ENCLOSURE 1

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

REPORT NO.: 50-407/OL-92-01

FACILITY DOCKET NO.: 50-407

FACILITY LICENSE NO.: R-126

FACILITY: University of Utah

EXAMINATION DATES: June 30 - July 2, 1992

EXAMINER: Brian Hughes, Chief Examiner

SUBMITTED BY: for James L. Caldwell 7/16/92
Brian Hughes, Chief Examiner Date

APPROVED BY: James L. Caldwell 7/16/92
James L. Caldwell, Chief Date
Non-Power Reactor Section
Operator Licensing Branch
Division of Licensee Performance
and Quality Evaluation
Office of Nuclear Reactor Regulation

SUMMARY:

During the week of June 29, 1992 the NRC conducted an operator licensing requalification examination on the TRIGA facility. The two senior reactor operators evaluated passed all portions of this examination.

REPORT DETAILS

1. Examiners:

   Brian Hughes, Chief Examiner

2. Results:

	RO (Pass/Fail)	SRO (Pass/Fail	Total (Pass/Fail)
NRC Grading:	N/A	2/0	2/0
Facility Grading:	N/A	2/0	2/0

3. Written Examination:

   The written examination as originally submitted by the facility required changes.

   The as submitted examination tested predominantly at the simple memory level (terms, definitions, setpoints). Since a requalification examination is open reference, this was not appropriate.

   A number of test items, specifically their distractors, required enhancement. Eleven percent of the as submitted examination, contained "all of the above", Twenty two percent of the as submitted examination contained "none of the above".

   The facility changed the submitted examination, which improved the validity and reliability of the requalification examination.

4. Operating Examinations:

   The operating examinations as submitted by the facility were adequate.

5. Exit Meeting:

   An exit meeting was conducted at the facility on July 1, 1992. This meeting was attended by Professor Gary M. Sandquist Ph.D., David M. Slaughter, Ph.D. of the University of Utah, and B. Hughes NRC Chief Examiner.

   Preliminary results were discussed, all personnel passed the operating portion of the requalification examination. The facility provided copies of the written examination and agreed to notify the NRC of their final results within two weeks.

   The results have been provided and are in agreement with the NRC's results. Both individuals passed both the written and operating portions of the requalification examinations.

ENCLOSURE 2

United States Nuclear Regulatory Commission

Requalification Examination
University of Utah
June 30, 1992

U.S.Nuclear Regulatory Commission
Non-Power Reactor License Requalification Examination

Facility: University of Utah

Reactor Type: TRIGA-I

Date Administered June 30, 1992

Region IV

Senior Reactor Opera'or or Reactor Operator____________________________

INSTRUCTIONS:

Answers are to be written on the exam page itself, or the answer sheet provided. Write answers on 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 section is required to pass the examination. Examinations will be picked up three (3) hours after the examination starts.

Category Value	% of Total	Score (NEL)	Score (NRC)	Average % category value	Category
~~22.00~~ 20.00	~~34.92~~ 34.48				A. Reactor Theory, Thermodynamics and Facility Operating Characteristics
~~21.00~~ 19.00	~~33.33~~ 32.76				B. Normal and Emergency Operating Procedures and Radiological Control
~~20.00~~ 19.00	~~31.75~~ 32.76				C. Plan and Radiation Monitoring Systems
~~63.00~~ 58.00	100				Totals Final Grade:

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

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Senior Reactor Operator or Reactor Operator

UNIVERSITY OF UTAH NUCLEAR ENGINEERING LABORATORY TRIGA REACTOR LICENSE REQUALIFICATION EXAMINATION

A - REACTOR THEORY, THERMODYNAMICS, FACILITY OPERATING CHARACTERISTICS

1. The TRIGA Reactor is critical at 100 kW when the operator inserts a positive reactivity of $0.10 for 1 minute. What is the approximate reactor power at the end of the minute time?
a. 100 kW
b. 190 kW
c. 145 kW
d. 115 kW

2. The TRIGA Reactor is critical a 100 kW when all three control rods scram and bring the reactor power down to 10 kW within 1 minute. What reactivity in dollars is held by the control rods?
a. $-1.70
b. $-2.70
c. $-3.70
d. $-4.70

3. The neutron balance for any reactor system is composed of the following terms
a. neutron production, absorption and scattering
b. neutron scattering, slowing down and fission
c. neutron production and decay
d. neutron production, absorption and leakage

4. In an radiative neutron capture process which statement is untrue
a. Momentum of the system is conserved.
b. The atomic number of the target nucleus remains unchanged
c. The nuclear product produced upon capturing the neutron is always radioactive
d. The atomic mass number of the target atom is increased by one.

