

Radiation Safety Procedures Manual




THE UNIVERSITY OF
WINNIPEG

May 24, 2017

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ABBREVIATIONS and ACRONYMS


ACT – Nuclear Safety and Control Act
ALARA – As Low as Reasonable Achievable
ALI – Annual Limit on Intake
Bq – Becquerel
Ci – Curie
CNSC – Canadian Nuclear Safety Commission
CPM – Counts per minute
CPS – Counts per second
DPM –Decays per minute
DPS – Decays per second
G – Giga
 μ - Micro
Gy- Gray
k – Kilo
IAEA – International Atomic Energy Agency
ICRP – International Commission on Radiological Protection
IP – Industrial Package
LS – Liquid Scintillation
LSA – Low Specific Activity
LSF – Liquid Scintillation Fluor
m – Milli
M – Mega
NEW – Nuclear Energy Worker
p- Pico
Pa – Pascal
NEW – Nuclear Energy Worker
R – Roentgen
RAD – Radiation absorbed dose
REM – Roentgen Equivalent to Man
Rn – Radon
Sv – Sievert
TI – Transport Index
T – Tera
TDG – Transportation of Dangerous Goods
TLD – Thermoluminescent Dosimeter
UN – United Nations

REVISION CONTROL SHEET

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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EMERGENCY PROCEDURES

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: 1 Revision Date: March, 2015 Revised By: Sangita Shah
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Emergency Telephone Numbers:

Fire Department	911
Ambulance Services	911
Security Services	(204) 786-6666 (24 hours)
Radiation Safety Officer	(204) 789-1439 (during office hours)
Health and Safety Specialist	(204) 786-9894 (during office hours) (204)782-2588 (after office hours)

Reportable Incidents:

The following incidents must be reported immediately to the Radiation Safety Officer (RSO) during business hours, or the Health and Safety Specialist/Campus Security after business hours:

1. A spill of radioactive material;
2. Personal contamination (including clothing);
3. Known or suspected internal contamination;
4. Known or suspected external exposure where person(s) may have received a dose in excess of 0.3 mSv;
5. Wide-spread contamination;
6. Loss or theft of any quantity of radioactive material;
7. A release of a radioactive nuclear substance into the environment not authorized by the licensed activity;
8. An attempted or actual breach of security or sabotage at the site of the licensed activity;
9. A serious illness or injury that occurred as a result of the licensed activity;
10. The death of any person at a nuclear facility as a result of licensed activity.

Radiation Safety Officer notifies immediately to the CNSC Duty Officer at 1-844-879-0805 followed by a report for the incidents listed below within 21 days of the incident (section 29 of the General Nuclear Safety and Control Regulations).

- Radiation dose exceeded.
- Positive leak test and Loss or theft of a radioactive substance.
- Contravention of the Nuclear Safety and Control Act.
- Unauthorized release of radioactive substance to the environment.
- Security violation or sabotage.
- Incident due to failure of a system or component that may adversely affect health, safety, environment or security.
- Actual, threatened or planned work disruption by workers.
- Serious illness or injury incurred or possibly caused by the licensed activity.
- Death of any person at a nuclear facility.
- Record deficiency that may adversely affect health, safety, environment or security.

Procedures for Radioactive Spill:

1. Do not panic.
2. Stop the source of the spill (e.g., turning a container upright).
3. Inform all occupants in the area about the spill. Keep them away from the contaminated area.
4. Inform supervisor and ask for their assistance.
5. Attend to injured or contaminated persons. Ensure first aid is provided to the injured personnel.
6. Remove all contaminated clothing and place in a double plastic bag. Attempts must be made to remove all external contamination as soon as possible. If contamination is splashed in the eyes, mouth, or on skin, flush the area for a minimum of 15 minutes.
7. Cover the spill with absorbent material to prevent the spread of contamination.
8. Get the spill kit and survey meter.
9. **If spill involves less than 100 EQ (see a third column of Appendix E, page 112 at the end of the manual for a list of 100 EQ) of a nuclear substance (Minor Spill)**
 - 9.1. Wear proper personal protective equipment (e.g., disposable lab coat or coverall, foot covers, two pairs of disposable gloves, safety goggles).
 - 9.2. Surround the spill with absorbent papers working from the outside of the spill towards the center to avoid splashes and spreading of contamination. Use wetted absorbent material for dry spill.
 - 9.3. Place the absorbed waste paper in a double plastic bag and transfer to a labeled waste container.
 - 9.4. Decontaminate the area with appropriate material while using the meter to determine the progress. The initial approach should be scrubbing with small quantities of hot water containing detergent. Use only necessary amount of water to minimize the spread of contamination.
 - 9.5. Wipe test or survey for residual contamination and repeat until removable contamination is below 0.5 Bq/cm^2 .
 - 9.6. Go to step 16.
10. **If spill involves more than 100 EQ of a nuclear substance or personnel contamination or release of volatile material (Major Spill), the RSO will notify the CNSC immediately in the event of the major spill.**
11. Secure the area; evacuate personnel not involved in the spill. Limit the movement of all personnel who may be contaminated until they are monitored.
12. Leave the fume hood running to minimize release of volatile nuclear substances to adjacent rooms and hallways.
13. Secure the spill area to prevent entry. Post warning sign(s).
14. Inform the Radiation Safety Officer (Safety Office: 204-789-1439/204-782-2588) or Security (204-786-6666) immediately.
15. Remain in the area to provide information and help with cleanup/decontamination as directed by the Radiation Safety Officer.
16. Ensure that all spilled and contaminated materials are properly packaged for disposal and are treated as radioactive waste. Ensure that all other items used in the cleanup are decontaminated. Record spill details and contamination monitoring results. Adjust inventory and waste records.
17. Check hands, clothing and shoes for contamination.
18. Send a copy of records of decontamination and result of subsequent monitoring to the Radiation Safety Officer and file a copy in the binder in the room where the incident occurs along with the University of Winnipeg incident report.
19. Investigate the factors contributed spill and take action on preventative measures to reduce the possibility of re-occurrence.

Procedures for Managing Personal Contamination:

Please note: Treatment and safety of the seriously injured person(s) always takes precedence over radioactive contamination control.

It is the responsibility of the Radioisotope permit holder to advise authorized workers and students to take immediate corrective actions regarding any susceptible radioactive contamination on clothing or skin in order to prevent further spread of contamination by way of inhalation, ingestion, or absorption through cuts in the skin.

Eye contamination:

1. Use local emergency eyewash station as soon as possible.
2. Monitor your hand for radioactive contamination; if clean use your thumb and index finger to open your eyelids and flush with tepid water for no less than 15 minutes. If your fingers are contaminated ask for assistance to hold your eyelids.
3. Monitor for contamination and if necessary repeat the flush.

Wounds (e.g., punctures, scrapes, cuts) on hands:

1. Remove gloves (grasp outside edge near wrist, peel away from hand, turn glove inside-out, hold in opposite gloved hand, slide ungloved finger under the wrist of the remaining glove, careful not to come in contact with the outside of glove and peel off from inside, creating a bag for both the gloves).
2. Save the gloves and the object that has caused the wound for monitoring and isotope identification to determine if internal exposure is likely or not.
3. Squeeze the wound and allow it to bleed; flush the wound with tepid water for no less than 15 minutes.
4. Bandage or cover the wound and seek medical attention at the University Student Health Clinic, your own health care provider, or any emergency department.
5. Report the incident to the Radiation Safety Officer (Safety Office: 204-789-1439/204-782-2588) or Security (204-786-6666) immediately. Complete the University of Winnipeg incident report form and provide the report to the supervisor/radioisotope permit holder.

Hair contamination:

1. Located the contaminated area and flush under tepid water for no less than 15 minutes.
2. If the contamination persists it might be necessary to clip the contaminated hair.
3. Contact the Radiation Safety Officer (Safety Office: 204-789-1439/204-782-2588) or Security (204-786-6666) immediately.

Contaminated Clothing:

1. Remove the contaminated gloves and put on a clean pair of gloves.
2. Remove all contaminated clothing in such a way to prevent further spread of contamination to the skin. Remove clothes inside out to contain the contamination.

3. Put the contaminated clothes in a sealed plastic bag and write the following information on the bag: name, telephone number, and radioisotope involved.
4. Monitor all exposed skin areas and hands after removal of clothes. Refer to the guidelines on personal contamination if skin contamination is detected.
5. Report the incident to the Radiation Safety Officer (Safety Office: 204-789-1439/204-782-2588) or Security (204-786-6666) immediately. Complete the University of Winnipeg incident report form and provide the report to the supervisor/internal permit holder.
6. If the clothing cannot be cleaned and the isotopes involved are short-lived, store the contaminated clothing until the radioactivity has decayed.

Personal Contamination:

1. Wash the exposed area with hand soap and tepid water, or other appropriate solution for skin. Do not use too hot or too cold water as this increases blood flow to the area which can increase the rate of absorption of the contamination.
2. Wash the affected skin area for about 2 to 3 minutes; remember to wash fingernails as well if the hands are contaminated. Rub, do not scrub as scrubbing may open the skin and allow internal contamination.
3. Rinse the affected area with clean water and gently pat dry.
4. Monitor the area with a contamination meter. Repeat the procedure as necessary.
5. Wear gloves to prevent the spread of contamination to the hands during decontamination procedures.
6. Work from the center of your body out (if forearm is contaminated, wash from the elbow towards the hands. Hold your arm in such a way that water runs off your arm into the sink, not onto the floor or your body).
7. Monitor affected skin areas after decontamination.
8. Stop cleaning immediately if contamination cannot be removed or if skin becomes irritated.
9. Rinse eyes with tepid water for no less than 15 minutes with the use of emergency eyewash station to flush out any foreign materials.
10. Rinse your mouth with water but do not swallow.
11. Blow your nose and keep the tissue for analysis of radioactive contamination.
12. If liquids have been absorbed in the outer ear, lean to the side that has the liquid in it. Do not insert anything into your ear.

