

# ACADIA UNIVERSITY



## RADIATION SAFETY

# POLICY AND PROCEDURES MANUAL

Revised by Dr. Don Stewart; April 2004  
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## A. RADIATION SAFETY - ADMINISTRATION

### 1. Acadia University Radiation Safety Committee (RSC)

- 1.1 The RSC reports to the Dean of the Faculty of Pure and Applied Science, who in turn reports to the President of Acadia University. The RSC is responsible for coordinating and controlling activities related to radiation safety, specifically for the establishment, interpretation and enforcement of regulations and procedures involving the use, handling, storage, transportation and disposal of radioisotopes and radiation-emitting devices on campus which involve University property and personnel and in conformance with other municipal, provincial and federal government regulations that may be in effect and apply.
- 1.2 The RSC consists of:
  - 1.2.1 Three faculty members named by the Dean of Science.
  - 1.2.2 One staff member from Physical Plant named by its Director.
  - 1.2.3 A Chair elected by the Committee from the three faculty members named above. The Chair of this Committee is the individual authorized to sign applications for licensing on behalf of the University and is the contact person for licensing concerns. The Chair should have practical knowledge of the nature and use of ionizing radiation. The Chair shall be the campus Radiation Safety Officer and the contact person for the CNSC. Note: the CNSC must be notified within 15 days of a change in contact person.
  - 1.2.4 A Secretary chosen from the committee. The Secretary will take and disseminate minutes for each meeting.
- 1.3 Responsibilities of the Radiation Safety Committee includes:
  - 1.3.1 To assist with the preparation and submission to the Canadian Nuclear Safety Commission of applications for the use of radioisotopes at Acadia University, including renewal of the Consolidated Licence as necessary.
  - 1.3.2 To authorize and control by the issue of internal permits the use of radioisotopes within the limits of the relevant consolidated and/or individual licenses issued by the Canadian Nuclear Safety Commission so as to ensure that the doses of ionizing radiation received by any person involved with the use of radioisotopes be kept as low as reasonable achievable (ALARA principle).
  - 1.3.3 To suspend the use, at the University, of radiation emitting sources and materials, regardless of any other source of authorization.
  - 1.3.4 To inform the Dean of Pure and Applied Science and/or the Director of the School of Recreation Management and Kinesiology, as appropriate, of the hazards associated with all radiation emitting sources and materials to regulate their use.

- 1.3.5 To produce and continually review the Acadia University Radiation Safety Policies.
- 1.3.6 To maintain a file on all active projects. These shall include inventories of all radioactive sources under a permit holder's control, before the commencement of and after the completion of projects. Such files shall be considered active until all of the radioactive sources have been accounted for, either by disposal or by safe storage. Note: changes in locations of use of radioisotopes must be made to the CNSC within 15 days.
- 1.3.7 To give final approval of all purchase orders for radioactive material in accordance with the specification of authorized projects.
- 1.3.8 To receive reports from the Radiation Safety Officer and recommend remedial action to correct any deficiencies.
- 1.3.9 To maintain written records of all meetings, incidents or unusual occurrences, recommendations and decisions, and supply the CNSC with a copy of these, as well as an annual report as outlined in the Canadian Nuclear Safety Commission (CNSC) Regulatory Guide G-300-3.1 Annual Compliance Reporting Group 3.1 Licences. (Note: this is a draft document; the official document should be issued shortly).
- 1.3.10 To advise the institution's administration of the resources necessary to set up and maintain an adequate radiation safety program which will incorporate the ALARA principle.
- 1.3.11 To approve designs for new laboratories in accordance with CNSC (AECB) Regulatory Document R-52 (Revision 1), entitled "Design Guide for Basic and Intermediate Level Radioisotope Laboratories".  
([http://www.nuclearsafety.gc.ca/pubs\\_catalogue/uploads/R-52e1.pdf](http://www.nuclearsafety.gc.ca/pubs_catalogue/uploads/R-52e1.pdf))
- 1.3.12 To meet at least twice a year. (Recommended Meeting times: May and December)
- 1.3.13 To act as a liaison between radioisotope user permit holders and other university safety committees and Physical Plant, as necessary. This includes the Acadia Animal Care Committee (if radionuclides are to be used in animals), the Biology Department Safety Committee, the University Joint Occupational Safety and Health Committee, and the Safety and Security Office [to (i) obtain card or key access for the Radiation Safety Officer/Chair Radiation Safety Committee to all locations where radioisotopes are used or stored; and (ii) to keep the Chair of the Radiation Safety Committee informed of all individuals having access to radiation work or storage spaces). Copies of this Policies and Procedures Manual should be forwarded to these individuals, Chairs of these committees, and the General Manager of Physical Plant (through the representative on the RSC) so that they will be aware of their responsibilities as they pertain to radiation safety on campus.