5. Delayed neutrons are especially important for reactor control because they
a. have greater energy when produced than prompt neutrons
b. don't appear until after the fission event occurs
c. increase the effective neutron lifetime
d. reduce neutron leakage

6. The production of energy from the fission process in the TRIGA Reactor core is
a. proportional to the neutron flux and the neutron mean free path for fission
b. inversely proportional to the neutron flux and the neutron mean free path for fission
c. proportional to the neutron flux and inversely proportional to the neutron mean free fission path
d. inversely proportional to the neutron flux and the neutron mean free path for fission

7. Fission product poisons have their greatest effect upon the following factor in the effective multiplication factor
a. the fuel utilization
b. the nonleakage probability
c.the thermal utilization
d.the resonance escape probability

8. The radioactive decay constant can be considered to be
a. the probability per unit time that a spontaneous radioactive disintegration will occur
b. directly proportional to the radioactive half life
c. directly proportional to the mean lifetime of the radioactive material
d. dependent upon environmental factors such as pressure and temperature.

9. The minimum shutdown margin required for reactor operation is given as the following
a. subcritical under all conditions
b. -$1.00
c. -$0.50
d. -$2.80

10. The majority of the energy released in any fission event is associated with the
a. kinetic energy of all gamma rays emitted in the fission process
b. kinetic energy of the fission fragments
c. the kinetic energy of the the neutrons released and subsequent nuclear reactions
d. numerous beta decay events arising from fission product decay.

11. The TRIGA Reactor is considered to be particularly operationally safe because it has.
a. a minimum fuel mass
b. a large prompt negative temperature coefficient of reactivity
c. numerous redundant, independent scram systems
d. a large thermal heat sink arising from the reactor tank coolant water.

12. A fuel element in the B ring of the TRIGA Reactor has greater reactivity than the same fuel element located in the C ring because
a. the fuel element is at a greater distance from the control rods which are located in the C ring.
b. the mean fuel atom density is greater in the B ring
c. neutron moderation is greater in the C ring
d. the neutron flux is greater in the B ring that in the C ring

13. The principal source of heat production in the TRIGA Reactor immediately after shutdown is
a. the radioactive decay of xenon-135
b. the radioactive decay of the fission products in the core.
c. the production of delayed neutrons and their fission reactions
d. fission reactions from photo neutrons.

14. Most heat transfer between the water coolant and the cladding of a TRIGA fuel element is due to
a. radiation heat transfer
b. conduction heat transfer
c. convection heat transfer
d. all of the above heat transfer processes are about equal

15. Which radionuclide has the greatest effect upon the UU TRIGA Reactor's reactivity state?
a. samarium- 149
b. xenon - 135
c. cesium - 137
d. the transuranics

16. The TRIGA Reactor's axial flux distribution is approximated by the following
a. a sinusoidal distribution
b. a bessel function distribution
c. a second degree curvature
d. approximately constant

17. A uranium -233 atom has the following nuclear properties
a. 92 protons, 141 neutrons and 141 electrons
b. 92 protons, 92 electrons and 233 neutrons
c. 233 nucleons and 92 electrons
d. 92 neutrons and the remainder as electrons and protons.

18. The TRIGA Reactor is considered to be approximately the following type of nuclear reactor
a. A homogeneous, thermal reactor with light water cooling and graphite moderation
b. A heterogeneous, thermal reactor with light water and graphite moderation
c. A homogeneous, epithermal reactor with heavy water cooling and moderation
d. A heterogeneous, fast reactor with water, graphite and aluminum in the core region.

