July 14, 2004

Dr. David M. Slaughter, Director
UC Davis McClellan Nuclear Radiation Center
5335 Price Avenue
McClellan, CA 95652

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-607/OL-04-01,
UC DAVIS/McCLELLAN NUCLEAR RADIATION CENTER

Dear Dr. Slaughter:

During the week of June 21, 2004, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your MNRC 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. 50-607

Enclosures: 1. Initial Examination Report No. 50-607/OL-04-01
2. Examination and answer key

cc w/encls:
Please see next page

cc:

Mr. Jeff Ching
5335 Price Avenue, Bldg. 258
McClellan AFB, CA 95652-2504

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

July 14, 2004

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UC Davis McClellan Nuclear Radiation Center
5335 Price Avenue
McClellan, CA 95652

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-607/OL-04-01, UC DAVIS/McCLELLAN NUCLEAR RADIATION CENTER

Dear Dr. Slaughter:

During the week of June 21, 2004, the NRC administered initial examinations to employees of your facility who had applied for a license to operate your University of Missouri 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.

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Please see next page

DISTRIBUTION w/encls.:
PUBLIC
WEresian
Facility File (EBarnhill)

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

EXAMINATION PACKAGE ACCESSION #: ML040570830
EXAMINATION REPORT ACCESSION #: ML041830548 **TEMPLATE #: NRR-074**

OFFICE	RNRP:CE		IROB:LA		RNRP:SC	
NAME	WEresian		EBarnhill		PMadden	
DATE	07/ 5 /2004		07/ 9 /2004		07/ 12 /2004	

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

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

REPORT NO.:	50-607/OL-04-01
FACILITY DOCKET NO.:	50-607
FACILITY LICENSE NO.:	R-130
FACILITY:	University of California/Davis - MNRC
EXAMINATION DATES:	June 21-22, 2004
EXAMINERS:	Warren Eresian, Chief Examiner

SUBMITTED BY: **/RA/** 06/ 30 /2004
Warren Eresian, Chief Examiner Date

SUMMARY:

During the week of June 21, 2004, the NRC administered operator licensing examinations to one Senior Reactor (Upgrade) candidate and two Senior Reactor Operator (Instant) candidates. All candidates passed the examinations.

ENCLOSURE 1

REPORT DETAILS

1. Examiners: Warren Eresian, Chief Examiner

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	**N/A**	**2/0**	**2/0**
Operating Tests	**N/A**	**3/0**	**3/0**
Overall	**N/A**	**3/0**	**3/0**

3. Exit Meeting:

Dr. David Slaughter, Reactor Director
Mr. Guy Steingass, Operations Supervisor
Warren Eresian, NRC Chief Examiner

The NRC thanked the facility staff for their cooperation during the examinations. The facility provided comments on the written examination, resulting in the deletion of two questions and the acceptance of two correct answers for two other questions.

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

FACILITY: University of California - Davis, McClellan Nuclear Radiation Center

REACTOR TYPE: TRIGA

DATE ADMINISTERED: 06/21/2004

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	35	______	____	A. REACTOR THEORY, THERMODYNAMICS, AND FACILITY OPERATING CHARACTERISTICS
20	35	______	____	B. NORMAL AND EMERGENCY OPERATING PROCEDURES AND RADIOLOGICAL CONTROLS
18	30	______	____	C. FACILITY AND RADIATION MONITORING SYSTEMS
58	100	______		

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)

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: 002 (1.00)

A reactor is critical at 50% of rated power, with reactivity = zero. A control rod is withdrawn and the power increases to a higher steady-state value. The reactivity of the reactor at the higher power level is zero because:

a. the positive reactivity due to the fuel temperature decrease balances the negative reactivity due to the control rod withdrawal.

b. the negative reactivity due to the fuel temperature decrease equals the positive reactivity due to the control rod withdrawal.

c. the positive reactivity due to the fuel temperature increase balances the negative reactivity due to the control rod withdrawal.

d. the negative reactivity due to the fuel temperature increase equals the positive reactivity due to the control rod withdrawal.