Procedures for Decontamination of Equipment and Areas:

1. Prior to decontaminating any equipment, worker must wear protective clothing as a minimum requirement lab coat and two pairs of gloves are necessary.
2. A paste made from two tablespoons of Alconox or Sparkleen dissolved in water or other commercially available products can be used for decontamination.
3. Begin by washing equipment, followed by scrubbing, and corrosive methods if washing did not remove the contamination.
4. Do not use methods such as grinding, sanding, scraping or chipping contaminated surfaces without direction from the Radiation Safety Officer.
5. Disassemble complex items as much as possible, if such action will not jeopardize the operational integrity of the equipment, to allow sufficient cleaning of inner surfaces which may be contaminated.

6. Use disposable material (e.g., paper towels) for decontamination.
7. Make every effort to minimize the spread of contamination during decontamination procedures. (i.e. Do not clean a less contaminated surface with the same towel used to clean a highly contaminated surface)
8. Start from the edge of a spill and work toward center.
9. If highly contaminated areas are creating unacceptable exposure levels, clean the highly contaminated surface first.
10. Monitor the surface during decontamination with either a portable survey meter or the wipe test to ensure the effectiveness of the procedures being performed. Repeat the decontamination procedures as necessary.
11. Conduct final wipe test to confirm that there is no further evidence of removable contamination.
12. Items and surfaces which cannot be successfully decontaminated must be identified and controlled as radioactive materials, and may require appropriate shielding.
13. Ensure that all radioactive waste generated during decontamination is properly collected and disposed of in solid and liquid radioactive waste containers.
14. Remove gloves and dispose of in the radioactive solid waste container. Remove other personal protective equipment.
15. Wash hands thoroughly. Monitor hands, body, lab coat, clothing etc. for evidence of radioactive contamination.

Procedures for Sealed Sources and Radiation Devices:

1. If a positive leak-test is reported, the Radiation Safety Officer will advise the radioisotope internal permit holder and users to discontinue using the source/device and the RSO will notify the CNSC immediately. The device should be properly packed and sent to the licensed service provider for repair or disposal.
2. In case of little damage of a source or device, a leak test (if applicable) must be performed before using the device or source. When the damage is extensive, the source or device should be properly packaged and sent for disposal to the licensed service provider.
3. Depending on the nuclear substance in the sealed source or radiation device, a complete radiation survey may be necessary to verify that there is no contamination of the area where the source or device was damaged.


Procedures for loss or theft of Radioactive Material:

1. Any loss/theft of radioactive material and/or radiation devices must be reported to the RSO immediately. The RSO will then inform CNSC immediately followed by a full report of the loss will be sent within 21 days of the incident.
2. When appropriate, a radiation survey meter or contamination meter may be used to locate the sealed source or radiation device.

Procedures for the event of Fire or Explosion:

1. In the event of a fire, immediately contact local fire department and the Radiation Safety Officer. If the RSO is unavailable, notify the Security Office regarding the location of a radiation device and/or radioactive material.

ORGANIZATION AND ADMINISTRATION OF RADIATION SAFETY

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: 1 Revision Date: March, 2015 Revised By: Sangita Shah
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1. Organization and Administration of Radiation Safety

1.1. Radiation Safety Policy

1.1.1. Purpose:


A variety of radiation sources are required for the teaching and research programs at the University of Winnipeg. The policies and procedures described herein are designed to provide for the health protection of personnel related to the use of radioactive materials and equipment which emit radiation, and ensure that the University is in compliance with all federal and provincial statutory acts and regulations pertaining to radiation safety.

These policies and procedures are based on the recommendations and codes of the Canadian Nuclear Safety Commission (CNSC).

1.1.2. Scope

The Radiation Safety Policy shall apply to all activities that utilize radioisotopes and radiation emitting devices, including:

- a) University teaching programs and research projects;
- b) Research involving the use of university facilities conducted by faculty for external organizations;
- c) Research conducted by external organizations involving the use of university facilities under agreement with the university.

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1.2. Canadian Nuclear Safety Commission (CNSC) – Legislated Requirements

The Canadian Nuclear Safety Commission (CNSC) controls the development, application and use of nuclear energy in Canada. The CNSC issues licence for various aspects of nuclear energy and materials. The University of Winnipeg currently possesses a consolidated Nuclear Substances and Radiation Device Licence issued by the CNSC.

The CNSC carries out compliance inspections of the University of Winnipeg Radiation Safety Program and radioisotope laboratories/areas to ensure that all regulatory and licence requirements are met.

1.2.1. Risk Assessment

The CNSC has implemented a risk-based assessment process in which the commission assesses 13 different Safety Control Areas (SCA) (see table below) and grades the performance based upon the risk to health, safety, security and the environment during the inspection. Not all aspects of the safety control areas are checked during the inspection; however it is the responsibility of licensees to be in compliance with all regulatory requirements.

1. Radiation Protection	8. Quality management
2. Emergencies and Unplanned Events	9. Non-radiological Health and Safety
3. Environmental Protection	10. Public Information Programs
4. Fire Protection	11. Security
5. Training and Qualification	12. International Obligation and Safeguards
6. Operational Procedure	13. Transportation
7. Organization and Management	

1.2.2. Licence Assessment and Inspections

The CNSC verifies that the licensee is complying with the laws and regulations, as well as the conditions of the licence through Type I and Type II inspections (see below), and Annual Compliance Reports. The grading system for the inspections are based upon certain expectations for documents, control measures, work performance, training records, records management and reporting requirements. When non-compliance in any of these areas has been identified, CNSC staff assess the significance of the non-compliance, and determine the appropriate enforcement action on the CNSC's graduated approach to enforcement, which can include revocation of licence and administration of monetary penalties. An administrative monetary penalty (AMP) is a monetary penalty imposed by a regulator, without court involvement, for the violation of a regulatory requirement. Individuals could incur fines of up to \$ 25,000 who are not compliant with the Nuclear Safety and Control Act. Additionally, corporations may be fined up to \$ 100,000 for non-compliance issues.

The CNSC's current compliance and enforcement system includes a number of tools, including: improvements orders, revocation of a licence, and prosecution of an offence. The enforcement tool selected by the CNSC depends on the severity and regulatory significance posed by the matter of non-compliance. An AMP system provides the CNSC with an additional tool to address non-compliance by individuals and corporations subject to the Nuclear Safety and Control Act.

1.2.2.1. Type I Inspection

A Type I inspection is also known as an audit. It is comprised of an on-site visit and verification and evaluation of the licensee's programs, processes and practices. Compliance verification is done through direct observation of work activities, a comprehensive review of procedures and records, and staff interviews. This type of inspection is usually done once every three to five years with a licensing specialist from Ottawa. At the end of the inspection, the licensee is presented with the preliminary findings, and a complete report is sent to the licensee within 60 days of the inspection. The licensee is given a list of any non-compliance found, and must provide timelines for addressing the findings. Should something be found during the inspection that is an imminent threat to health, safety, or the environment, the Nuclear Safety and Control Act provides inspectors with the power to immediately issue stop work orders.

1.2.2.2. Type II Inspection


A Type II inspection involves verification of activities related to routine (item by item) checks and rounds. CNSC staff conducts a compliance inspection of the University of Winnipeg Radiation Safety program and radioisotope labs/storage rooms every year. This inspection involves the verification of licensing activities which are grouped into Safety and Control Areas (SCA) on the Type II Inspection Worksheet.

A Type II inspection is an on-site snapshot of the licensee's operations. These inspections are typically shorter than Type I inspections since extensive interviews are not performed, and data is collected mainly through direct observations, measurements, and reviews of on-site records. At the end of the inspection, the licensee is presented with a preliminary report, and a complete report is sent to the licensee within 30 days of the inspection. The licensee is given a list of non-compliances found, and must provide timelines for addressing these findings. As with Type I

inspections, should something be found during a Type II inspection that is an imminent threat to health, safety, or the environment, the Nuclear Safety and Control Act provides inspectors with the power to immediately stop these activities.

1.2.2.3. Annual Compliance Report

An Annual Compliance Report (ACR) is a condition of the licence issued by the CNSC. The ACR is a brief overview of the licensee's activities in the previous year which serves to keep the CNSC up-to-date on the status of the licensee's nuclear substances, prescribed equipment, and locations and licence contact information. The Radiation Safety Officer will prepare the ACR on behalf of the Radiation Safety committee. The ACR will be submitted to the CNSC by November 30 of each year.

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1.3. University of Winnipeg Radiation Safety Program

The University of Winnipeg is committed to providing a safe and healthy work and study environment for the entire university community and to protecting the environment as a whole from any potential adverse effects resulting from the use of ionizing and non-ionizing radiation on campus.

The Safety Office is responsible for developing policies and procedures and for providing training and information on the unique hazards associated with these types of sources and all forms of radiation. All faculty members, employees, students, volunteers, contractors and visitors are required to comply with the radiation safety policy and procedures manual as well as all applicable legislation.

1.3.1. Obligations of Licensees

The General Nuclear Safety and Control Regulations list the obligations of licensees as follows:

- Ensure the presence of a sufficient number of qualified workers to carry out the licensed activity safely and in accordance with the Act, the regulations made under the Act, and the licence;
- Train the workers to carry out the activity in accordance with, the regulations made under the licence, and; the Act
- Take all reasonable precautions to protect the environment and the health and safety of persons, and to maintain the security of nuclear facilities and of nuclear substances;
- Provide the devices under the Act and regulations required by the licence are maintained within the manufacturer’s specifications;
- Require that every person at the site of the licensed activity use equipment, devices, clothing and procedures in accordance with the Act, and regulations. Take all reasonable precautions to control the release of radioactive nuclear substances or hazardous substances within the site of the licensed activity, and into the environment;
- Instruct the workers on the physical security program at the site of the licensed activity and on their obligations under that program; and
- Keep a copy of the Act and the regulations made under the Act that apply to the licensed activity readily available for consultation by the workers.

As the licensee, it is the responsibility of the University of Winnipeg to ensure that these obligations are met through the organizational structure outlined in the following section.