- 1.3.14 To limit access to potentially dangerous radioisotopes and in keeping with international obligations, the Radiation Safety Committee will not approve shipments/receipt of U235/238 over the limit set in Licence Condition 2402-1.

## **2. Chair of the Radiation Safety Committee and Radiation Safety Officer**

- 2.1 The Radiation Safety Officer shall administer the consolidated radioisotope licence issued to the institution by the CNSC by overseeing and coordinating all aspects of radiation safety within the institution. The Radiation Safety Officer shall act as the agent of the institution with respect to licensing matters.
- 2.2 Responsibilities of the Chair of the RSC and the RSO.
  - 2.2.1 To chair the meetings of the committee.
  - 2.2.2 To prepare an annual report in consultation with the RSC, of the activities of the RSC to the Dean of Science, the Director of the School of Recreation Management and Kinesiology, the President of the University, and the CNSC as outlined in Regulatory Guide G-300-3.1 Annual Compliance Reporting Group 3.1 Licences. (Note: this is a draft document; the official document should be issued shortly).
  - 2.2.3 To systematically and periodically review survey programs, implemented by permit holders, for radiation and contamination levels in all areas where radioactive materials are used, stored or disposed of. NOTE: To facilitate inspections and to be able to respond to emergency situations, the Radiation Safety Officer MUST obtain key and/or card access to all buildings and rooms where radioactive materials are stored. (Memo sent to Security Office to this affect 22 April, 2004).
  - 2.2.4 To ensure that each incident involving radioisotope spillage or exposure to ionizing radiation is evaluated to decide if decontamination procedures and/or medical examination should be carried out.
  - 2.2.5 To supervise decontamination procedures.
  - 2.2.6 To receive documentation for project applications, to administrate the authorization, and to maintain a list of users to be updated annually..
  - 2.2.7 To ascertain the requirements for personnel monitoring and approve the use of radiation detection instruments and dosimeters.
  - 2.2.8 To inspect and approve, with the assistance of RSC, all proposed radiation laboratories according to the CNSC (AECB) Regulatory Document R-52 ([http://www.nuclearsafety.gc.ca/pubs\\_catalogue/uploads/R-52e1.pdf](http://www.nuclearsafety.gc.ca/pubs_catalogue/uploads/R-52e1.pdf)).
  - 2.2.9 To supervise, with the assistance of RSC, the semi-annual leak testing of all large sealed sources as required by Government regulations.
  - 2.2.10 To ensure that general advice on radiation hazards and protection is available to

users.

- 2.2.11 To maintain a record of the Inventory of radioisotopes at the University, of their purchase, disposal and the results of all contamination tests performed on campus.

### **3. Radioisotope User Permit Holders**

Internal Permit Holders will be faculty members with experience in the safe handling of radiation emitting sources and materials.

3.1 The responsibilities of each permit holder are:

- 3.1.1 To provide adequate facilities, equipment, instruments, supervision and instruction to control radiation hazards and to comply with the University's radiation protection standard.
- 3.1.2 The maintenance of an up to date listing with the Chair, RSC of the rooms in which radioactive material is stored or handled, and of rooms in which radiation-emitting equipment is used.
- 3.1.3 The maintenance of an inventory of radioactive materials used in his project, and to ensure that his project does not exceed its allotment of radioactive material. An up to date inventory must be submitted each September to the Chair, RSC.
- 3.1.4 Keeping records of the disposal of radioactive material.
- 3.1.5 The posting of warning signs and labels as required by the Canadian Nuclear Safety Commission Regulations and Radiation Safety Policy.
- 3.1.6 The establishment of a daily laboratory procedure to ensure that at the end of the work day:
  - a) survey-meter measurements have established that external radiation and contamination level are within permissible limits;
  - b) radiation sources are properly labeled and stored;
  - c) experiments that will be in progress after normal working hours will be properly attended;
  - d) each laboratory is secured against unauthorized access.
- 3.1.7 Reporting all radiation incidents in accordance with Radiation Incidents – Emergency Procedures, Section E. Preliminary reporting to the CNSC office shall be within 21 days of the incident. For details on information required, see the CNSC regulatory document entitled General Nuclear Safety and Control Regulations section 29.  
(Available at [http://www.cnscc.gc.ca/eng/regulatory\\_information/pdf/SOR202.pdf](http://www.cnscc.gc.ca/eng/regulatory_information/pdf/SOR202.pdf))
- 3.1.8 The training of all personnel and students who work with or are in the vicinity of radioactive material is the responsibility of the permit holder which is the direct supervisor and teacher of such individuals and ultimately of the campus radiation safety officer. Such training shall include a thorough familiarization of all