QUESTION: 003 (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

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

QUESTION: 004 (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: 005 (1.00)

Which ONE of the following describes the relationship between thermal neutron flux and reactor power?

a. Power is proportional to the square of the thermal neutron flux.

b. Power is proportional to the square root of the thermal neutron flux.

c. Power is proportional to the thermal neutron flux.

d. Power and thermal neutron flux are independent of each other.

QUESTION: 006 (1.00)

A reactor is operating at a steady-state power level of 1.000 kW. Power is increased to a new steady-state value of 1.004 kW. At the higher power level, K_{eff} is:

a. 1.004

b. 1.000

c. 0.004

d. 0.000

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

QUESTION: 007 (1.00)

During fuel loading, which ONE of the following will have NO effect on the shape of the 1/M 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.

QUESTION: 008 (1.00)

A reactor is slightly supercritical with the following values for each of the factors in the six-factor formula:

Fast fission factor =	1.03
Fast non-leakage probability =	0.84
Resonance escape probability =	0.96
Thermal non-leakage probability =	0.88
Thermal utilization factor =	0.70
Reproduction factor =	1.96

A control 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. 0.702

c. 0.704

d. 0.708

QUESTION: 009 (1.00)

Reactor power is increasing by a factor of 10 every minute. The reactor period is:

a. 65 seconds.

b. 52 seconds.

c. 26 seconds.

d. 13 seconds.

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

QUESTION: 010 (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.

QUESTION: 011 (1.00)

Which ONE of the following would <u>increase</u> the shutdown margin of a reactor?

a. Inserting an experiment that adds positive reactivity.

b. Lowering the moderator temperature, if the moderator temperature coefficient is positive.

c. Depletion of burnable poison.

d. Depletion of uranium fuel.

QUESTION: 012 (1.00)

Which ONE of the following statements correctly describes the influence of delayed neutrons during the neutron life cycle?

a. Delayed neutrons are more likely to cause fission after they become thermalized because they thermalize more quickly than prompt neutrons.

b. Delayed neutrons take longer to thermalize because they are born at a higher average energy than prompt neutrons.

c. Delayed neutrons increase the average neutron generation time.

d. Delayed neutrons are produced some time after prompt neutrons and make up the majority of neutrons produced by fissions.

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

QUESTION: 013 (1.00)

Which ONE statement below describes a positive fuel temperature coefficient?

a. When fuel temperature increases, positive reactivity is added.

b. When fuel temperature decreases, positive reactivity is added.

c. When fuel temperature increases, negative reactivity is added.

d. When fuel temperature increases, reactor power decreases.

QUESTION: 014 (1.00)

Reactivity may be defined as a measure of:

a. the number of neutrons (both prompt and delayed) produced in the core.

b. the multiplication factor, K_{eff}.

c. heat energy produced by the reactor.

d. the fractional change in the neutron population per generation.

QUESTION: 015 (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: 016 (1.00)

A reactor is operating at a constant power level with equilibrium xenon. Reactor power is then doubled. The equilibrium xenon level at the higher power level will be:

a. higher than its value at the lower power level, but not twice as high.

b. twice as high.

c. more than twice as high.

d. the same as at the lower power level.

QUESTION: 017 (1.00)

Which ONE of the following statements correctly describes a characteristic of subcritical multiplication?

a. The number of neutrons gained per generation doubles for each succeeding generation.

b. A constant neutron population is achieved when the total number of neutrons produced in one generation is equal to the number of source neutrons added in the next generation.

c. For equal reactivity additions, it requires less time for the equilibrium neutron population to be reached.

d. When the indicated count rate doubles, the margin to criticality has been reduced by approximately one-half.

