdrawn.

d. To ensure that the reactor can be shut down.

QUESTION: 005 (1.00)

Which ONE of the following is FALSE about 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: 006 (1.00 TOTAL OR 0.25 PER CORRECT ANSWER)

For the movable neutron absorbers listed in Column I, select the appropriate absorbing material from Column II. Items in Column II may be used once, more than once, or not at all.

	Column I		Column II
a.	Coarse Control Rods.	1.	Cadmium.
b.	Fine Control Rod.	2.	Graphite.
c.	Safety Rods.	3.	Boron-carbide.
d.	Poison Sheets.	4.	Silver-Indium-Cadmium Alloy

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 007 (1.00)

For the sentence:

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

Which ONE of the following correctly fills in the blanks?

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 a location to take samples for radioactive particulates; alarms at the reactor console.

d. a location to take samples; scrams the reactor.

QUESTION: 008 (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: 009 (1.00)

Which ONE of the following is the function of the core delta P instrument?

a. Directs overflow to fuel loading tank on high setpoint.

b. Scrams the reactor on low setpoint.

c. Alarms at the console on low setpoint.

d. Shuts down primary coolant pumps to avoid net positive suction head problem on low setpoint.

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 010 (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 breaker supplying power to the safety rod magnets, and the console manual scram does not.

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

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

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

QUESTION: 011 (1.00)

Which ONE of the following is TRUE with regard to the low differential pressure between the reactor cell and the control room?

a. If the pressure difference drops below the set-point, a reactor scram is actuated.

b. If the pressure difference drops below the set-point, the north and south cell doors can not be opened.

c. If the pressure difference drops below the set-point and reactor power is greater than 0.1 kilowatt, reactor power is manually lowered to ≤0.1 kilowatt immediately.

d. If the pressure difference drops below the set-point and reactor power is greater than 0.1 kilowatt, reactor power is automatically lowered to ≤0.1 kilowatt.

QUESTION: 012 (1.00)

Which ONE of the following is TRUE with regard to the holes in the primary coolant flow-distributor tube?

a. They distribute flow uniformly.

b. They distribute flow to enhance shielding.

c. They have baffle plates to prevent flow impingement on fuel.

d. They distribute flow to correspond to the core power distribution.

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 013 (1.00)

Which ONE of the following is why two special sections of the graphite reflector-moderator are removable?

a. To allow experiment insertion.

b. To allow manual neutron monitoring.

c. To allow movement of poison sheets.

d. To allow inspection of the fuel container.

QUESTION: 014 (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-closed solenoid valve on top of the empty heater housing located between the heat exchanger and the primary pump.

QUESTION: 015 (1.00)

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

a. Holes in rod guide to regulate fluid displacement.

b. Primary coolant flow.

c. Spiral springs.

d. Air dash pot shock absorber

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 016 (1.00)

Which ONE of the following is the function of the photo electric sensor for the south cell?

a. Alerts reactor operator to traffic to or from the cell.

b. Alerts reactor operator to cell door opening.

c. Alerts reactor operator to cell door closing.

d. Alerts reactor operator to shutter not closed.

QUESTION: 017 (1.00)

Which ONE of the following is FALSE about the drive-in limit switches on the safety rods?

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

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

c. They energize green lights at console.

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

QUESTION: 018 (1.00)

Which ONE of the following is the difference between a reactor scram with electrical power and a reactor scram without electrical power? 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 indications and lights.

c. The secondary coolant pump would stop.

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

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

C. FACILITY AND RADIATION MONITORING SYSTEMS

QUESTION: 019 (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 the position it was in 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.

QUESTION: 020 (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.