provisions of the campus radioisotope licence with respect to procedures for the safe handling of radioactive materials, procedures for the recognizing and dealing with leakage and contamination, methods used for disposal of radioactive waste, methods used for surveying contamination. Practical training in the safe handling of radioactive materials and in the operation of radioactivity measuring devices is undertaken as required. Health aspects of dealing with radioactive materials is stressed. **NOTE:** As of 2000, all new users of radioactive materials at Acadia University must attend the day-long Radiation Safety Workshop at Dalhousie University (coordinated by Ms. Pauline Jones, Dalhousie RSO) or provide evidence of similar training

#### **4. Radioisotope Users**

- 4.1 Each individual who may use radioactive materials is responsible for complying with the procedures and precautions contained in the radiation Safety Policy and Procedures and with those prescribed in the permit.

### **B. WORK PROCEDURES**

#### **1. Project Authorization and Registration**

- 1.1 Prior to possessing or using radioactive material, authorization must be obtained from the Radiation Safety Committee (RSC).
  - 1.1.1 Complete an “Application for Radioisotope Permit” and forward to the Chair RSC. A copy of the application form is illustrated in Appendix 2. This form is also available on the Department of Biology website at:  
<http://ace.acadiau.ca/science/biol/gen/Home.htm>
  - 1.1.2 After approval, a copy of the application will be returned to the applicant stating the conditions of approval and a “permit number”.
  - 1.1.3 If any changes are to be made to an authorized project, the permit holder must apply in writing to the Chair RSC for an amendment to his project.
- 1.2 Each room or laboratory in which radioactive material is to be handled or stored must be approved for use by the RSC. A list of these rooms has been forwarded to the campus Safety and Security Office (to be updated as necessary) so that individuals with key access to these rooms can be identified. Furthermore, the Safety and Security Office has been notified that access to room 423 Patterson Hall (a Basic Radiation Laboratory) must be pre-approved and authorized by the Radiation Safety Committee.

#### **2. Procedure for Procurement of Radionuclides**

- 2.1 Complete and sign a requisition and forward to the Chair RSC. Include your permit number on the requisition.
- 2.2 As a condition of our license, all requisitions of radioactive material must be authorized. Arrangements have been made to authorize and forward requisitions to suppliers without delay.

### 3. Procedures for Receiving Radioactive Shipments

- 3.1 Shipments should be inspected immediately upon receipt.
- 3.2 Wear a lab coat and disposable gloves while handling the package. Place the package in a fume hood.
- 3.3 Monitor the radiation field about the package and compare with the units stated on the package. Packages containing radioactive materials are categorized by radiation level and display IAEA warning labels as follow:



Category 1  
Less than 0.5  
mR/hr at the  
surface



Category II  
Not exceeding 10 mR/hr  
at the surface nor 0.5  
mR/hr at one meter from  
the surface



Category III  
Not exceeding 200 mR/hr  
at the surface nor 10  
mR/hr at one meter from  
the surface

- 3.4 The transport index for a package is the number expressing the maximum exposure rate (mR/hr) at one meter from the center of the package.
- 3.5 Open the outer package and check for possible damage to the contents as apparent by broken seals or by discolouration of packing material. Wipe test the interior packaging.
- 3.6 Remove the inner package or primary container, monitor the radiation field, and wipe test the container.
- 3.7 Verify the radioisotope, activity and other details with the information on the packing slip and with your copy of the purchase order. Log the pertinent data in your inventory record.
- 3.8 Report any anomalies (contamination, leakage, short or wrong shipment) immediately to the project supervisor.