QUESTION: 018 (1.00)

Which ONE of the following describes the shape of an integral rod worth curve?

a. S-shaped, with a maximum at the top of the core height.

b. Cosine shaped, with the maximum at the middle of the core height.

c. Bell-shaped, with the maximum at the middle of the core height.

d. A curve proportional to the square of the neutron flux, with a maximum at the top of the core height.

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

QUESTION: 019 (1.00)

The term prompt critical refers to:

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

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

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

d. a reactivity insertion which is less then β_{eff}.

QUESTION: 020 (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.

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

QUESTION: 001 (1.00)

During reactor operation a BAY CAM ALARM IS RECEIVED. The reactor operator should:

a. secure HV-1, HV-2 and HV-3.

b. secure EF-2 and isolate the radiography bays.

c. notify the SRO and have all neutron shutters closed.

d. notify HP personnel and the SRO.

QUESTION: 002 (1.00)

In accordance with the Technical Specifications, which ONE condition below is NOT permissible when the reactor is operating?

a. Scram time of a control rod = 1 second.

b. Depth of water above bottom of reactor tank = 23.5 feet.

c. Facility Stack Monitor out of service for maintenance.

d. Reactor Room exhaust system out of service for maintenance.

QUESTION: 003 (1.00)

A radiation survey of an area reveals a general radiation reading of 1 mrem/hr. There is, however, a small pipe which reads 10 mrem/hr at one (1) meter. Assuming that the pipe can be considered a point source, which ONE of the following defines the posting requirements for the area in accordance with 10CFR Part 20?

a. Restricted Area.

b. Radiation Area.

c. High Radiation Area.

d. Grave Danger, Very High Radiation Area.

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

QUESTION: 004 (1.00)

During fuel movement operations, the building evacuation horn sounds. The reactor operator should immediately:

a. ensure that all personnel have evacuated.

b. report to the assembly area.

c. report to the Operations Supervisor for instructions.

d. ensure that all fuel is logged in its authorized location.

QUESTION: 005 (1.00)

“Rounds” readings should be taken prior to:

a. reactor startup.

b. reactor startup and during performance of the Shift Inspection Checklist.

c. reactor startup and approximately every four hours thereafter.

d. reactor startup and approximately every two hours thereafter.

QUESTION: 006 (1.00)

Upon receipt of a DEMIN. OUTLET CONDTVTY alarm, the reactor operator should:

a. scram the reactor and notify the SRO.

b. notify the SRO and switch to the spare set of resin canisters.

c. reduce reactor power to less than 1.5 MW and notify the SRO.

d. notify the SRO and manually check the primary water conductivity.

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

QUESTION: 007 (1.00)

The role of Emergency Director during dayshift operations is normally assumed by the:

a. SRO on duty.

b. Reactor Operations Supervisor.

c. Supervisory Health Physicist.

d. Facility Director.

QUESTION: 008 (1.00)

In the event of an unscheduled scram due to instrument malfunction or unexplained failure, the reactor operator should:

a. write a complete description of the incident and submit it to the Operations Supervisor.

b. satisfactorily perform those portions of the Startup Checklist that pertain to the incident.

c. satisfactorily perform the reactor's prestart checks.

d. verify the calibration of the malfunctioning instrument.

QUESTION: 009 (1.00)

Final approval to perform an experiment is granted when the SRO on duty signs the:

a. Experimenter Approval Request.

b. Experiment Request.

c. Reactor Facility Irradiation Summary.

d. Irradiation Request.

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

QUESTION: 010 (1.00)

A reactor core manipulation is defined as any in-tank movement of:

a. fuel elements, control rods, graphite reflector elements, or in-tank beam tube assemblies.

b. fuel elements or control rods.

c. fuel elements, control rods, graphite reflector elements, in-tank beam tube assemblies, in-tank fuel storage racks or the fuel transfer cask.

d. fuel elements, control rods or graphite reflector elements.