1.3.2. Radiation Safety Committee (RSC)

The Radiation Safety Committee is a sub-committee of the University Workplace Health and Safety Committee. The RSC, in conjunction with the Workplace Health and Safety committee, provides assistance to laboratory personnel in the identification, documentation, examination, evaluation, and resolution of concerns pertaining to use of radioisotopes and radiation emitting devices related to teaching and research laboratories at the University and work performed therein.

The RSC acts in an advisory capacity to the Radiation Safety Officer and performs the following functions:

- Authorizes and controls the use of radionuclides and radiation-producing devices at the University in compliance with the aforementioned legislation, the consolidated licence issued by the Canadian Nuclear Safety Commission
- Regulates the use of radiation emitting sources/materials at the University and, if warranted, suspends their use.
- The committee determines the corrective actions to be implemented in the event of non-compliance by radioisotope internal permit holders.

Terms of Reference

The committee has the mandate and authority to:

- Advise on the safe use of sources of ionizing radiation (radioactive material).
- Develop and implement a radiation protection program for the University and periodically review this program.
- Enforce the Radiation Safety Program.
- Issue internal permits to control all licensed activities involving radioactive materials.
- Review reports of all inspections and incidents and make recommendations as appropriate.
- Make determinations regarding revoking permits from individuals who contravene these policies and procedures. The RSC determines the corrective actions to be implemented in the event of non-compliance by radioisotope internal permit holders.
- Report radiation safety program and licensed activities to the University Workplace Safety and Health Committee through the Radiation Safety Officer.

Membership

1. Voting members

The following members are appointed by the Associate Vice-President, Research and Innovation and the Dean of Science, in consultation with department chairs

- Two faculty members from each of these departments, Physics, Chemistry and Biology, involved with the use of radioactive materials or radiation-emitting devices or knowledgeable in the use of radioactive materials.

2. Non-voting members

- The Radiation Safety Officer (RSO)
- The Alternate Radiation Safety Officer/Health and Safety Specialist

3. Alternates

Each department is encouraged to register an alternate committee member (of each type, as applicable) for the purpose of attending meetings in the event that the regular member(s) of the committee from their department is unavailable

4. Chairperson

The Chair and Vice-chair shall be selected from the faculty members on the committee, and will serve two-year terms. In the absence of the Chair, the Vice-Chair will assume the duties of the chair.

5. Meetings

Radiation Safety Committee meets at least once a year and whenever necessary to fulfill its responsibilities.

6. Quorum

This subcommittee will make its recommendations through consensus. One representative from each department will need to be present to form a consensus.

1.3.3. Radiation Safety Officer (RSO)

The Radiation Safety Officer is assigned lead responsibility to ensure radiation safety throughout the University campus, and should therefore have relevant theoretical and practical knowledge of the nature and use of radiation. The RSO is administratively responsible to the Vice President (Human Resources, Audit and Sustainability).

The alternate Radiation Safety Officer will act as a Radiation Safety officer in the absence of the Radiation Safety Officer.

The RSO should understand the methods and technology utilized to control, use, handle, store and transfer nuclear substances, and those utilized to monitor and control radioactive contamination, radiation fields and radiation exposures. He/she should also understand the pertinent regulatory processes and legislation. These may include licensing processes, conditions of the licence issued to the University of Winnipeg by the CNSC, the Nuclear Safety and Control Act and its regulations, as well as pertinent CNSC regulatory guidance and documents.

According to Section 15 of the General Nuclear Safety and Control Regulations, the Radiation Safety Officer or designate must inform the CNSC within 15 days of any changes in the RSO position or the RSO's contact information.

The Radiation Safety Officer or designate shall administer the radioisotope licence issued to the university by the Canadian Nuclear Safety Commission. The Radiation Safety Officer or designate shall have the authority to suspend any operation which is considered unsafe or which has the potential to cause harm to members of the general public or the environment.

The responsibilities of the Radiation Safety Officer are to:

- Assist the Radiation Safety Committee in developing the radiation safety policies and procedures manual and to review the manual periodically or whenever there is a change in the legislation.
- Monitor, advise, and consult on issues related to the handling of nuclear substances and radiation devices in accordance with regulations and licence conditions.
- Review requests for authorization to purchase or use nuclear substances and radiation devices in order to ensure that both the radioactive materials to be purchased and the proposed handling and storage locations are acceptable and comply with the regulations and licence requirements.
- Develop radiation safety training for University staff/faculty members who are required to use nuclear substances and radiation devices and ensure that they are adequately trained in radiation safety and radiation protection procedures. Develop basic radiation safety training for staff whose duties may occasionally expose them to nuclear substances and radiation devices, (e.g. Security and physical plant staff, other support staff) and ensure that they are trained in radiation protection procedures.

- Develop and implement programs to inspect and review licensed activities, radioisotope laboratories and storage rooms, the adequacy of staff and student training, and safety procedures in the work environment. Implement remedial actions to correct any identified deficiencies.
- Initiate any revisions to radiation safety procedures, changes to equipment, and licence amendments required to ensure that the University's licence operations, equipment and facilities comply with regulatory requirements.
- Design and implement, in accordance with regulatory requirements, appropriate personal monitoring programs.
- Administer the distribution and use of dosimeters and equipment, and the recording of the results.
- Monitor the occupational radiation exposures to staff by reviewing the records of exposure and, if required, implement measures to reduce exposures in accordance with the ALARA principle of dose limitation.
- Investigate all reports of overexposures to ionizing radiation, accidents and losses involving nuclear substances and radiation devices, and recommend appropriate actions to prevent recurrences. Ensure that the incidents and results of related investigations are reported to the CNSC and the Radiation Safety Committee members.
- Report radiation safety activities to RSC and Workplace Safety and Health committee
- Assess the adequacy of survey programs which measure or control radiation fields and radioactive contamination during licensed activities.
- Ensure sealed sources are leak tested and radiation monitoring instruments are calibrated in accordance with the regulatory requirements.
- Ensure that all records and reports which are required by the conditions of the licence and the regulations are prepared, maintained and submitted in a timely fashion.
- Maintain RSC documents including meeting agendas and minutes.
- Report on the activities of radiation safety program at the Workplace Safety and Health Committee meetings.
- Refer radioisotope projects or any application to use radioactive materials or radiation devices to the Radiation Safety Committee or to the Canadian Nuclear Safety Commission for approval as necessary.
- Maintain a University-wide inventory of radioactive sources and radiation devices.
- Consult with permit holders and authorized workers regarding the use, storage and disposal of radioactive materials and radiation emitting devices.
- Liaise with the CNSC for licensing matters regarding the University's Radioisotope consolidated licence.
- Inform the Co-chairs of the University Workplace Safety and Health Committee, the RSC, the Vice President (Human Resources), Vice President Academic and Research and Innovation, and the Dean of Science of any matter pertaining to radiation protection that warrants their attention.

1.3.4. Radioisotopes Permit Holder

The responsibilities of Internal Permit Holders are to:


- Ensure that all authorized workers and students, as listed on the permit, are aware of radiation hazards associated with the radioisotopes in use and all radiation safety procedures.
- Ensure that all authorized workers and students are trained to work safely with radiation and to provide site-specific training in the safe use of radioactive materials.
- Assess and inspect their work areas for compliance with the CNSC act and regulations; ensure any incidents which occur in their area are promptly reported to the RSO and adhere to all responsibilities as listed on the permit.
- Provide adequate and appropriate Personal Protective Equipment (PPE), instruments, supervision and instruction to students and authorized workers in compliance with the University's Radiation Safety Policy.

1.3.5. Authorized Workers (Radioisotope Permit holders, authorized staff and students)

Authorized workers are University of Winnipeg faculty members and staff, other than the Radioisotope Permit Holder. Permit holders, Authorized workers and students must know and comply with applicable policies, procedures, and regulations when working with nuclear substances as outlined below:

- Complete Radiation Safety Training.
- Know the physical properties of the nuclear substances (radioactive materials) being handled.
- Follow the ALARA (As Low As Reasonably Achievable) principle – reduce the time, increase the distance, and use correct shielding to reduce external radiation dose.
- Know what to do in case of a spill or accident with a nuclear substance, and report all radiation incidents to the Radiation Safety Officer.
- Keep all food and beverages or anything associated with food out of the laboratory.
- Wear dosimeters when required.
- Know all applicable University of Winnipeg policies and procedures and conduct radioactive work procedures using good work practices.
- Record all usage, storage and disposal of radioactive materials on a Radioisotope Inventory Form.
- Allow only authorized persons to enter rooms which are specified as restricted areas to prevent potential radiation exposure.
- Maintain the transfer log kept in the storage room.
- Perform wipe checks on incoming nuclear substance shipments.
- Place absorbent bench coat on radioactive work surfaces.
- Label radioactive work areas on all four sides with radioactive warning tape.
- Label all equipment that is inside the radioactive work area with radioactive warning tape.
- Conduct radioactive work procedures using good work practices.
- Conduct post –procedure wipe checks for contamination.
- Decontaminate the area when contamination is found.

- Keep the radioactive area as clean as possible! After an experiment all areas must be checked for contamination. Radiation should ideally be at background levels.
- Record all usage, storage and disposal of radioactive materials on Radioisotope Inventory forms.
- Conduct personal contamination surveys.
- Dispose of radioactive waste from the laboratory after consultation with the RSO.

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1.4. Internal Compliance

The University of Winnipeg’s RSO performs an annual inspection of all authorized locations and storage rooms to verify compliance with regulations, licence conditions and internal permit conditions. Incidences of non-compliance are documented by the RSO and must be corrected in a timely fashion by the radioisotope permit holders and authorized workers. The audits and inspection reports are reported to the Radiation Safety Committee and the Health and Safety Committee meetings by the RSO. Appendix D contains the Internal Inspection checklist.