### 4. Use and storage of Radionuclides

- 4.1 Any laboratory in which radioactive material is used or stored shall be classified as a radioisotope laboratory and authorized by the Acadia University RSC.
- 4.2 The quantity of radioactive material used or stored in a laboratory shall not exceed that specified on the internal radioisotope permit issued by RSC.
- 4.3 Radioactive material shall be kept or stored in a manner that:



- 4.3.1 the storage container is labeled in accordance with the regulations of radiation – Signs and labels, Section E.
- 4.3.2 provides adequate radiation shielding as prescribed in the users permit.
- 4.3.3 Provides adequate protection against theft, fire, explosion, flooding or accidental breakage of primary storage.
- 4.4 Radiation readings around storage areas must be checked at least annually and records maintained by the Permit Holder and/or the Radiation Safety Committee
- 4.5 Emergency Contact Numbers, including the Name and Home and Office Numbers of the Radiation Safety Officer, must be posted near the site of storage of any radioactive material or on any radiation devices.

## **5. Procedures for Project Termination**

- 5.1 Complete Section 3 of the Application for “Radioisotope Permit” and forward to the Chair RSC. Account for all radioisotopes acquired and used for the project. Indicate the amounts and methods of disposal and amounts and storage location of any remaining radioactive material.
- 5.2 Radioactive material may not be transferred to the possession of any person nor used for any purpose in any place other than originally authorized without prior approval of the RSC.
- 5.3 Decommission lab to acceptable levels as stated on licence. Before a lab can be classified as “decommissioned”, it must be thoroughly cleaned and/or decontaminated as necessary and wipe-tests must indicate that there is no residual contamination (i.e., all counts are within two (2) times background. All radiation signage and labels must be removed or defaced. These records must be copied to the Radiation Safety Officer to be included in the Annual Compliance Report.

## **6. Wipe Testing Procedure**

- 6.1 On plan of the laboratory, mark locations that are to be tested. Ten to fifteen locations should be adequate for most laboratories.
- 6.2 Using filter paper (3M) lightly moistened with water, wipe a representative area (50 – 100 cm) in each of the designated locations. Use one wipe per location and make sure the wipe is identified.
- 6.3 Place wipe in scintillation tube with 5 ml scintillation fluid.
- 6.4 Measure the radioactivity on each wipe using appropriate detection equipment (ie. liquid scintillation counter).
- 6.5 Do a background count using an uncontaminated wipe.
- 6.6 If there is significant contamination (2-3x background) on any of the wipes proceed to

decontaminate the area. Repeat wipe testing the location and decontaminating until contamination is un-detectable.

6.7 Keep records of results.

6.8 Wipe test on a regular basis, according to instructions on permit. (Normally weekly during any week radioisotopes are used in the lab.)

6.9 When you set up a wipe test programme, aim to test locations where radioisotopes are used and include unlikely locations such as door handles, telephone receivers, pipettor handles and taps.

6.10 Although one can use elaborate formulae to calculate the levels of contamination present, the best way to use wipe-testing is as a qualitative check for contamination. If a wipe indicates any contamination above the background, clean the location and check it again.

## 7. Wipe Test Survey (SEE SAMPLE PAGE 9)

## 8. Disposal of Radioactive wastes

Radioactive wastes shall be:

8.1 Returned to the supplier after making prior arrangements or

8.2 Sent to Atomic Energy of Canada Ltd. after making prior arrangements.  
(See [www.aec.ca](http://www.aec.ca))

8.3 Radioactive waste material to be stored for decay should be double-bagged. Solid radioactive material may be disposed of through the municipal garbage system provided that the concentration is less than 1 scheduled quantity (see licence for scheduled quantities) per kilogram and the radioactivity is uniformly distributed throughout. (NOTE: when material such as S35 or P33 has been stored for decay for >10 half-lives, it should first be scanned with a portable radiation meter prior to disposal in the municipal garbage system.) Disposal method, confirmation that radiation levels are within acceptable parameters, and date of disposal **must** be documented by the Permit Holder.

8.4 For water soluble material, disposed of through the municipal sewage system provided that the concentration in the sewer at the exit of the licenced building is less than 0.01 scheduled quantities per litre based upon a yearly average or

8.5 For vapours and gases, disposed of to the atmosphere provided that the concentration at the point of release is less than 0.001 scheduled quantities per cubic meter of air when averaged over a 1 week period and the point of release is at least 10 meters away from any air intake.

Any other waste disposal method will require specific approval of the Canadian Nuclear Safety Commission.