QUESTION: 011 (1.00)

The Fuel Handling Checklist is required to be completed:

a. at the first opportunity each week before any reactor core manipulation.

b. prior to the commencement of, and each day of, any reactor core manipulation.

c. at the beginning of each shift, before any reactor core manipulation.

d. at the beginning of each shift, before any movement of fuel elements or control rods.

QUESTION: 012 (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. limits on the release of effluents to an unrestricted area.

c. the dose equivalent to organs that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

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

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

QUESTION: 013 (1.00)

The dose rate from a mixed beta-gamma source is 100 mrem/hour at a distance of one (1) foot, and is 0.1 mrem at a distance of twenty (20) feet. What percentage of the source consists of beta radiation?

a. 20%.

b. 40%.

c. 60%.

d. 80%.

QUESTION: 014 (1.00)

The Maximum Hypothetical Accident for the MNRC reactor is:

a. the uncontrolled withdrawal of all control rods.

b. the loss of coolant accident (LOCA)

c. a cladding rupture of one highly irradiated fuel element in air.

d. a fuel loading error.

QUESTION: 015 (1.00)

During performance of the Shift Inspection Checklist, the reactor operator notices that the helium bottle pressure is less than 200 psig. The reactor operator should:

a. secure the beam port inserts.

b. change the helium bottle.

c. inform the SRO.

d. make a notation in the “Green Book.”

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

QUESTION: 016 (1.00)

The absolute total reactivity worth of all in-tank experiments shall be less than:

a. $1.75.

b. $1.92.

c. $2.12.

d. $3.00.

QUESTION: 017 (1.00)

The Emergency Action Station (EAS) is normally located at the:

a. Facility Director's office.

b. Staging Area 1.

c. reactor control room.

d. assembly area.

QUESTION: 018 (1.00)

"Control rod worths shall be determined annually or after physical removal or any significant change in core or control rod configuration." This is an example of a(n):

a. safety limit.

b. limiting safety system setting.

c. limiting condition for operation.

d. surveillance requirement.

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

QUESTION: 019 (1.00)

A system or component is defined as "operable" by the Technical Specifications if:

a. a channel test has been performed.

b. it is capable of performing its intended function.

c. it has no outstanding testing or surveillance requirements.

d. a channel check has been performed.

QUESTION: 020 (1.00)

The facility stack monitor has been out of service for one hour. As a result:

a. the reactor cannot be operated and must be shut down.

b. the reactor can continue to operate.

c. the reactor can continue to operate only if the monitor is replaced with a portable monitor with its own alarm.

d. the reactor can continue to operate only if no experiment or maintenance activities are conducted which could result in alarm conditions.

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

QUESTION: 001 (1.00)

Primary system flow is measured by:

a. using a turbine-style flow meter mounted in the primary system piping.

b. using a liquid- vortex flow meter mounted in the primary system piping.

c. using an ultrasonic flow sensor mounted on the outside of the primary system piping.

d. using differential pressure readings across the discharge of the primary pumps.

QUESTION: 002 (1.00)

Low water level in the cooling tower is corrected by:

a. periodically filling from the city water supply.

b. adding the water via a hose after the tower has been drained and cleaned.

c. adding makeup water while the reactor is shutdown.

d. the opening of a float valve when level is low.

QUESTION: 003 (1.00)

The stack damper affects effluents from the bay ventilation system:

a. and the reactor room ventilation system.

b. and the pneumatic transfer system.

c. the reactor room ventilation system and the pneumatic transfer system.

d. the reactor room ventilation system, the pneumatic transfer system and the building ventilation system.

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

QUESTION: 004 (1.00)

In the event of a power failure, the emergency electrical generator provides:

a. emergency backup to the building.

b. emergency power to the ECCS pump, EF-1, and the temperature control panel.

c. 15 minutes of emergency power to the CSC, DAC, translators, RAMs and CAMs.

d. emergency electrical power for the AMUWS pump, EF-1 and the temperature control panel.