19. The radiation level from a single irradiated fuel element in the TRIGA Reactor tank exhibits a gamma radiation level of 1000 mrad at 1 meter (3 feet). The gamma radiation level at 8 meters (24 feet) from the same fuel element in the tank is
a. less than 20 mrad
b. between 20 mrad and 150 mrad
c. between 150 mrad and 600 mrad
d. greater than 600 mrad

20. The principal reaction process for 1 MeV photons (gamma rays) with matter is
a. photoelectric effect
b. Compton scattering
c. pair production
d. inelastic scattering

B - NORMAL AND EMERGENCY PROCEDURES & RADIATION CONTROL

1. The University of Utah TRIGA Reactor Technical Specifications require that scram systems present for operation of the reactor include
a. Manual console scram button and startup count rate interlock
b. Control rod withdrawal interlock and reactor power
c. Reactor tank water level and fuel element temperature
d. Magnet current key switch and startup and control rod interlocks

2. Radiation exposures to extremities (hands and feet) are limited to the following values for badged personnel within the Nuclear Engineering Laboratory.
a. 18.75 rem per year
b. 12 rem per quarter
c. 100 mrem per hour
d. twice background

3. The TRIGA Reactor Technical Specifications require the following minimum scram time for each scrammable control rod.
a. 1 second
b. 2 seconds
c. 0.5 seconds
d. immediately

4. Initial administrative control and responsibility during any emergency in the Nuclear Engineering Laboratory is vested in
a. the Radiation Safety Officer or Laboratory Director
b. any authorized person in the laboratory
c. the senior staff person present in the laboratory
d. the Reactor Supervisor

5. The EAL's (emergency action levels) for the Nuclear Engineering Laboratory include
a. unusual events reportable under 10 CFR 20.403
b. emergency alerts which involve hazards which could affect reactor operation or personnel safety
c. reactor emergencies due to physical threats to the laboratory, e.g., fires, explosions, flooding,etc
d. all of the above.

6. The principal purpose of the Safety Evaluation Report (SER) for the UU TRIGA Reactor is to
a. describe and evaluate the Technical Specifications and Emergency Plan
b. summarize the results of the safety review and radiological safety assessment by the NRC
c. specify the physical security and emergency actions required for safe operation
d. all of the above statements.

7. Which credible accident involving the UU TRIGA Reactor is not analyzed in the SER
a. fuel handling accident
b. nuclear excursion
c. mechanical rearrangement of the fuel
d. failure of essential reactor instrumentation.

8. A channel test of the TRIGA reactor instrumentation is defined as
a. the introduction of a signal into the channel to verify operation
b. the comparing a measured value indicated by the channel with a known value.
c. the qualitative verification of acceptable performance by inspection of channel behavior
d. a maintenance test by a certified console technician

9. The TRIGA Reactor safety system setting includes the following specification
a. the temperature in a stainless-steel clad, high hydride fuel element shall not exceed 1000 C
b. the reactor power shall not exceed 110% of licensed maximum power
c. the temperature of an aluminum clad, low hydride fuel element shall not exceed 530 F
d. both conditions a. and c. above

10. Which condition is not a reactivity limitation condition for the TRIGA Reactor
a. shutdown margin with greatest worth control rod withdrawn is greater that $0.50
b. excess reactor worth of the cold, critical, xenon free reactor is less than $2.80
c. the rate of reactivity insertion by control rod movement cannot exceed $0.30 per minute
d. any experiment with reactivity worth greater than $1.00 must be securely fastened.

11. Mandatory operating measuring channels required for TRIGA Reactor operation include
a. fuel element temperature and reactor power level
b. reactor tank water level and continuous air radiation monitor
c. startup count rate and area radiation monitor
d. all of the above channels

12. Minimum information required for an entry in the reactor operations log are
a. time, description of event and action taken and initials of person making entry
b. log number, description of event and action taken and initials of person making entry
c. time, description of event and action taken and signature of a senior reactor operator
d. reactor run number, description of event and action taken

13. All radioactive samples discharged from the UU Nuclear Engineering Laboratory must
a. meet current University of Utah Broad Form License requirements where appropriate
b. be transferred only to University designated "Responsible Users".
c. be approved by the Reactor Safety Committee
d. be surveyed by the Radiation Safety Officer

14. The University of Utah Radiation Safety Policy Manual contains
a. a detailed listing of all licensed and approved radioisotopes for campus storage and use
b. the policies and general procedures for radiation protection
c. emergency procedures for all laboratories using hazardous materials
d. detailed standard operating procedures to be used by personnel handling hazardous materials