1.4.1. Internal Enforcement

The Radioisotope permit holder is responsible for encouraging compliance among the authorized workers and students. If the RSO finds any violations during the inspection or audits, the following procedures will be followed:

- A written inspection report will be forwarded to the internal permit holder for his/her review and to develop actions to correct deficiencies according to any recommendations provided by the RSO.
- The permit holder will provide a progress report on any action items when requested by the RSO.
- A follow-up inspection will be conducted within 30 days of the report.
- If there is a failure to correct the deficiencies, the report will be forwarded to the RSC to review and determine what enforcement action to take, reflecting the severity and repetition of the incidents of non-compliances.
- Enforcement actions taken by the Radiation Safety Committee and the Radiation Safety Officer may include, but are not limited to:
 - Temporary or permanent closure of a radioisotope laboratory.
 - Temporary suspension of radioisotope user permit and use of radioactive materials.
 - Revoking radioisotope permit indefinitely.

The Radiation Safety Committee or the Radiation Safety Officer reserves the right to revoke a user’s authorization at any time if the health or safety of the persons or property is placed in immediate danger.



Section: 1

Part: Records and Reporting System

Pages: 2

1.5 Records and Reporting System

The Nuclear Safety and Control regulations prescribe specific records and reports as well as the conditions for their retention and disposal. These records are used to evaluate the University's radiation safety program, compliance with the ALARA principle, and to demonstrate compliance.

The radioisotope permit holder is responsible for maintaining the following records in accordance with the Radiation Safety and Procedures manual. These records must be made available for inspections by the Radiation Safety Officer and to officers of the Canadian Nuclear Safety Commission at any time.


- Receipt of radioactive material records.
- Inventory records (accounting for stock and sub-stock materials, materials in use, disposal).
- Weekly contamination (wipe test) records.
- Authorized worker lists.
- Incident reports.
- Leak test records for sealed sources (as required).
- Authorized worker training records.

The following records and reports must be maintained and available, at the site where nuclear substances are used, for inspection by the CNSC. The RSO is responsible for ensuring records are available and complete. These records must be retained unless otherwise stated in the radioisotope licence conditions or until written permission to dispose of the records has been received by the CNSC. A written notification should be sent to the CNSC for authorization of the intended date of disposal and the nature of the records at least 90 days before the intended date of disposal.

1. Names of persons who use and handle nuclear substances (Authorized worker lists).
2. If applicable, the names and job categories of persons designated as Nuclear Energy Workers (NEWs).
3. Training program information for workers who handle nuclear substances.
4. External dosimetry results.
5. If applicable, internal bioassay results.
6. Records of acquisitions, disposals and transfers of nuclear substances.
7. Inventory of unsealed sources.
8. Inventory of sealed sources and radiation devices.
9. List of laboratories, rooms and other locations designated for the use of nuclear substances.
10. List of storage locations of nuclear substances.

11. Inventory of radiation detection equipment.
12. Wipe test monitoring results for unsealed substances.
13. Fixed contamination monitoring results, if applicable.
14. Decommissioning results.
15. Records of methods and characteristics of radioactive waste disposal.
16. Transfer and transport documents.
17. Leak test monitoring results.
18. Details of emergencies and other incidents involving nuclear substances.
19. Documentation related to the internal permit program.
20. Survey meter calibration reports.

RADIOISOTOPE PERMITS

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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2 Radioisotopes Permits

2.1 Internal Radioisotope Permit

The University of Winnipeg currently possesses consolidated nuclear substances and radiation devices licence issued by the Canadian Nuclear Safety Commission. The University of Winnipeg Radiation Safety Committee authorizes the purchase, use and storage of radioisotopes at the University of Winnipeg or at any location governed by this license. Authorization is given in the form of an internal radioisotope permit issued under the University of Winnipeg nuclear substances and radiation devices licence.

Faculty members who want to purchase, use, or store radioisotopes or devices in which a sealed source is embedded must apply for a radioisotope internal permit.

The University of Winnipeg radioisotope permit consists of the following:

- Approved locations for storage and/or usage
- Name of the permit holder
- Authorized workers – list of the individuals who are authorized to work under the internal permit
- The date when the permit was issued and when it will expire
- Approved radioisotopes/radiation devices
 - Radioisotope possession limit
 - Type of laboratory
 - Sealed sources
 - Radiation devices
- Methods of radioisotope disposal
- Appendix A.4 states the conditions of approval that the Radioisotope permit holder and authorized workers must comply with in order to maintain radioisotope permit. Appendix A.5 states in Vivo Use Conditions of approval, it is only applicable to Radioisotope Permit Holder who does in vivo radioisotope work with animals. Conditions will be applied to each approved protocol.

The conditions of approval depend on the types of procedures that will be conducted, the radioisotopes to be used, and quantity of radioactive materials to be used. These conditions must be must be complied by the Radioisotope Permit Holder.

The Radioisotope Internal permit and permit conditions must be posted in each room, area or enclosure where nuclear substances and radiation devices are used or stored.

2.1.1 Radioisotope Permit Application

The following is the permit application procedure:

1. The faculty member must complete a Permit Application Form (Appendix A.1) and return it to the RSO.
2. Upon receipt of completed application for a Radioisotope permit, the RSO may arrange a meeting with the faculty member to discuss the laboratory requirements and University of Winnipeg policies and procedures related to radioisotope use. An inspection of the proposed areas of use/storage may also be required to determine if the facilities are acceptable and meet the design requirements of the CNSC (CNSC Design Guide R-52. Rev. 1, Design Requirements for Radioisotope Laboratories).
3. The RSO will then forward the application to the University Radiation Safety Committee for approval.
4. If approved by the Radiation Safety Committee members, the RSO will prepare the Radioisotope user permit and permit conditions. The Radiation Safety Committee chair will sign the approved permit.
5. The RSO will issue the permit and review the conditions with the radioisotope permit holder.

See Appendix A for a permit application form, a sample Radioisotope Internal permit and conditions of the permit approval.

2.1.2 Radioisotope Permit Amendment

The radioisotope permit holder must request an amendment for any of the following changes:

- Addition or deletion of radioisotope(s);
- Change in possession limit;
- Change in location of use and/or storage;
- Renovations to the laboratory space;
- Addition/deletion of authorized workers.

The internal permit holder must send an email to the Radiation Safety Officer requesting any amendments to the internal permit. An amended permit will be prepared by the RSO and forwarded to the University Radiation Safety Committee for approval. Once approved, the permit will be sent to the permit holder.

2.1.3 Radioisotope Permit Renewal

The radioisotope permit holder will be responsible for renewing the internal permit at least one month in advance of the expiry date. The radioisotope permit holder must complete and forward the renewal application to the RSO. The RSO will not be responsible for renewing permits in the absence of the permit holder for any reason such as sabbatical, illness or maternity leave.

2.1.4 Radioisotope Permit Application/Amendment Rejection

The RSO will advise the Radioisotope Permit holder requesting an application or amendment of the reasons why the application or amendment was not approved. The University of Winnipeg Radiation Safety Committee makes the final decision on all application/amendment requests.

2.1.5 Temporary Transfer of Radioisotope Permit for Sabbatical, Maternity or Extended Leave

The radioisotope permit holder is responsible for informing the RSO prior to leaving for an extended period of time. The permit holder must arrange for a temporary transfer of the Radioisotope permit to an acceptable individual which may apply during the original permit holder's absence.

A Radioisotope permit suspension may be imposed by CNSC if a temporary transfer of the Radioisotope permit is not arranged prior to leaving.

2.1.6 Radioisotope Permit Cancellation

The permit holder will forward an email to the RSO requesting permit cancellation when employment is terminated or when there are no plans to continue radioactive work. The following is the procedure to be followed by the permit holder:

1. Forward a written request for cancellation of the radioisotope permit to the RSO.
2. Consult with the RSO for the disposal or transfer of radioactive materials and devices/equipment containing radioisotopes and decommissioning procedures.
3. Remove all radiation warning placards following decontamination and final inspection by the RSO.
4. Ensure that dosimeters are returned to the RSO.
5. Contact the RSO to make final permit cancellation arrangements.

The RSO will ensure that all laboratories stated on the radioisotope permit are inspected prior to Radioisotope permit cancellation.

The Radioisotope permit holder will be responsible for decontamination if any contamination is found during the final inspection.

2.1.7 Dormant Radioisotope Permit

The radioisotope permit holder must contact the Radiation Safety Officer to make arrangements for changing a Radioisotope permit to DORMANT status if he/she does not have immediate plans to continue radioactive work. The following is the procedure to be followed by the internal permit holder:

- Consult with the RSO to dispose of all unsealed radioactive materials and to transfer devices and equipment containing radioisotopes to another Radioisotope Permit Holder.
- Complete a wipe check and contamination survey of the laboratories and equipment and decontaminate as required.

- Remove all radiation warning placards following decontamination and final inspection by the RSO.
- Ensure that dosimeters are returned to the RSO.
- Contact the RSO to make the permit in dormant status.

The RSO will ensure that all laboratories stated on the radioisotope permit are inspected prior to changing the radioisotope permit to DORMANT status.

The Radioisotope permit holder will be responsible for decontamination if any contamination is found during the final inspection.

The RSO will inform the RSC that a Radioisotope Permit be made DORMANT due to inactivity in using radioactive materials.

The RSC may cancel a DORMANT Radioisotope permit after two years.

2.1.8 Radioisotope Permit Suspension

A Radioisotope Permit Suspension may result when relevant regulations or conditions of approval are violated.

The RSO will notify the Health and Wellness manager and the Health and Safety Specialist when violations necessitate the investigation of a radioisotope lab and review of radioisotope permit conditions and the investigation report will be reported to the RSC.


The RSC will decide whether to suspend the Radioisotope Permit or impose other disciplinary action.

2.1.9 CNSC approval for Special projects – projects using more than 10,000 times Exemption Quantities

A radioisotope internal permit holder requiring the use of an unsealed nuclear substance in a quantity of more than 10,000 times the exemption quantity for his/her research project(s) must contact the RSO for approval 4-6 weeks prior to beginning of work.

The permit holder must forward the permit amendment request to the RSO and RSC for review and approval. The RSO must obtain written approval from the CNSC prior to issuing an internal authorization.