QUESTION: 005 (1.00)

After a reactor room CAM alarm has been cleared, the reactor room ventilation system is restored to normal operation by:

a. pressing the CAM reset button on the temperature control panel.

b. restarting AC-1.

c. switching the reactor room ventilation from the RECIRC mode back to the NORMAL mode.

d. restarting AC-2.

QUESTION: 006 (1.00)

Valve ECC-4 in the ECCS is accidentally opened. As a result:

a. water from the ECCS could be added to the reactor.

b. water from the AMUWS could be added to the reactor.

c. water from the diffuser could be directed through the ECCS nozzle.

d. the AMUWS could drain onto the roof.

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

QUESTION: 007 (1.00)

The operator presses the RABBIT SYSTEM POWER (control room interlock) switch on the auxiliary console to the ON position. As a result:

a. power is applied to the PTS timer so that it can operate in the AUTO mode.

b. the rabbit is sent into the reactor.

c. the PTS blower is enabled so that the upstairs operator can start it.

d. power is applied to the PTS control box upstairs.

QUESTION: 008 (1.00)

Which ONE of the following is an input to the reactor protective system?

a. Tank temperature.

b. Primary flow.

c. Cooling tower level.

d. Console keyswitch.

QUESTION: 009 (1.00)

The EF-2 audible alarm on the temperature control panels signifies that:

a. there is loss of negative pressure in the reactor room.

b. EF-2 was stopped from the temperature control panel.

c. the stack damper cannot be closed.

d. there is a loss of the radiography bay exhaust fan.

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

QUESTION: 010 (1.00) QUESTION DELETED

In order to ensure that the secondary system pressure is higher than the primary system pressure, the heat exchanger _______________ is maintained at a higher pressure than the heat exchanger _________________.

a. primary outlet pressure; secondary inlet pressure.

b. primary outlet pressure; secondary outlet pressure.

c. primary inlet pressure; secondary inlet pressure.

d. primary inlet pressure; secondary outlet pressure.

QUESTION: 011 (1.00)

The primary purpose of erbium in TRIGA fuel is to:

a. enhance the negative temperature coefficient.

b. limit the prompt reactivity insertion rate.

c. decrease fuel burnup.

d. extend the fuel lifetime.

QUESTION: 012 (1.00)

Which ONE of the following statements is NOT true regarding the interlock system for the bay shutters?

a. Shutter movement can be stopped at any time from any of the three shutter control stations.

b. The shutter can only be opened from the radiography control room if the keyswitch (S2-2) is in place <u>and</u> the bay door is closed.

c. The shutter can only be opened from the bay floor station if the keyswitch (S2-1) is activated.

d. The shutter can be closed at any time (except when a “stop” switch is depressed) from either of the two control stations located in the radiography bay.

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

QUESTION: 013 (1.00) QUESTION DELETED

Which ONE of the conditions below will prevent the operator from manually inserting control rods?

a. Source level below minimum count.

b. Mode switch in the PULSE position.

c. Mode switch in the AUTO position.

d. Two DOWN switches depressed at the same time.

QUESTION: 014 (1.00)

What is the major difference between a standard control rod and the transient control rod?

a. A standard control rod is longer and smaller in diameter.

b. A standard control rod has air dampers.

c. A standard control rods is 20 wt. % uranium, while the transient rod is only 8.5 wt. %.

d. A standard control rods is fuel followed, while the transient control rod is air followed.

QUESTION: 015 (1.00)

Which ONE of the following could cause a RX HX OUTLET TEMP alarm?

a. Low water level in the reactor tank.

b. High water level in the cooling tower.

c. Loss of flow through the diffuser piping.

d. Low flow through the secondary system.

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

QUESTION: 016 (1.00)

The controller for the cooling tower fan is in the AUTO position. The temperature of the primary coolant returning to the reactor tank is 75 degrees F. As a result:

a. the cooling tower fan is operating, and will stop if the temperature of the primary coolant reaches 70 degrees F.

b. the cooling tower fan is not operating, and will start if the temperature of the primary coolant reaches 70 degrees F.

c. the cooling tower fan is operating, and will stop if the temperature of the primary coolant reaches 88 degrees F.

d. the cooling tower fan is not operating, and will start if the temperature of the primary coolant reaches 88 degrees F.