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

A. REACTOR THEORY, THERMODYNAMICS & 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 AND 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

$Q = m\, c_p\, \Delta T$	$CR_1\ (1\text{-}Keff)_1 = CR_2\ (1\text{-}Keff)_2$
$P = P_0\, e^{(t/\tau)}$	$\tau = (\ell^*/\rho) + [(\beta-\rho)/\lambda_{eff}\rho]$
$\lambda_{eff} = 0.1$ seconds^{-1}	$DR_1 D_1^2 = DR_2 D_2^2$
$DR = DR_0 e^{-\lambda t}$	$DR = 6CiE/D^2$
$\rho = (Keff-1)/Keff$	1 ft^3 (water) = 7.48 gallons
1 kW = 3413 Btu/hour	1 gallon (water) = 8.34 pounds
°F = 9/5°C + 32	°C = 5/9 (°F - 32)

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

ANSWER: 001
B.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 002
B.
REFERENCE:
Reactor Physics Training Manual, Section E, Neutron Slowing Down Theory.

ANSWER: 003
A.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 004
A.
REFERENCE:
Reactor Physics Training Manual, Section C, The Nuclear Fission Process.

ANSWER: 005
B.
REFERENCE:
Reactor Physics Training Manual, Section D, Neutron Multiplication Factors.

ANSWER: 006
A.
REFERENCE:
Reactor Physics Training Manual, Section B, Types of Nuclear Reactions.

ANSWER: 007
D.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 008
D.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 009
C.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 010
D.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 011
A.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 012
A.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 013
B.
REFERENCE:
Reactor Physics Training Manual, Section H, Subcritical Multiplication.

ANSWER: 014
D.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

ANSWER: 015
B.
REFERENCE: Reactor Physics Training Manual, Section H, Subcritical Multiplication.
CR_1 $(1\text{-Keff})_1$ = CR_2 $(1\text{-Keff})_2$ 100(1-0.95)=1000(1-Keff) 0.005=1-Keff Keff=0.995

ANSWER: 016
B.
REFERENCE:
Reactor Physics Training Manual, Section E, Neutron Slowing Down Theory.

ANSWER: 017
B.
REFERENCE:
Reactor Physics Training Manual, Section F, Fission Product Poisoning.

ANSWER: 018
B.
REFERENCE:
Reactor Physics Training Manual, Section A, Basic Reactor Physics Definitions.

ANSWER: 019
C:
REFERENCE:
Reactor Physics Training Manual, Section H, Period = $\tau = (\ell^*/\rho) + [(\beta-\rho)/\lambda_{eff}\rho]$
$(5\times10^{-5}\text{sec}/(-1.5 \times 10^{-4}\ \Delta K/K/°F)(-10\ °F))+(0.0075-(-1.5 \times 10^{-4}\ \Delta K/K/°F)(-10\ °F)/(0.1\text{sec}^{-1})(-1.5 \times 10^{-4}\ \Delta K/K/°F)(-10\ °F))$ (note first term is insignificant so drop)
=0.0075-(0.0015)/0.00015=0.006/.00015=40 sec

ANSWER: 020
C.
REFERENCE:
Reactor Physics Training Manual, Section I, Reactor Kinetics.

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

ANSWER: 001
C.
REFERENCE:
GE NTR SOP 6.6, Section 6.1.19, page 7.

ANSWER: 002
D.
REFERENCE:
GE NTR SOP 7.9, Sections 6.2, 8.2, 7.2, and 9, pages 2 through 6.

ANSWER: 003
A.
REFERENCE:
GE NTR SOP 9.9, Sections 6.7& 6.9, 6.8, 6.2, 6.10, pages 3 and 6.

ANSWER: 004
C.
REFERENCE:
GE NTR SOP 7.2, Section 4, page 3.

ANSWER: 005
D.
REFERENCE:
GE NTR SOP 2.4, Section 5.1, page 5.

ANSWER: 006
A,2; B,2; C,3; D,1.
REFERENCE:
GE NTR Technical Specifications, Definitions.

ANSWER: 007
C.
REFERENCE:
GE NTR Technical Specification 3.2.3.5.