RADIOISOTOPE LABORATORY REQUIREMENTS

 <p>THE UNIVERSITY OF WINNIPEG</p>	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW
Section: 3 Part: Radioisotope Laboratory Designation Pages: 1	Revision Date: Revised By: Sangita Shah

3. Radioisotope Laboratory Requirements


3.1 Radioisotope Laboratory Designation

Laboratories where unsealed nuclear substances are used are designated as Basic, Intermediate or High level laboratories. The designation level of the laboratory is based upon limits for the internalization of various nuclear substances (Annual Limit of Intake (ALI) – listed in Appendix E, and the maximum activity in the stock vial of nuclear substances used in that laboratory. Additional restrictions and requirements are based on a risk assessment of the procedures being used and the total activity of the radioisotopes in use.

Currently at the University of Winnipeg, radioisotope laboratories are classified as Basic Level or Storage rooms. Sealed and unsealed sources are used for teaching and research purposes, and radioactive waste and decaying radioactive materials are stored in the storage room. A Basic level radioisotope laboratory is a space in which an unsealed nuclear substance is used and where the nuclear substance is larger than one “exemption quantity” (defined in section 1 of the Nuclear Substances and Radiation devices Regulations), and where the largest quantity of each unsealed nuclear substance in one container does not exceed five time its corresponding Annual Limit of Intake (ALI), (defined in section 12(1) of the Radiation Protection Regulations).

Designation of a laboratory is based upon the amount of radioactive material within a single vial, the types of procedures to be conducted, and the University of Winnipeg Licence conditions. The RSO will determine laboratory designations and restrictions based on the information stated on the application for a Radioisotope permit or permit amendment request.

The RSO will determine if there are any laboratory design inadequacies based upon the Guidance Document GD-52 Design Guide for Nuclear Substance Laboratories. The Radioisotope permit holder will be notified, in writing, of any inadequacies found. The Radioisotope Permit Holder will be responsible for requesting alterations or additional equipment to meet design requirements. The radioisotope permit will not be approved if the design requirements have not been met.

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3.2 Radioisotope Laboratory Identification

At the University of Winnipeg all publicly accessible entrances to a radioisotope laboratory must be identified with lab door placard to ensure that individuals are aware, prior to entering, that a radiation hazard may exist in the laboratory. The RSO and permit holder shall ensure the correct posting of all warning signs and safety posters. Any maintenance work must be scheduled through the RSO.

Section 21 of the CNSC Radiation Protection Regulations (Ref. 3) requires that a durable and legible sign bearing the radiation warning symbol set out in Schedule 3 and the words “RAYONNEMENT-DANGER-RADIATION”, be posted at the boundary of and every point of access to:

- An area, room, enclosure or vehicle where there is a quantity of nuclear substance greater than 100 times its regulated exemption quantity, or
- Where there is reasonable probability that a person will be exposed to a radiation dose rate greater than 25 $\mu\text{Sv/hr}$.

Radiation emitting devices (e.g. X-Ray) or devices in which a sealed source is embedded (GC device, Liquid Scintillation Counter) must be labeled with the radiation warning symbol.

3.2.1 Radioisotope Laboratory Identification and Safety Rules

Radioisotope Laboratory Identification Cards (see Appendix F) containing laboratory designation and safety rules for working with radioisotopes are available from the CNSC and will be supplied and posted in all radioisotope laboratories/rooms.

The radioisotope permit holder will be responsible for notifying the RSO if the identification cards are missing, defaced and/or if replacement is required. The radioisotope permit holder must ensure that the card remains conspicuously posted at all times. The permit holder is also responsible for ensuring that all laboratory staff, students and authorized visitors are aware of the safety rules.

Frivolous posting of signs is prohibited. **Radiation warning signs and symbols must be removed when the area or equipment will no longer be used for radioactive work.** Section 23 of the CNSC Radiation Protection Regulations (Ref. 3) states “No person shall post or keep posted a sign that indicates the presence of radiation, a nuclear substance or prescribed equipment at a place where the radiation, nuclear substance or prescribed equipment indicated on the sign is not present”.

The radioisotope permit holder is responsible for removing all radiation warning signs and labels following decommissioning of laboratory/room.


3.2.2 Posting of CNSC Licence and Internal Permit

A valid copy of the radioisotope permit and a notice stating that “A copy of the University of Winnipeg Radioisotope CNSC licence can be obtained from the Radiation Safety Officer (phone # 204-789-1439), Safety Office, 1C05, 515 Portage Avenue”, shall be conspicuously posted at all approved locations where radioactive materials are used or stored (Section 14 of CNSC General nuclear Safety and Control Regulations (Ref. 2)).

3.2.3 Emergency Contact Information

The Canadian Nuclear Safety Commission also requires Emergency contact information to be posted at all radioisotope laboratory/room entrances. Licensees are obligated to post the name or job title and telephone number of a person who can initiate the appropriate procedures referred to in the licence and who can be contacted 24 hours a day in case of an emergency.

The radioisotope permit holder is responsible for posting this information, maintaining up-to-date information and ensuring that all laboratory staff and students are aware of the information on the posting.

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3.3 Labeling Requirements for Radioactive Laboratories and Equipment

The radioisotope internal permit holder is responsible for posting the radiation warning symbol at specific work areas where open sources are handled and on equipment that is used to manipulate open sources. This is required to protect University of Winnipeg staff, students, and the general public. Well defined areas and equipment make people aware of potential radioactive contamination of these areas. The radiation warning symbol is to be prominently displayed, of a size appropriate for the size of the container, equipment, or area being labeled.

Radiation Warning signs and symbols must be removed when the area or equipment will no longer be used for radioactive work.

3.3.1 Defining Radioactive Work Areas

The radioisotope permit holder must select counters in low traffic areas and next to the fume hood if work procedures require the use of a fume hood. The procedures below will assist the permit holder in choosing functional work spaces for working with radioactive substances.

- Select a sufficient, but small radioactive work area to carry out procedures.
- Define radioactive work areas by displaying the radiation warning symbol.
- Cover all four sides of radioactive work areas by using radioactive warning tape.
- Cover radioactive work areas and waste trays with appropriate absorbent bench top covering; ensure the absorbent side is facing up.
- Change the covering at least once per week. Replace contaminated covering immediately and mark it as radioactive waste.
- Carry out work in spill trays covered with appropriate absorbent pads for work with radioactive liquids.
- Tape the sink used for cleaning radioactive contaminated glassware with radioactive warning tape. This sink should be in or near radioactive work areas. Only one sink should be defined for this purpose.
- Label large equipment (water baths, centrifuges, fume hood, incubators etc.) used in conjunction with radioisotopes with radiation warning sign or radioactive warning tape. Label all lab equipment (micropipettes, glassware, etc.) which will be used within radioactive work areas with radioactive warning tape. Dedicate this equipment and glassware ONLY to radioactive work.

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3.4 Decommissioning of Radioisotope Laboratories


The RSO must approve the decommissioning of all designated laboratories and storage rooms.

The University of Winnipeg CNSC licence must comply with all decommissioning requirements by removing all nuclear substances and radiation devices, ensuring that the contamination levels do not exceed the limits specified on the licence and removing all related radiation warning signs and labels. Decommissioning records must be kept for review by the CNSC.

Radioisotope laboratories and rooms may be decommissioned and released in compliance with licence conditions. Records must be kept on file and an updated list of authorized laboratories and room classifications must be forwarded to the CNSC. Decommissioned laboratories/rooms may be subject to a CNSC inspection prior to their release from regulatory control.

Decommissioning Procedures:

1. Characterize the licensed activities (e.g. contamination monitoring).
2. Examine historical information, including the following:
 - The length of time that nuclear substances and radiation devices were in use;
 - The location where they were used;
 - The specific type(s) and quantities of substance(s) which were used, and;
 - The information available by reviewing previous licences.
3. Monitor radiation contamination and decontamination.
4. Prepare for the monitoring, dismantling and removal of equipment.
5. Plan for the removal, transfer and disposal of nuclear substances and radiation devices.
6. Remove or deface all signs, labels and nuclear substances packaging.
7. Conduct a final radiological survey and submit a complete report to the CNSC so that verification of the decommissioning can be completed.
8. Plan for a possible CNSC final inspection prior to releasing the location from regulatory control.


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3.5 Access, Control and Security

Access to radioactive materials must be controlled from the time of acquisition until disposal. Radioactive materials and radiation devices should be secured in a locked room, area, enclosure or vehicle when not in use or not under the direct supervision or control of an authorized workers or permit holder.

Only authorized and trained personnel are permitted to have access to radioactive materials. Students are not authorized to enter the radioactive storage room. These security means are necessary to prevent the loss or theft of radioactive materials. Radioisotope internal permit holders and authorized workers are responsible for ensuring that unauthorized personnel do not have access to radioisotopes or unattended radioisotope laboratories when radioactive material are in use. If unattended by authorized radioisotope workers, radioisotopes must be stored in a locked enclosure, fridge, or cabinet within a locked radioisotope laboratory. Radioactive waste must also be stored in a secured area to prevent unauthorized access.

RADIATION SAFETY TRAINING

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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4. Radiation Safety Training

4.1 Training Requirements

Section 12(1) (b) of the General Nuclear Safety and Control Regulations requires that every licensee shall “train the workers to carry on the licensed activity in accordance with the act, the regulations made under the act and licensed”. No person shall be permitted to work with radioactive materials until they have received appropriate training and have been informed of the risks associated with exposure to ionizing radiation.

The RSO and radioisotope permit holder shall ensure that staff and students have appropriate radiation safety training before authorizing the individual to use or handle radioactive materials. Each radioisotope permit holder is responsible for training each individual working in their laboratory in the radiation protection techniques specific to each procedure.

4.1.1. Training

The University of Winnipeg Radiation Safety course is offered online through Nexus by the Safety Office to allow individuals to complete it at their own pace and time. Faculty members and laboratory staff, undergraduate students, security and maintenance personnel must complete the training through Nexus. The RSO will forward the list of staff/students to the Nexus Administrators for processing. Once processed, staff/students will be able to see the Radiation Safety training course on their Nexus Home Page.

The Radioisotope Permit holder must ensure that all individuals working under their supervision complete the Radiation Safety training prior to using radioactive materials in any laboratory at the University of Winnipeg and forward a list of all authorized workers who require Radiation Safety Training to the RSO.