SAMPLE

WEEKLY LABORATORY CONTAMINATION SURVERY

---

Permit holder: \_\_\_\_\_

Permit #: \_\_\_\_\_

Room #: \_\_\_\_\_

Type of Counter Used: \_\_\_\_\_ LS Counter  
\_\_\_\_\_ Other (Specify) \_\_\_\_\_

Radioisotope Used: \_\_\_\_\_

Date: \_\_\_\_\_ (D/M/Y)

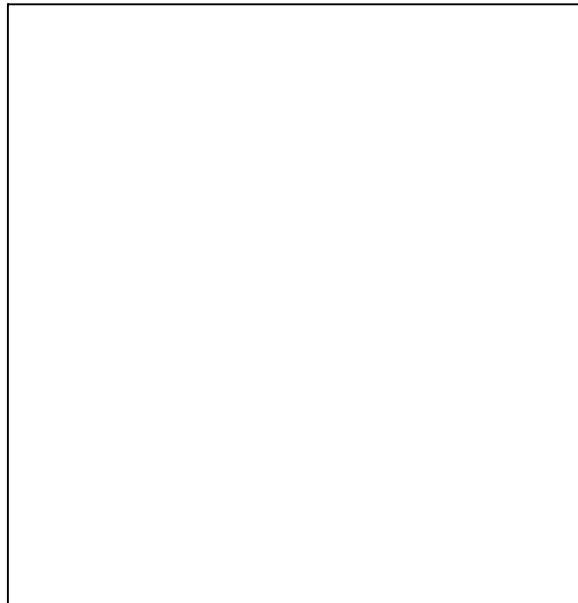
\*\*\* \_\_\_\_\_ LAB DID NOT USE RADIOISOTOPES DURING THIS REPORTING PERIOD

---

Wipe test results in (CPM)

1. Background
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
15. Background

**Diagram of Laboratory**



Signature of Surveyor: \_\_\_\_\_

Date: \_\_\_\_\_

## C. RADIONUCLIDES · GENERAL REQUIREMENTS, PRECAUTIONS, AND ACTION LEVELS

1. There shall be no smoking, eating or storage of food in any area containing radioactive material.
2. There shall be no mouth pipetting of solutions containing radioactive material.
3. Whenever practical, the user should perform a trial experiment using stable or low activity material to establish the adequacy of the procedures and equipment.
4. Prior to performing an operation on a source of radioactive material, radiation levels will be measured. Handling tongs or suitable remote handling devices must be used for handling any source or container that emits, at contact, a dose rate in excess of 200 mrem/hr.
5. When performing operations that might produce airborne contamination (e.g., boiling, evaporating, sanding or grinding), work shall be carried out in a fume hood.
6. A glove box shall be used for work involving dry radioactive powdered material.
7. When hand or clothing contamination is possible, protective gloves and clothing shall be worn.
8. After handling unsealed radioactive materials, hands shall be washed before leaving the laboratory and clothes, shoes and hands shall be monitored for contamination.
9. Whenever possible, work with radioactive material should be carried out in trays lined with disposable absorbent material.
10. Objects and equipment used in work with radioactive material should not be used for other purposes and shall be surveyed for contamination prior to removal from the laboratory.
11. Action Levels:

An "Action Level" is a specific dose of radiation or other parameter that if reached, may indicate a loss of control on the part of the licensee's radiation protection program, and triggers a requirement for a specific action to be taken.

CNSC criteria for radioactive contamination are discussed in CNSC regulatory guide G-228, "Developing and Using Action Levels"

The licensee shall ensure that:

*(a) non-fixed radiation contamination in all areas, rooms or enclosures where unsealed nuclear substances are used or stored does not exceed:*

- i) 3 becquerels per square centimetre for all Class A radionuclides which are long-lived and emit alpha radiation;*
- ii) 30 becquerels per square centimetre for all Class B radionuclides which are long-lived and emit beta or gamma radiation;*

- iii) 300 becquerels per square centimetre for all Class C radionuclides which are short-lived and emit beta or gamma radiation

averaged in an area not exceeding 100 square centimetres; and

(b) non-fixed radiation contamination in all other areas does not exceed;

- i) 0.3 becquerels per square centimetre for all Class A radionuclides;
- ii) 3 becquerels per square centimetre for all Class B radionuclides;
- iii) 30 becquerels per square centimetre for all Class C radionuclides

averaged an area not exceeding 100 square centimetres;