15. Immediate notification of the NRC is required for which set of conditions given below
I - 25 rem whole body exposure
II - release of 5000 times limits in 10 CFR 20 Appendix B, Table II
III - loss of one working week in affected facility
IV - Damage to property exceeding $20,000

a. I,II,III
b. I, II, IV
c. II,III,IV
d. I,II,III,IV

16. During operation of the TRIGA reactor, a manual scram operation shows that the safety rod fails to fully scram. What minimum steps are required before the reactor is restarted and brought critical again?

a. The malfunctioning safety rod must be repaired before operating again.
b. Approval of a licensed operator must be obtained to immediately restart
c. The senior reactor operator must be notified, the safety rod repaired and basis for nonoperation determined and restart approval given
d. Notification to and approval for restart from the NRC is always required.

17. The minimum operating staff for TRIGA Reactor operation is the following

a. An NRC licensed reactor operator (RO) and one other person
b. The Reactor Supervisor (RS) and at least one other person
c. A NRC licensed operator, a Senior Reactor Operator (SRO) on call and one other person
d. Two personnel in the Laboratory one of whom is an NRC licensed Operator and an SRO on call

18. Who is authorized to make temporary changes to laboratory procedures (which do not entail violation of Technical Specifications or other regulations) involving safety issues before review and approval by the Reactor Safety Committee.

a. A NRC licensed reactor operator
b. The Reactor Administrator
c. The Radiation Safety Officer
d. The Reactor Supervisor

19. The University of Utah TRIGA Reactor Technical Specifications specify the maximum fuel temperature safety limit setting for an aluminum clad element in the B ring as follows:

a. 1000 C
b. 800 C
c. 460 C
d. The temperature for onset of local nucleate boiling

20. Changes in the UU TRIGA Reactor's excess reactivity or circuitry can be authorized only by

a. the Reactor Safety Committee
b. the NRC
c. the Reactor Supervisor
d. an NRC licensed SRO

C - PLANT AND RADIATION MONITORING SYSTEMS

1. The TRIGA Reactor's instrumented fuel element provides the principal control function
   a. the critical fuel temperature safety limit measurement
   b. an indication of the reactor power within the ring containing the element
   c. an independent scram function
   d. an indirect indication of the thermal neutron flux within the core

2. The neutron source within the core of the TRIGA Reactor is
   a. a PuBe source which produces neutrons due to a photoneutron capture process
   b. a RaBe source which produces neutrons due to alpha, neutron reaction processes
   c. a Cf-252 isotopic neutron emission from spontaneous fission
   d. a PuBe source which produces neutrons due to alpha, neutron reaction processes

3. Before discharge of waste water (possibly contaminated) to the sanitary sewer can be made
   a. the water must be diluted with potable water to meet minimum NRC discharge requirements
   b. a radiation survey must be performed and released only as permitted by appropriate regulations
   c. held up in the storage holding tank for radioactive decay before discharge
   d. all of the above

4. The tank water in the TRIGA Reactor must meet the following requirements for reactor operation.
   a. A pH between 5.0 and 8.0 and a conductivity not to exceed 5 micromho/cm
   b. A temperature less than 50 C and a pH less than 7.0
   c. A conductivity less than 1 micromho/cm and water temperature between 20 and 60 C.
   d. Requirements given in the Technical Specifications.

5. The TRIGA Reactor uses the following detector as the linear power channel monitor
   a. a BF-3 chamber
   b. a compensated ion chamber
   c. an uncompensated ion chamber
   d. a fission chamber

6. The TRIGA Reactor Checklist (NEL-001) fuel temperature channel check requires
   a. review of a previous run for the date, the log entry and the page number in log
   b. power and fuel temperature readings from current and previous reactor runs
   c. indication of fuel temperature channel number entry
   d. all operations listed above are required

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8. The Nuclear Engineering Laboratory monthly inspection includes which activities and checks
a. security check, radiation survey, fuel element temperature calibration, low water level alarm
b. ventilation system, low water level alarm, fuel element temperature calibration, emergency power
c. radiation survey, area radiation monitor, continuous stack monitor, pool water check
d. administrative review, air particulate check, fuel element temperature calibration, low water alarm