QUESTION: 017 (1.00)

For a control rod, the magnet up limit switch is open, the magnet down limit switch is open, and the rod down limit switch is open. The color of the rod as shown on the high resolution screen will be:

a. black.

b. magenta.

c. green.

d. yellow.

QUESTION: 018 (1.00)

How does the NM-1000 system compensate for the gamma flux?

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

b. The gamma flux is not eliminated, but is part of the total signal from the NM-1000 system.

c. The gamma flux is eliminated by creating an equal and opposite gamma current.

d. The microprocessor uses the Campbelling process to eliminate the gamma signals.

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

QUESTION: 019 (1.00)

The three-position switch for the first primary coolant pump on the motor controller in the equipment room is in the HAND position. As a result:

a. the second primary coolant pump will start without an eight-second time delay after the first pump is started.

b. after the first primary coolant pump is started from the temperature control panel, the second pump will start after an eight-second time delay.

c. the first primary coolant pump cannot be started from the temperature control panel.

d. the first primary coolant pump cannot be started until the three-position switch is moved to AUTO.

QUESTION: 020 (1.00)

Which ONE of the following is the purpose of the shim plates installed on the outer periphery of the reactor core?

a. They provide the means to level the reflector assembly.

b. They provide structural support for the lower grid plate and the suspended core.

c. They provide the means to level the reactor core.

d. They force the water towards the fuel elements and prevent water from bypassing the core.

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

A. REACTOR THEORY, THERMODYNAMICS & FACILITY OPERATING CHARACTERISTICS

ANSWER: 001 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Neutron Interactions.

ANSWER: 002 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Reactivity Coefficients.

ANSWER: 003 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Neutron Moderation.

ANSWER: 004 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Neutron Flux Spectrum.

ANSWER: 005 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Nuclear Theory Sample Questions, No. 48.

ANSWER: 006 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Reactivity Summary.

ANSWER: 007 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Subcritical Multiplication.

ANSWER: 008 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Neutron Life Cycle.

ANSWER: 009 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Equation Sheet.
$P/P_o = 10 = e^{60/T}$; $60/T = 2.303$; $T = 26$ seconds.

ANSWER: 010 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Neutron Cross Sections and Neutron Flux.

ANSWER: 011 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Reactor Operation.

ANSWER: 012 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Prompt and Delayed Neutrons.

ANSWER: 013 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Reactivity Coefficients.

ANSWER: 014 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Reactivity Summary.

ANSWER: 015 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Modes of Radioactive Decay.

ANSWER: 016 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Xenon.

ANSWER: 017 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Subcritical Multiplication.

ANSWER: 018 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Control Rods.

ANSWER: 019 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Reactor Kinetics.

ANSWER: 020 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Nuclear Theory Learning Objectives, Nuclear Theory Sample Questions, No. 35.

B. NORMAL/EMERGENCY PROCEDURES & RADIOLOGICAL CONTROLS

ANSWER: 001 (1.00)
D.
REFERENCE:
MNRC Reactor Operating Instructions.

ANSWER: 002 (1.00)
D.
REFERENCE:
MNRC Reactor Technical Specifications, Section 3.4.

ANSWER: 003 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Radiation Control and Safety.
10 mrem/hr at 1 meter (100 cm.) = 111.1 mrem/hr at 30 cm.

ANSWER: 004 (1.00)
B.
REFERENCE:
MNRC Emergency Plan and Procedures.

ANSWER: 005 (1.00)
C.
REFERENCE:
MNRC Reactor Operating Instructions.

ANSWER: 006 (1.00)
B.
REFERENCE:
MNRC Reactor Operating Instructions.