#### ALARA PROGRAM REQUIREMENTS\*

Contamination Level	Action Required
< 0.3 Bq/cm <sup>2</sup> for Class A radionuclides	Post result as "no contamination" or check mark
< 0.5 Bq/cm <sup>2</sup> for Class B & C radionuclides	Post result as "no contamination" or check mark
Work Surfaces > 0.5 Bq/cm <sup>2</sup> All other surfaces > 0.5 Bq/cm <sup>2</sup>	clean the area immediately  re- monitor and repeat cleaning until all contamination is removed or further cleaning does not decrease contamination levels  record contamination levels before and after cleanup
All other surfaces > 0.5 Bq/cm <sup>2</sup> for Class B & C radionuclides	record contamination levles before and after cleanup.

\*To convert CPM data use Bq/cm<sup>2</sup>=(CPM)/60s\*Efficiency of LSC\*0.1\*100cm<sup>2</sup>

For efficiencies of the LSC located in Patterson 420, refer to the most recent calibration values provided by BeckmanCoulter.

#### D. RADIATION SIGNS AND LABELS

##### 1. Radioisotopes Laboratories

Note: The CNSC has strict guidelines prohibiting frivolous labeling. To ensure compliance relating to items 1.1 to 1.5, see Sections 20-23 of the CNSC Radiation Protection Regulations (available at [http://www.nuclearsafety.gc.ca/eng/regulatory\\_information/pdf/SOR203.pdf](http://www.nuclearsafety.gc.ca/eng/regulatory_information/pdf/SOR203.pdf))

1.1 Laboratories in which radioactive isotopes are present shall have posted at each entrance to that laboratory, a sign with the warning "Rayonnement – Danger- Radiation". All labs must also have a sign indicating the names and local and home telephone numbers of responsible persons to be contacted in an emergency. Any other special emergency instructions should also be noted.

1.2 Cupboards, cabinets, refrigerators and other containers used to store active materials in the radioisotope laboratory must be identified.

1.3 Primary storage containers must be identified with a radiation warning symbol and

information respecting the nature, form, quantity and date of measurement of the radioactive isotopes contained within. Labelling is not required for containers such as beakers, flasks and test tubes used while the responsible individual is present.

- 1.4 Radiation signs may be available from the Chair RSC, alternatively, they may be purchased through Medical Stores, Tupper Building, Dalhousie University.
- 1.5 Internal User Permits, specifying radioisotopes and maximum quantities must be posted in each laboratory.

## E. RADIATION INCIDENTS · EMERGENCY PROCEDURES

1. All radiation incidents (exposure, spill, contamination, loss of source, etc.) must be reported immediately to the Chair RSC or any member of the RSC.
2. Persons exposed to internal or external radiation present no hazards to others. Such persons will be placed under medical supervision. Re-entry into the radiation area is prohibited, until authorized by Chair RSC or any member of the RSC.
3. In the event of personnel contamination, clothing and other articles that may be contaminated must be left in the controlled area. Contamination should be washed from the skin under running water until the arrival of experienced assistance.
4. In the event of a spill, laboratory contamination, or environmental contamination, vacate the area. Do not attempt decontamination procedures and do not remove contamination articles from the area. The Chair or a member of RSC will direct decontamination operations and authorize re-entry into the radiation area.

## F. SECURITY POLICIES

Ensuring the security of radioactive materials consists of two components:

1. accountability
2. physical security

Accountability has important security ramifications as well as being a CNSC licence condition. Accurate records of inventory must be kept in order to know what is missing, should theft or loss occur. Physical security means ensuring that a mechanism is in place either by a locked laboratory door or a locked storage area to ensure that unauthorized removal of unattended radioactive materials does not occur.

The Canadian Nuclear Safety Commission **requires**:

### a) General Safety -

1. Keep unauthorized persons out of this laboratory. Keep locked when unoccupied.

### b) Usage, Storage and Disposal -

1. Store radioisotopes in a locked room or enclosure.
2. Supervise radioisotopes at all times when in use.
3. Maintain up-to-date inventory, usage and disposal records for all radioisotopes.