In order for students to be registered for Radiation Safety Training through Nexus, the Department chair/course Instructor should provide a list of courses for which students require training, indicating the full course number, course name and term (for e.g. PHYS-3901-001; Intermediate Physics Lab; U2013W) to the RSO.

Personnel who are required to enter radioisotope laboratories or the storage room as a part of their duties must also receive basic training. This will inform them when they may be placing themselves at risk, who to contact in the event of an emergency, and what simple steps to take to protect themselves and others until the Radiation Safety Officer arrives. This group includes

personnel in shipping/receiving, contractors, physical plant staff, security and external emergency personnel.

Personnel who are receiving or packing the packages containing nuclear substances must also receive Transportation of Dangerous Goods (TDG) training. This group includes RSO, alternate RSO, and personnel in shipping/receiving. The refresher training is required every two years.

Training records of all staff must be kept by the RSO and their supervisors and be made available for CNSC inspections. The training records of undergraduate students will be kept by the laboratory instructor as well as the RSO.

4.1.2. Authorized Workers

The radioisotope permit holder must maintain a current list of personnel authorized to use nuclear substances in the laboratory including university faculty members, lab staff and undergraduate students. Names of authorized individual(s) should be added or deleted from the internal permit and training list as necessary. Once undergraduate students have completed the Radiation Safety Training successfully, the lab instructor shall advise the RSO to add these students to the internal permit for the authorized teaching laboratory.

4.1.3. Refresher Training

When there is a significant change in duties, equipment, procedures, radioisotope hazards, licensed conditions and/or regulations, retraining is required. All permit holders and authorized workers are required to complete refresher training every three years. The RSO will determine when and if additional retraining is required.



4.2. Nuclear Energy Workers and Authorized Workers

A Nuclear Energy Worker (NEW) is defined as a person who is required, in the course of his business or occupation in connection with nuclear substance, to perform duties in such circumstances that there is a reasonable probability that the person may receive a dose of radiation that is greater than the prescribed limit for the general public (1 mSv). NEWs are required to provide specific information under the CNSC Act and must be registered accordingly.

An Authorized worker is defined as “a personnel listed on the permit as working under the authority of the permit holder”.

Personnel Registration Form (Appendix B.1) must be completed for each individual and returned to the Radiation Safety officer for registration.

4.2.1. Nuclear Energy Worker Notification:

Radioisotope Permit Holder will ensure that all Nuclear Energy Workers are notified with Radiation Safety Officer prior to using nuclear substances.


A NEW Notification Form (Appendix B.2) must be completed for each individual and returned to the Radiation Safety Officer for notification. The CNSC inspector may verify that copies of the notification forms are completed during compliance inspections.

4.2.2. Pregnant Nuclear Energy Worker:

Every Nuclear Energy Worker shall, as soon as her pregnancy has been confirmed, notify the RSO, her supervisor and the permit holder of any internal radioisotope permit on which she is listed as an authorized worker by completing the “Nuclear Energy Worker – Declaration of Pregnancy” form (Appendix B.3).

Once a pregnancy has been declared, this individual’s radiation dose shall not exceed the applicable dose limit for the remainder of her pregnancy. Supervisors and permit holders shall attempt to make reasonable accommodation, barring undue hardship or cost, for the declared pregnant worker, in order to minimize her radiation dose during the remainder of her pregnancy.

RADIATION DOSIMETRY

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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5. ALARA

5.1. ALARA – Introduction

ALARA is an acronym from the phrase “As Low as Reasonably Achievable”. The phrase refers to a principle of keeping radiation doses and releases of radioactive materials to the environment as low as can be achieved, based on technological and economic considerations.

The CNSC, through the authority of applicable acts and regulations, is responsible for the control, supervision of development, application and use of nuclear energy. At the University of Winnipeg, the responsibility to ensure compliance with CNSC act and regulations rests with the Radiation Safety Committee and the Radiation Safety officer with financial and moral support from the management.

The university is committed to an effective radiation protection program to eliminate unnecessary exposures to radiation and to reduce all exposures to levels that are as low as reasonably achievable (ALARA), and will take all necessary steps required to support the ALARA concept. The Radiation Protection Regulations require all licensees to implement a radiation protection program to keep exposures “As Low as Reasonably Achievable” (ALARA) through the management and control of


- Work practices
- Personnel qualification and training
- Occupational and public exposure to radiation and
- Planning for unusual situations

5.1.1. Authorized Workers

Authorized workers are obligated to take all reasonable precautions to ensure their own safety, the safety of the other persons at the site of the licensed activity, the protection of the environment, the protection of the public and the maintenance of security.

5.1.2. Radiation Safety Officer

The Radiation Safety Office will review quarterly the occupational radiation exposures of all monitored workers and report to the Radiation Safety Committee, the dose limits set by the CNSC apply to all users of nuclear substances.

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5.2. Personal Dose Monitoring

Canada’s Radiation Protection Regulations set forth the radiation dose limits for the possession and use of radioactive prescribed substances in Canada. The purpose of monitoring is to inform individuals of external or internal dose exposures. The University of Winnipeg has a comprehensive personnel dose monitoring program including Dosimetry services Individual users of radioactive material are responsible for keeping their occupational radiation exposures as low as reasonably achievable.

Canada’s Radiation Protection Regulations specify:

- Personal monitoring is required for each Nuclear Energy Worker (NEW) who is likely to receive more than 5 mSv/year;
- Dosimeters must be worn properly to ensure they accurately record the external doses received by the wearer;
- Dosimeters must be exchanged at a predetermined frequency, and;
- The licensee’s Dosimetry service must be licensed by the commission.

The RSO shall determine if an individual is required to participate in a bioassay program or wear a dosimeter. This decision is based on the potential exposure of an individual and pursuant to CNSC’s regulatory document G-91 “Ascertaining and Recording Radiation Doses to individuals”. Generally personal monitoring shall be performed:

- For every NEW, including pregnant NEWs”;
- For “a person who is not a NEW” who handles radioactive materials or works in an area where there is the likelihood for accumulation of an annual radiation dose of 1 millisievert (mSv).

5.2.1. External Monitoring

Dosimeters are used to measure radiation doses from external radiation fields. The InLight dosimeter uses Optically Stimulated Luminescence (OSL) technology which measures whole body, skin and extremity radiation doses equivalent to X-ray, gamma and beta radiation, and neutron exposure.

The National Dosimetry Services (NSD) of Health Canada is the dosimeter service provider for the University of Winnipeg. The dosimeters must be worn and changed as required by NDS to ensure external doses are accurately recorded. The RSO is responsible for issuing and changing the dosimeters. Proper care and use of personal dosimeters should be done in accordance with the information supplied on the CNSC safety poster INFO-0742 (APENDIX F.2).

5.2.2. Internal Monitoring

Internal monitoring is required under certain conditions with the use of some unsealed radioisotopes.

Internal radiation exposures can be measured by screening or a licensed bioassay procedure. Screening procedures must be submitted to the CNSC for approval. Tritium and radioiodine are the more commonly used radioisotopes that require internal monitoring.

5.2.3. Application for Dosimetry Services

- Individuals who require a Dosimetry badge must complete the Dosimetry application from (see Appendix B.4).
- Once complete, return the form to the RSO for processing in a timely manner.
- The RSO will contact the recipient when the badge is ready for delivery or pick up.

Advise the RSO immediately if any of the following occur:

- Loss of a Dosimetry badge
- Contamination of a Dosimetry badge
- Change in Dosimetry badge requirements (e.g. change in type of radioisotope used)
- Name change
- A change of permit holder
- An individual is no longer working in the laboratory

The Radioisotope Permit Holder is responsible for all dosimetry badges issued under their radioisotope permit, including charges for lost, damaged, or unnecessary dosimetry badges.

5.2.4. Dosimetry Badge Storage

Store Dosimetry badges in an area of low radiation, away from where radioisotopes are used, stored and away from the waste areas.

5.2.5. Dosimetry Badge Change Periods

Whole body dosimeters and wrist dosimeters are changed quarterly, approximately the 1st of January, April, July and October. Ring dosimeters are changed monthly and pregnant workers' Dosimeters are changed twice per month.

The RSO will notify the Radioisotope Permit Holder of the exchange dates. The Radioisotope Permit Holder will collect all Dosimetry badges for the laboratory and take them to the appropriate exchange area (e.g. 2C37) or to the Radiation Safety Officer.

5.2.6. Dosimetry Reports

The RSO will review all dosimetry reports to ensure the exposures are ALARA. Dosimetry results for Non-NEWs subjected to personal radiation monitoring are available from the RSO **on request**. Dosimetry records must be maintained and be available for inspection by the CNSC.

Authorized NEWs must receive their dose received in writing by the RSO, regardless of if any regulatory dose limits have been exceeded. The CNSC will be notified immediately by the RSO if a regulatory dose limit is exceeded.

The RSO will investigate any radiation overexposure or unusually high accumulated doses to implement corrective actions and to avoid a recurrence. Doses exceeding the annual dose limit shall be reported to the CNSC. The causes and circumstances contributing to the dosimetry results and a report on the investigation must be submitted to the CNSC within 10 days.

All individuals and the responsible Radioisotope Permit holder will be notified of any dose above the minimum reportable dose. The RSO will investigate high dose for individuals. An individual receiving a dose exceeding the maximum permissible dose may result in suspension from radioactive work.

5.2.7. Previous Dose History

Health Canada – National Dose Registry (NDR) maintains a central database of occupational radiation doses received by individuals working with radioactive materials in Canada. This is tracked using individual social insurance numbers, thus ensuring that readings are assigned to only one person.

In order to protect privacy, individuals may only request a copy of their own registered dose. Copies can be requested by completing an employee's Dose History Summary request Form (Appendix B.5) and faxing it directly to NDR at 613-957-0960.

5.2.8. Neutron Dose:

Neutron dose from neutron radiation sources are measured by neutron dosimeters and they are changed quarterly, approximately the 1st of January, April, July and October.