ANSWER: 008
C
REFERENCE:
GE NTR Technical Specification 2.1.4

ANSWER: 009
A,4; B,2; C,2; D,1
REFERENCE:
10 CFR 55 and SOP 9.14, Section 5

ANSWER: 010
B.
REFERENCE:
NTR SOP 7.4, Section 6.1.5 (8), page 11.
The window stops the betas, and so the gamma dose rate is 60 mrem/hour.

ANSWER: 011
A.
REFERENCE:
10 CFR 20.1003

ANSWER: 012
A.
REFERENCE:
NTR Technical Specification 6.1.3.2.

ANSWER: 013
B.
REFERENCE:
10 CFR 20.1003 and 20.1902, at 30 cm the point source dose is >100 mrem/hr so it's a high rad area..

ANSWER: 014
D.
REFERENCE:
NTR SOP 1.2, page 1 and 2.

ANSWER: 015
A.
REFERENCE:
NTR Emergency Plan, Section 5.

ANSWER: 016
B.
REFERENCE:
NTR SOP 9.2, Section 7, page 6.

ANSWER: 017
D.
REFERENCE:
GE NTR Procedure 7.10, Section 2.D page 2.

ANSWER: 018
D.
REFERENCE:
GE Tech Spec 3.4.3.1, Tech Spec 3.4.3.5, Tech Spec 3.1.3.3, and Tech Spec Table 3-1.

ANSWER: 019
D.
REFERENCE:
GE NTR Tech Specs Section 3.2.4, page 3-7.

ANSWER: 020
A.
REFERENCE:
GE NTR Tech Specs Section 3.3.4, page 3-10.

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER: 001
C.
REFERENCE:
GE NTR SAR Section 10.6, page 10-4.

ANSWER: 002
C.
REFERENCE:
GE NTR SAR Section 8.5, page 8-16.

ANSWER: 003
C.
REFERENCE:
GE NTR SAR Section 8.5, pages 8-18 through 21.

ANSWER: 004
B.
REFERENCE:
GE NTR SAR, Section 8.1, pages 8-1 and 2.

ANSWER: 005
D.
REFERENCE:
GE NTR SAR, Section 4.4, pages 4-6 & 7.

ANSWER: 006
a___3__b__3__c__3__ d__1__
REFERENCE:
GE NTR SAR, Section 4.6 page 4-8.

ANSWER: 007
A
REFERENCE:
GE NTR SAR, Section 6.7 page 6-4.

ANSWER: 008
B.
REFERENCE:
GE NTR SAR, Section 5.3 page 5-6.

ANSWER: 009
C.
REFERENCE:
GE NTR SAR Section 5.2, Figure 5.1, page 5-2, and SOP 8.4, page 41.

ANSWER: 010
B.
REFERENCE:
GE NTR SAR, Sections 8.3.1 and 8.3.2, pages 8-4 & 8-6, and SOP 2.1, Sections 6.1 & 7, pages 4& 5.

ANSWER: 011
C.
REFERENCE:
GE NTR SAR, Section 8.4 page 8-11.

ANSWER: 012
D.
REFERENCE:
GE NTR SAR, Section 4.2 pages 4-1 and 4-4.

ANSWER: 013
D.
REFERENCE:
GE NTR SAR, Section 4.5 page 4-8.

ANSWER: 014
A.
REFERENCE:
GE NTR SAR, Section 5.2 page 5-5.

ANSWER: 015
D.
REFERENCE:
GE NTR SAR Section 8.5, page 8-19.

ANSWER: 016
A.
REFERENCE:
GE NTR SAR, Section 8.2 page 8-3.

ANSWER: 017
B.
REFERENCE:
GE NTR SAR, Section 8.5 page 8-19.

ANSWER: 018
A
REFERENCE:
GE NTR SAR, Section 11.3.1, pages 11-8 and 11-9.

ANSWER: 019
C.
REFERENCE:
GE NTR SAR, Section 11.3.2, page 11-9.

ANSWER: 020
D.
REFERENCE:
GE NTR SAR Section 8.8, pages 8-25 & 27.