The Canadian Nuclear Safety Commission **further requires** under its "General Nuclear Safety and Control Regulations" that:

1. Section 12: Obligations of Licensees

g) implement measures for alerting the licensee to the illegal use or removal of a nuclear substance, prescribed substance, prescribed equipment or prescribed information, or the illegal use of a nuclear facility

h) implement measures for alerting the licensee to acts of sabotage or attempted sabotage anywhere at the site of the licenced activity;

j) instruct workers on the physical security program at the site of the licenced activity and on their obligations under that program;

2. Section 17: Obligations of Workers

1. i) promptly inform the licensee or supervisor of any situation in which the worker believes there may be

ii) a threat to the maintenance of security or an incident with respect to security

iii) an act of sabotage, theft, loss or illegal use or possession of a nuclear substance, prescribed equipment or prescribed information,

## REQUIREMENTS:

### Nuclear Substances In Use:

1. Constant surveillance and control must be maintained for nuclear substances in use. This means that an individual who has received training, as approved by the Acadia Radiation Safety Committee, in the safe use of radioactive material must be present in the laboratory or the laboratory must be locked if the material is left unsecured in the laboratory.

### Nuclear Substances In Storage:

1. All nuclear substances in storage such as stock or stock dilutions must be secured from unauthorized removal or access. This normally means that the material must be in a location such as a room, freezer, refrigerator or other container with a lock.

2. When a room containing nuclear substances is unoccupied for periods such as lunch, evenings , meetings etc. the room must be locked. If this is impractical the nuclear substance may be secured by placing the material in a locked storage container such as a refrigerator or a lock box within the refrigerator provided that it is secured within the unit.
3. The storage of nuclear substances in hallways is not permitted. Any exceptions to this policy must be approved by the Radiation Safety Committee.
4. Radioactive waste containers must be secure from unauthorized removal.
5. Counting rooms must be secured if nuclear substances are present.

#### RESPONSIBILITIES:

1. It is the responsibility of the Permit Holder to secure nuclear substances in their possession that are in storage from unauthorized access or removal.
2. It is the responsibility of the Permit Holder or his/her designate to maintain surveillance over nuclear substances in their inventory that are not in storage.
3. If constant surveillance cannot be maintained, the materials must be secured.
4. Nuclear substances must be secured in such a manner that an individual with authorized access to the area, but who is not authorized to use or possess the materials, cannot gain control of the materials.
5. The Permit Holder or his/her designate must contact the RSO within 24 hours of any actual or suspected loss or theft of a nuclear substance. An investigation must begin immediately.



## APPENDIX 1

### RELATIVE TOXICITY, HALF LIFE AND SCHEDULED QUANTITY OF SOME RADIOISOTOPES

Isotope	Half Life	Scheduled Quantity (µCi)
<b>A. Very High</b>		
Americium 241	458 y	0.1
Curium 242	163 d	
Lead 210	21 y	
Plutonium 238	89 y	
Radium 226	1620 y	
Thorium 228	1.9 y	
<b>B. High</b>		
Bismuth 207	30 y	10
Calcium 45	165 d	10
Cerium 144	285 d	1
Cesium 137	30 y	10
Chlorine 36	$3 \times 10^5$ y	10
Cobalt 60	5.3 y	10
Hafnium 181	45 d	1
Iodine 131	8 d	1
Manganese 54	291 d	10
Sodium 22	2.6 y	10
Strontium 90	28 y	0.1
<b>C. Moderate</b>		
Beryllium 7	54 d	100
Cadmium 109	470 d	10
Carbon 14	5770 y	100
Chromium 51	28 d	100
Copper 64	13 h	100
Iodine 125	60 d	1
Iron 55	2.7 y	100
Iron 59	45 d	10
Mercury 203	47 h	10
Molybdenum 99	66 h	10
Nickel 63	92 y	.10
Phosphorus 32	14 d	10
Rubidium 86	19 d	10
Selenium 75	120 d	10
Sulfur 35	87 d	10
Zinc 65	245 d	10
<b>D. Slight</b>		
Hydrogen 3	12.3 y	1000

## APPENDIX 2

### **RADIATION SAFETY COMMITTEE ACADIA UNIVERSITY WOLFVILLE, NS**

#### **1. APPLICATION FOR RADIOISOTOPE PERMIT**

Complete Section 1 and forward to the Chair RSC. When approved, the application will be assigned a number and a copy will be returned to the permit holder. The conditions of approval will be indicated in Section 2

#### **2. PURCHASE OF RADIOACTIVE MATERIALS**

Submit purchase orders to the Chair RSC for authorization. On the purchase order state "Radioactive Material" and identify the isotope and activity to be acquired. Include your RSC permit number and sign the purchase order. The RSC will forward a copy of our CNSC licence to your supplier.