5.3. Action Levels

According to the CNSC Radiation Protection Regulations (Section 6, SOR/2003-203), an action level is a specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of licensee’s radiation protection program and triggers a requirement for specific action to be taken. In order to maintain control within the radiation safety program, and in accordance with regulations, action levels are defined.

5.3.1. Radiation Doses

The University of Winnipeg action level for authorized workers is one third of the maximum allowed dose limit (see Table below). These limits apply to combined external and internal exposures per year. Any accumulated doses approaching or exceeding the action level will be investigated by the RSO. Hazard control measures will be implemented to prevent or minimize the potential recurrence of the exposure.

Table: Effective dose limits for the general public, authorized Nuclear Energy Workers (NEW), and the actionable exposure levels for UWinnipeg Authorized Workers per quarter.

Type of Exposure	Exposure Period	Effective Dose Limit for General Public and authorized Worker (mSv)*	UWinnipeg Action Level for Authorized Worker Exposures (mSv)	Effective Dose Limit for NEW (mSv)*
Whole body exposure	1 year	1 mSv	0.5 mSv	50 mSv
Whole body exposure	5 years			100 mSv
Lens of an eye	1 year	15 mSv	5 mSv	150 mSv
Skin	1 year	50 mSv	16 mSv	500 mSv
Hands & feet	1 year	50 mSv	16 mSv	500 mSv

*Data obtained from the Radiation Protection Regulations, Nuclear Safety and Control Act (2007-09-18 through 2015-06-11), Section 14(1) “Equivalent Dose Limits”, accessible at the following address:

<http://laws-lois.justice.gc.ca/eng/regulations/SOR-2000-203/20070918/P1TT3xt3.html>

5.3.2. Radioactive Contamination


Radioisotopes Permit holders and authorized workers are required to measure and evaluate the levels of contamination in laboratories that use nuclear substances (see table below). Licence conditions require that removable contamination levels must not exceed specific radionuclide limits on any accessible surfaces within a designated radioisotope laboratory or on equipment after working with nuclear substances.

In keeping with the ALARA philosophy, contamination limits are set at or below regulatory limits, however, every effort should be made to maintain contamination levels at or as close to background levels as possible. Contamination limits are based on activity per square centimeter.

Table: Regulatory licence limits and University of Winnipeg limits for radioactive contamination of radioactive work areas and public areas (based on the guidelines established by the CNSC).

Class of Radionuclide	Regulatory Licence Limit		University of Winnipeg	
	Radioactive Control Area limit	Public Areas /Decommissioning Limit	Limits for Radioactive Work area	Non-Radioactive Areas Decommissioning Limit
Class A - typically long lived and emit alpha radiation	3 Bq/cm ²	0.3 Bq/ cm ²	0.3 Bq/ cm ²	0.3 Bq/ cm ²
Class B - typically long lived and emit beta or gamma radiation	30 Bq/ cm ²	3 Bq/ cm ²	0.5 Bq/ cm ²	0.5 Bq/ cm ²
Class C - typically short lived and emit beta and gamma radiation	300 Bq/ cm ²	30 Bq/ cm ²	0.5 Bq/ cm ²	0.5 Bq/ cm ²

CONTROL OF NUCLEAR SUBSTANCES

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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6. Control of Nuclear Substances

6.1. Acquisition and Control of Nuclear Substances

Radioisotope possession limits for radioisotopes are stated on the University of Winnipeg consolidated Radioisotope licence. The Radiation Safety Officer maintains an inventory of all radioactive materials to ensure University of Winnipeg radioisotope licence does not exceed the licence possession limit. All acquisitions, (loans, purchases or transfers from other licensees or Radioisotope permit holders) free of charge or purchased, must be approved by the RSO.

The Canadian Nuclear Safety Commission must approve any protocol that will use greater than 10,000 times the exemption quantities (see Appendix E). Approval to use these quantities must be received prior to ordering nuclear substances which may exceed exemption limits.

6.1.1. Purchasing procedure for radioactive material

1. The Radioisotope permit holder must submit a completed and signed Radioisotope Purchase Authorization Form (Appendix C.4) to the Radiation Safety Officer (RSO). The Radioisotope permit holder is allowed to purchase only those radioisotopes listed on the internal permit.
2. When a request is approved, the RSO will forward a copy of the request form to the Radioisotope permit holder and the purchasing department.
3. The Radioisotope permit holder must include the word "Radioactive" and the RSO's contact information on the purchase requisition form made for the University's purchasing department and approve the expenditure from the designated account.
4. The purchasing department will process the order with the supplier.
5. The purchasing department will request a copy of the University's CNSC licence (or licence number) from the RSO to accompany the purchase order for the nuclear substance or device being acquired.
6. The purchasing department will contact the RSO and the Radioisotope Permit holder when the order is received.
7. The Radioisotope permit holder will sign to confirm the order has been received, perform a wipe test, and complete the inventory record documenting the purchase. The Radioisotope permit holder must file the shipping documents in the records binder with

the corresponding inventory sheet and forward a copy to the Radiation Safety Officer for record retention.

8. The Radioisotope permit holder must immediately report any discrepancies with any order to the RSO.

The supplier must be provided with the RSO's contact information and provided with instructions that no other individuals at the University are authorized to purchase radioisotopes directly from the supplier.

A copy of the University CNSC licence (or licence number) must accompany the purchase order or transfer document for the nuclear substance or device being acquired.

The RSO shall ensure that the CNSC licence lists the radioisotope, possession limit for unsealed sources (if applicable), maximum activity of a sealed source (if applicable), and the type (model and manufacturer) of device (if applicable). If the University's CNSC licence does not list the appropriate information, or if acquiring the new radioactive material will exceed the possession limits, the acquisition of the radioactive material must be suspended until an amended radioisotope licence has been received from the CNSC.

6.1.2. Radioisotopes Shipments from Another University or Institution

Do not transfer radioactive materials from an external organization without authorization from the RSO (see section 7.1.4.2. "External Transfers" and section 7.1.4.3 "Record of Transfer").

The RSO must be contacted a minimum of three to four weeks BEFORE radioisotopes or devices are transferred from another university or institution. If the University CNSC licence does not list the radioisotopes or device, or acquiring the new radioactive material will exceed existing possession limits, the shipping date must be postponed until an amended radioisotope licence has been received from the CNSC.

6.1.3. Spoiled Shipments/Incorrect Item Shipped

The Radioisotope permit holder or designate must notify the RSO regarding spoiled shipments, or the receipt of incorrect items. The RSO will contact the purchasing department about replacement orders. ***Please note: the Radioisotope Permit Holder must not contact the supplier directly.***

6.1.4. Borrowing Radioisotopes

All internal transfer of radioisotopes between Radioisotope Permit Holders must be approved by the RSO. (See section 7.1.4.1 "Internal Transfers".) A transfer is possible ONLY if the radioisotope is stated on the recipient's Radioisotope Permit and the possession limit will not be exceeded.

Complete the Radioisotope Transfer Form (Appendix C.5) before transferring the radioisotope and contact the Radiation Safety Office to confirm the approval for transfer.

The transfer must also be documented on the lender's Radioisotope Inventory Form (radioisotope, volume and activity transferred). The recipient's radioisotope permit holder shall include the transferred isotope in their inventory.

RADIOISOTOPE INVENTORY

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
Section: 7 Part: Radioisotope Inventory Requirements Pages: 3	

7. Radioisotope Inventory

7.1. Radioisotope Inventory Requirements

The radioisotope permit holder is responsible for maintaining a current and detailed inventory of all radioactive materials acquired under the Radioisotope permit. Radioactive materials must be tracked from acquisition, during storage, use and until final disposal. Radioisotope inventories must include sealed and unsealed material. The radioisotope inventories provide required information during an incident or an exposure investigation.

Inventory records shall be maintained in the areas where the nuclear substances are used or stored and must be available for inspection by the RSO or the CNSC.

7.1.1. Unsealed nuclear Substance Inventory

A "Radioisotope Inventory Sheet" (Appendix C.1) must be completed for each vial of radioisotope acquired. Every Radioisotope Inventory Form must be placed in the Radioisotope Permit Holder's Radioisotope Inventory log book. The inventory number must be written on the corresponding vial of radioactive material.

Use and Storage:

The following must be noted on the inventory sheet each time radioactive materials used:

- Room where material is used
- Procedure name (a brief description of use)
- User name
- Date
- The volume used
- The volume remaining in the stock vial
- Volume of waste disposed of into each container (solid, liquid, LS vial, carcass – this information is required for Waste Disposal)
- Stored radioactive material should be indicated in the "stored" column (e.g. radioactively labeled materials left over at the end of a procedure that are kept in the laboratory for further use)
- lab container disposal date
- Check the check box on the inventory sheet if wipe checks were done (must complete contamination surveys after procedures are complete)

Disposal:

If there is material left in the stock vial for disposal, record the information in the box “Activity in Stock Vial Disposed”. Record the “Activity Remaining in the Laboratory” on the Radioisotope Inventory Form for any stored materials that have not been removed from the laboratory. Due to long half-lives of such isotopes as Na-22, H-3 and C-14, accumulation of end product cannot be left unaccounted in the laboratory. The isotope must be tracked until it is disposed of entirely.

Upon disposal, ensure that the date of disposal and the activity of the waste at that date (measured or calculated) are recorded in the Radioisotope Inventory Form in the Waste Disposal Section. The Waste Disposal Authorization form (Appendix C.3) must also be completed.

Radioisotope shipment information includes batch tracking, daily radioisotope usage, experimental product information, storage location and disposal/release activities – see Radioisotope Inventory Form appendix C.1. Shipment information can be obtained from the packing slip and/or the stock vial. The remaining information is to be entered by authorized workers as the material is used.

7.1.2. Sealed Source Inventory

Contact the RSO upon receipt of a sealed source to amend the current inventory. The information required includes the supplier, licence number (if applicable), manufacturer, model number, radionuclide, source size, calibration date, serial number, storage location and date of receipt.

7.1.3. Annual Verification of Inventory

The RSO will send out a copy of the current radioisotope inventory to each Radioisotope Permit Holder annually for updates. The Radioisotope Permit Holder or designate will note any discrepancies on the inventory and return the information to the Radiation Safety Officer within three weeks. The Radiation Safety Office will make the adjustment in the inventory in the Safety Office.