9. The TRIGA Reactor thermal power calibration procedure is based upon the physical principal -
a. volumetric expansion of the tank water upon sensible heating
b. the level of induced radioactivity produced above ambient or background
c. sensible heat rise and evaporative loss of the tank water incurred by fission heating
d. none of the above

10. The purpose for the procedure for water addition to the TRIGA Reactor tank is
a. to test the performance of the water coolant lines, valves and monitoring instruments
b. to measure the quality of the tank water and replace filters as required
c. to functionally test the water recharge and refrigeration system
d. to replace tank water lost through evaporation

11. A tritium spill in the reactor area is best monitored and measured using a
a. a beta-gamma survey meter
b. a NaI detector
c. a high purity germanium detector
d. a liquid scintillation counter

12. The primary whole body occupational dose limit is
a. 3000 mrem per quarter or 12 rem per year
b. 5000 mrem per year or 1250 mrem per quarter
c. 500 mrem per year or 125 mrem per quarter
d. determined by the University of Utah Radiation Safety Policy Manual.

13. The ALARA principle for radiation protection asserts that
a. all ionizing radiation exposures should be maintained as low as practicable
b. no removable radiation contamination should be tolerated indefinitely
c. there is no threshold limit for which there is no biological effect from radiation exposure
d. all of the above

14. According to the UU Radiation Safety Policy Manual the laboratory survey frequency required for a less than 1 ALI monthly averaged bioassay when radionuclides are in use is
a. personal surveys every day and laboratory surveys every month
b. personal surveys every day and laboratory surveys every week
c. personal surveys and laboratory surveys every day
d. personnel surveys and laboratory surveys are not required.

15. A radiological criteria of 10 MPC and 15 mrem whole body (within 24 hours) is considered
a. an "unusual event " emergency classification
b. an "alert" emergency classification
c. an "site area emergency" classification
d. an "general emergency" classification

16. The ventilation system for the UU Nuclear Engineering Laboratory is designed to provide the following air flow rate
a. sufficient to insure that an exposure level less than 1 MPC exists in the laboratory
b. a mean air flow rate of 148 cfm
c. at least one air exchange per hour
d. at least four air exchanges per hour

17. Assign the proper detector type (capital letters) with the neutron measurement channel specified
a. startup channel____________
b. percent power meter________
c. linear power recorder_______
d. log channel________________

A- fission chamber
B- uncompensated ion chamber
C- compensated chamber

18. The high level radiation scram for the TRIGA Reactor actuates the following systems
a. signal to campus security and actuates a reactor scram
b. closes the air inflow dampers and causes a reactor scram
c. closes the air inflow dampers and signal campus security
d. all of the above functions

19. For emergency planning the "emergency planning zone" (EPZ) is designated as
a. The reactor room and radiochemistry laboratory (i.e., MEB 1205 E,F,G)
b. The area designated by answer "a" and the TRIGA control room (i.e., MEB 1205 D)
c. All of Merrill Engineering Building
d. The reactor room only.

20. Which is not a formal emergency procedure for the UU TRIGA Reactor
a. Loss of primary water from the reactor tank
b. Loss of water from a fuel storage pit
c. Reactor excursion accident
d. Spill of a radioactive liquid sample

ANSWERS TO UNIVERSITY OF UTAH
NUCLEAR ENGINEERING LABORATORY
TRIGA REACTOR LICENSE REQUALIFICATION EXAMINATION

PART A

1. 190 kW -calculation
2. -$3.70 - calculation
3. GS & TM, Section 2
4. GS & TM, Section 1
5. GS & TM, Section 3
6. GS & TM, Section 1 & 2
7. GS & TM, Section 5
8. GS & TM, Section 1
9. TS 3.2
10. GS & TM, Section 1
11. GS & TM, Section 3
12. GS & TM, Section 2
13. GS & TM, Section 3
14. GS & TM, Section 5
15. GS & TM, Section 4
16. TM, Section 5
17. GS & TM Section 2
18. GS & TM, Section 5
19. GS & TM, Section 1
20. SER
21. RSPM
22. RSPM

LEGEND
TM - UUNEL TRAINING MANUAL
TS - TECHNICAL SPECIFICATION
GS - Glasstone & Sensonske - Nuclear Reactor Theory
RSPM - UU RADIATION SAFETY POLICY MANUAL
SER - NRC SAFETY EVALUATION REPORT NUREG 1096
FOM - UU FACILITY OPERATION MANUAL
EP - UU EMERGENCY PLAN