#### **3. TERMINATION OF RADIOISOTOPE PROJECTS**

Complete Section 3 and forward a copy, along with your disposal records, to the Chair RSC. Account for all radioisotopes acquired and used for your project.

Radioactive material may not be transferred to the possession of any person nor used for any purpose in any place other than originally authorized, without prior approval of the Radiation Safety Committee.

**RADIATION SAFETY COMMITTEE  
ACADIA UNIVERSITY  
WOLFFVILLE, NS**

**APPLICATION FOR RADIOISOTOPE PERMIT**

**SECTION 1**

**1. APPLICANT**

<b>NAME</b>	<b>DEPARTMENT</b>	<b>BUILDING</b>	<b>ROOM NO.</b>	<b>TEL. EXT.</b>

**2. TECHNICIANS AND OTHER HANDLING THE MATERIAL**

<b>NAME</b>	<b>DEPARTMENT</b>	<b>BUILDING</b>	<b>ROOM NO.</b>	<b>TEL. EXT</b>	<b>TRAINING</b>

**3. BUILDING AND ROOMS WHERE MATERIAL WILL BE HANDLED.**

<b>DELIVERED TO</b>	<b>PREPARATION IN</b>	<b>USED IN</b>	<b>STORED IN</b>

4. DESCRIPTION (ATTACH ADDITIONAL LIST IF NECESSARY)

OPEN SOURCES

Isotopes	Activity		Form
	Maximum Held at One Time	Per Experiment Annual Requirement	

SEALED SOURCES

Isotope	Activity	Manufacturer	Model #	Type of Device

5. STATEMENT OF INTENDED USE

6. LIST OF INSTRUMENTS TO BE USED FOR RADIATION DETECTION AND MONITORING

Type	Sensitivity mr/hr

7. WASTE DISPOSAL \*

Isotope	Proposed Method of Disposal

*\* Attach additional list if necessary*

8. ANTICIPATED DATE FOR PROJECT TERMINATION \_\_\_\_\_

9. APPLICANT'S SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_

**RADIOISOTOPE PERMIT**

**SECTION 2**

**A. COMMENTS RELATED TO THE APPLICATION**

**B. CONDITIONS OF APPROVAL**

**C. REQUIREMENTS**

1. The proposed work shall be performed in the manner specified in Section 1 and 2 B. There shall be no change in the procedures, equipment, radioactive material, or places of use without prior approval of the Radiation Safety Committee.
2. The use, storage and disposal of radioactive material shall be in conformity with,
  - A) The Canadian Nuclear Safety Commission regulations,
  - B) The provisions for radiation protection as stipulated in the Acadia University Radiation Safety Policy and Procedures.

**APPROVED BY:** \_\_\_\_\_  
Chair, Radiation Safety Committee

**TERMINATION OF RADIOISOTOPE PROJECTS**

**SECTION 3**

Radioactive material may not be transferred to the possession of any person nor used for any purpose in any place other than originally authorized without prior approval of the Radiation Safety Committee.

A. DATE OF TERMINATION \_\_\_\_\_

B. INVENTORY \*

<b>ISOTOPE</b>	<b>TOTAL ACQUIRED</b>	<b>DISPOSAL OR DECAY</b>	<b>TOTAL REMAINING</b>

*\* Attach additional list if necessary, and disposal records*

C. PROPOSAL FOR DISPOSAL OR STORAGE OF REMAINING ISOTOPES

D. PERMIT HOLDER'S SIGNATURE \_\_\_\_\_

E. AUTHORIZING SIGNATURE \_\_\_\_\_

Chair, RSC

APPENDIX 3

ACADIA UNIVERSITY RADIOISOTOPE INVENTORY YEAR \_\_\_\_\_

*An inventory record is required for each radioisotope authorized on the permit.  
Show all receipts, account for decay and/or disposal, and indicate the final balances on hand.*

PERMIT HOLDER \_\_\_\_\_ PERMIT NUMBER \_\_\_\_\_ LOCATION OF INVENTORY \_\_\_\_\_

SEALED SOURCES	$t_{1/2}$	FORM	DATE	ACTIVITY	NOTES

OPEN SOURCES	$t_{1/2}$	FORM	DATE	ACTIVITY			
				ACQUIRED	DECAYED	DISPOSED*	BALANCE

*\* Note the activity disposed via methods permitted on your permit.*

DATE OF SUBMISSION \_\_\_\_\_

SIGNATURE \_\_\_\_\_