ANSWER: 007 (1.00)
D.
REFERENCE:
MNRC Emergency Plan and Procedures.

ANSWER: 008 (1.00)
A or B.
REFERENCE:
MNRC Reactor Operating Instructions.

ANSWER: 009 (1.00)
D.
REFERENCE:
MNRC Regulations and Administrative Controls.

ANSWER: 010 (1.00)
A.
REFERENCE:
MNRC Fuel, Fuel Handling and Overhead Cranes.

ANSWER: 011 (1.00)
B.
REFERENCE:
MNRC Fuel, Fuel Handling and Overhead Cranes.

ANSWER: 012 (1.00)
A.
REFERENCE:
10CFR20.

ANSWER: 013 (1.00)
C.
REFERENCE:
GM tubes cannot distinguish between gammas of different energy.

ANSWER: 014 (1.00)
C.
REFERENCE:
MNRC Safety Analysis Report.

ANSWER: 015 (1.00)
C.
REFERENCE:
MNRC Reactor Operating Instructions.

ANSWER: 016 (1.00)
B.
REFERENCE:
MNRC Technical Specifications, Section 3.8.1.

ANSWER: 017 (1.00)
A.
REFERENCE:
MNRC Emergency Plan and Procedures.

ANSWER: 018 (1.00)
D.
REFERENCE:
MNRC Technical Specifications, Section 4.2.

ANSWER: 019 (1.00)
B.
REFERENCE:
MNRC Technical Specifications, Section 1.12.

ANSWER: 020 (1.00)
D.
REFERENCE:
MNRC Technical Specifications, Section 3.7.1.

C. FACILITY AND RADIATION MONITORING SYSTEMS

ANSWER: 001 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 002 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 003 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 004 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 005 (1.00)
A.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 006 (1.00)
B.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 007 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 008 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Reactor Instrumentation and Control.

ANSWER: 009 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Normal, Abnormal and Emergency Procedures.

ANSWER: 010 (1.00) QUESTION DELETED
D.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 011 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Fuel, Fuel Handling and Overhead Cranes.

ANSWER: 012 (1.00)
C.
REFERENCE:
MNRC SAR, page 9-25.

ANSWER: 013 (1.00) QUESTION DELETED
C.
REFERENCE:
MNRC SAR, page 7-11.

ANSWER: 014 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 015 (1.00)
D.
REFERENCE:
MNRC Reactor Operator Training Program, Normal, Abnormal and Emergency Procedures.

ANSWER: 016 (1.00)
A or D.
REFERENCE:
MNRC Operation and Maintenance Manual, Secondary Cooling System.

ANSWER: 017 (1.00)
C.
REFERENCE:
MNRC Operation and Maintenance Manual, Control Rod System.

ANSWER: 018 (1.00)
A.
REFERENCE:
MNRC Operation and Maintenance Manual, Nuclear Instrumentation.

ANSWER: 019 (1.00)
C.
REFERENCE:
MNRC Reactor Operator Training Program, Design and Operating Characteristics.

ANSWER: 020 (1.00)
D.
REFERENCE:
MNRC Operation and Maintenance Manual, Core Structure.

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 _____	QUESTION DELETED
011	a	b	c	d _____	
012	a	b	c	d _____	
013	a	b	c	d _____	QUESTION DELETED
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

$Q = m\, c_p\, \Delta T$

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

$SUR = 26.06/\tau$

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

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

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

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

$\text{Doserate}_1 \times D_1^2 = \text{Doserate}_2 \times D_2^2$

$DR = DR_o e^{-\lambda t}$

$DR = 6CiE/D^2$

$\rho = (\text{Keff}-1)/\text{Keff}$

1 Curie = $3.7\text{x}10^{10}$ dps

1 gallon water = 8.34 pounds

1 Btu = 778 ft-lbf

°F = 9/5°C + 32

1 Mw = $3.41\text{x}10^{6}$ BTU/hr

°C = 5/9 (°F - 32)