PART B

1. TS 3.3.3
2. RSPM and 10CFR20
3. TS 3.3.1
4. EP
5. EP
6. SER
7. SER
8. TS 1.4
9. TS 2.0 & 3.3.3
10. TS 3.2
11. TS 3.3.2
12. FOM 4.5
13. RSPM
14. RSPM
15. RSPM
16. 10CFR20.403
17. FOM 13.3
18. FOM 13.3.1
19. FOM 13.3
20.TS 2.2
21. FOM 13.3.1

PART C

1. TS 2.0
2. FOM
3. RSPM & FOM
4. TS 3.8
5. SER FIG 7.4
6. NEL OO1
7. NEL-015
8. NEL-020
9. NEL-012
10. NEL-008
11. RSPM pg 9
12. 10CFR20
13. RSPM
14. RSPM
15. RSPM
16. SER pg 6-1
17. SER fig 7.4
18. TM, Hardware Description Fig 13
19. EP fig in appendix
20. EP table in appendix

OPERATIONAL TASK EVALUATION FOR UU REQUALIFICATION EXAMINATION

PROCEDURE	CRITICAL TASKS
TRIGA PRESTART CHECKLIST NEL-001	1- Section 6 "Other Scram Tests and Fuel Temperature Channel Check • demonstrate recognition that all scram systems must be operational for reactor operation: → 1-a Suppose the source interlock scram fails to function because the source counts are less than 3 cps. Explain the consequences of this and your immediate actions → 1-b. Suppose the source count rate is found to be 300 cps while the previous run source count rate was only 3 cps. What are possible explanations 2 "Fuel Temperature Channel Check" • demonstrate awareness of fuel temperature safety limit settings 2-a. What is the basis for the 200 C fuel temperature setting and why must the fuel temperature be set below the conditions established in the Technical Specifications? • determination of comparison and compatibility of past and present fuel temperature measurements. 2-b If the previous fuel temperature (see TS 4.2(3) is significantly different at a similar power level from present readings what are your actions and what may be the possible explanations for this?
WATER ADDITION NEL-008	3 - Step 9 "Resetting valves properly" • perform and insure proper setting of water supply valves for satisfactory operation of water coolant and shielding system. 3-a Suppose valve 1 and water supply valve are left slightly open and water continues to slowly overfill the tank. What are the safety consequences of this if any? 3-b What is the purpose of the check valve in the potable water supply?
THERMAL POWER CALIBRATION NEL -012	4 - Step 16 "Power calculation" • insure accurate (less than 10% deviation) thermal calibration of neutronic system and actual thermal power to prevent exceeding TS 4-a & b. In steps 16 & 17 the calculated (thermally measured) power is compared to the power channel readings. What are the consequences of thermal values higher than neutronic values and thermal values lower than neutronic values?
IRRADIATION REQUEST NEL-027 irradiation	5 - Material Release Survey • properly execute survey form by correct identification of principal isotopes and determination of license limits and allowable release 5-a. Upon survey of a sample to be released the maximum surface dose rate is 12 mrem/hr. What is your first response and what are probable actions for acceptable release • perform radiation measurements (swipe, exposure, etc) for release 5-b Suppose that tritium has been generated in a sample (e.g., of a lithium compound). Will a wipe sample detect the presence of tritium.? Why?

MONTHLY INSPECTION NEL -020

6 - Step 7 "Security Check"

- insure proper function of alarm systems and timely response by Campus Security. Satisfactory restoration of system after alarming

7-a Why is it important that the crane be secured. What are possible consequences of its being unsecured?

7-b. Suppose one of the alarm systems fails to operate. What are your immediate actions and notification procedures?

7- Step 8 "Radiation Survey"

- insure no unacceptable level of radiation (sources or contamination) exists in the laboratory

7-a Suppos[illegible] [illegible]at pool water [illegible]vity is higher than anticipated upon surveillance with a beta-[illegible] meter. What are potential sources of this and what are your actio[illegible]

7-b Suppose that air filter radioactivity is higher than anticipated upon surveillance. What are potential sources of this and what are your actions?