7.1.4. Releases or Transfer

“Releases” of nuclear substances from a licensee’s possession include transfers to another licensee and disposals as waste.

7.1.4.1. Internal Transfers

Do not transfer radioactive materials to or from another location or another Radioisotope permit holder within the University without authorization from the RSO. Internal transfers will be treated as an acquisition or purchase.

7.1.4.2. External Transfers

Nuclear substances and radiation devices can be transferred or accepted only if each material is specifically authorized in the recipient's current CNSC licence. The recipient may need to apply to the CNSC for a licence amendment before any transfer can occur. Do not transfer radioactive materials to a radioisotope licensee from an external organization without authorization from the RSO.

Obtain a copy of the recipient's valid radioisotope licence before the transfer takes place. This licence must be made available during inspections.

7.1.4.3 Record of Transfer

Complete records of transfers, releases and disposals must include:

- Date of transfer;
- Recipient's name, address and licence number;
- Name, quantity and form of the nuclear substance;
- Activity, manufacturer, model and serial number associated with the radiation device(s) and sealed sources;
- Copy of most recent leak test of devices or sealed sources of > 50 MBA;
- For sealed sources or devices, a completed CNSC "Record of Disposition of Radioactive material";
- A Type A or B transport container certificate (if applicable), and ;
- A special form certificate (if applicable).

The RSO shall ensure appropriate transfer and release documentation is completed and radioisotope licence and transport regulations are in compliance before the transfer takes place.

7.1.5. Disposal Activities

The isotope must be tracked until it is disposed of entirely. Amend the sealed or unsealed radioactive inventory to reflect the release, transfer or disposal of radioactive material. Record the date of removal, and the activity level on the Radioisotope Inventory Form in the waste disposal section.

Keep Radioisotope Inventory Form available for inspection at all times. A physical inventory may be requested during an inspection. A physical radioisotope inventory also required prior to laboratory relocation, when there are discrepancies in the inventory, and prior to a cancellation of a radioisotope permit.

See Section 9 "Radioactive Waste Disposal" for more information. Contact the RSO for the disposal of any nuclear substances.



7.2. Receiving Radioisotope Shipments

The handling, packaging, transport and receipt of radioactive materials are governed by the Packaging and Transport Regulations under the Nuclear Safety and Control Act and the Transportation of Dangerous Goods regulations of Transport Canada.

Shipments of radioactive materials are delivered and accepted at the University only during normal working hours, unless other arrangements have been made. The shipments are to be made shipping/receiving department and then delivered without delay to the appropriate laboratory.

The shipping and receiving staff must be informed by the Radioisotope Permit holder/RSO of the anticipated delivery date and time of delivery. Only individuals trained in TDG Class 7 (Radioactive Materials) can receive packages containing nuclear substances. **Do not accept TYPE A packages if you are not TDG trained.**

Non-certified personnel may receive packages of radioactive materials that are shipped as "Excepted Packages". The RSO will drop the survey meter with the shipping and receiving staff before the delivery time.

7.2.1 Procedures upon receipt of a package before opening the radioactive material (will be performed by the trained shipping and receiving staff or authorized workers (Radioisotope permit holder and users)).

1. Do not leave package of radioactive materials unsecure at any time.
2. Upon receipt visually inspect the outer package(s) for damage, tampering and leaks. If the package does not appear damaged, proceed to step 3.

If the package appears damaged, isolate the package to prevent further contamination and notify the RSO immediately. Notify the delivery person of the concern and request that he/she remain on site until the exterior and interior surface of the package is checked for contamination. It may be necessary to check the delivery vehicle for contamination.

3. The shipping and receiving staff should check the package to confirm it is addressed properly; sign for it as required by the courier; and advise the Radioisotope permit holder and RSO that the package has arrived. The Radioisotope permit holder or RSO will sign that they have received the package, and take the packages to the appropriate laboratory or storage room. The package should be transported by placing it on a cart or other device (in order to increase the distance between people and the package, as well as to minimize radiation exposure and the possibility of an unplanned release of radioactive materials).

7.2.2 Procedures for Opening Radioactive Packages Containing Unsealed Radioactive Materials

Only the RSO and trained and authorized workers (Radioisotope permit holder and users) may open packages containing nuclear substances and radiation devices.

1. If the package cannot be opened immediately, place in secure storage area.
2. Wear disposable gloves, safety glasses and a lab coat when handling and opening a shipment of radioactive materials. If required use remote handling tools for manipulation of the primary container to keep the radiation doses ALARA to the hands.
3. If the radioactive material is volatile or a powder, place the package in the fume hood. If the materials are high energy beta or gamma emitters, open the package behind appropriate shielding before proceeding.
4. Open the outer package and check for possible damage to the contents, broken seals or discoloration of the package materials. If no damage is apparent, proceed to step 5. If damage or leakage is obvious:
 - a) Perform the wipe test to monitor for radioactive contamination on the exterior surface of the damaged package.
 - b) When there is evidence of leakage caused by accidental release, take immediate steps to limit the spread of any radioactive materials and isolate the package.
 - c) Place the appropriate signage at entrance to the affected area/fume hood. -Monitor your hands and clothing for radioactive contamination.
 - d) Contact the RSO and report the leakage. Radiation Safety Office will also assist you in radiation field measurements if necessary.
5. Using an appropriate and calibrated radiation survey meter monitor the radiation field around the package and compare the units stated on the package labels (type A package); for an excepted package, verify that the radiation field is below 5 $\mu\text{Sv}/\text{hour}$. The calibrated survey meter is available from the Radiation Safety Officer at 204.789.1439. Report any anomalies (radiation level in excess of the package labeling, incorrect TI, incorrect safety marks) to the supervisor in charge and the RSO.
6. Open the outer package and check for possible damage to the contents such as broken seals or by discoloration of packing material. Wipe test the interior packaging to ensure it is less than $0.5 \text{ Bq}/\text{cm}^2$ or 300 DPM ($\text{DPM} = \text{CPM}_{\text{sample}} - \text{CPM}_{\text{background}} / \text{Detector Efficiency}$) on wipe.
 - If contamination is detected, monitor all packaging and if appropriate, all areas coming into contact with the package for further evidence of contamination.
 - Contain the contamination, decontaminate and dispose in accordance with the conditions of the CNSC radioisotope licence. Contact the RSO and report the incident along with your measurements.
7. Remove the inner vial or primary container. Avoid unnecessary direct contact with unshielded containers. Wipe test the primary container. Write the results on the Radioisotope inventory Form.
8. Verify the radioisotope, the activity level, and other details on the primary container and compare with the information on the packing slip, and your copy of the purchase order. Place the radioactive material in a secure area and log the data in the inventory record.
9. If the packaging is free of contamination
 - a) Deface Radiation and Transportation of Dangerous Goods markings, and/or labels on shipment boxes. The boxes, if they are free of detectable contamination, can be thrown into the recycling bin or regular garbage. Ensure that removable contamination does not exceed $0.5 \text{ Bq}/\text{cm}^2$.

- b) Remove all inserts and flatten cardboard boxes.
- c) Styrofoam inserts that are free of detectable contamination may be recycled directly through the University of Winnipeg recycling program.

Refer to section 9.6 for further information on the disposal of shipment, box, Styrofoam, and other packaging materials.

7.2.3 Procedures for Opening Radioactive Packages Containing Sealed Radioactive Materials

Only the RSO and trained authorized workers (Radioisotope permit holder and users) are permitted to open packages containing nuclear substances and radiation devices.

1. If the package is damaged or leakage of contents is evident go to step 7.
2. If the package cannot be opened immediately, place in secure storage area.
3. Wear disposable gloves, safety glasses and a lab coat when handling and opening a shipment of radioactive materials. If required use remote handling tools for manipulation of the primary container to keep the radiation doses ALARA to the hands.
4. Using an appropriate and calibrated radiation survey meter monitor the radiation field around the package and compare with the units stated on the package labels (type A package). For an excepted package, verify that the radiation field is below 5 $\mu\text{Sv}/\text{hour}$. The calibrated survey meter is available from the Radiation Safety Officer at 204.789.1439. Report any anomalies (radiation level in excess of the package labeling, incorrect TI, incorrect safety marks) to the supervisor in charge and the RSO.
5. There should be a valid leak test certificate, TYPE A or B transport container certificate (if applicable) and a special form certificate (if applicable) provided with sealed source shipments. The certificate(s) may be attached to the shipping documents or to the source container. If no leak test certificate is provided, carry out a leak test on the sealed source container. Retain a copy of the leak test certificate for a minimum of three years and also forward a copy to the RSO. If no TYPE A or B certificate is provided, contact the shipper or manufacturer to obtain a copy.
6. Open the outer container and visually inspect the source holder for damage and to ensure that the shutter mechanism (if applicable) is locked in the closed position. Verify the source holder manufacturer, model number, serial number, radioisotope, source size, manufacturer date and any other details match information on the packing slip and with the purchase order or transfer document. Place the sealed source in a secure area and log it in the radioactive source inventory.
7. If the outer package appears damaged the delivery person shall be notified and requested to stay on site until the package is opened and the radioactive source is checked for potential leakage.
8. If there is evidence of leakage the delivery person and the transport vehicle shall be checked for radioactive contamination by the RSO. The delivery employer and the consignor should be notified by the RSO. The activity of any non-fixed radioactive material on the external surface on the package. It should not exceed 4 Bq/cm^2 for beta and gamma and 0.4 Bq/cm^2 for all alpha emitters when averaged over any area of 300 cm^2 of any part of the surface.
9. Report any anomalies (contamination, leakage, short or wrong shipment, wrong safety marks, etc.) to the RSO.

For more information, refer to CNSC poster **Guidelines for Handling Packages Containing Nuclear Substances INFO-0744 (Appendix F.4, page # 118)**

7.2.4 Packaging and Transport Regulations:

The consigner and CNSC shall be informed immediately by the RSO if:

- The package is discovered to be damaged or there is evidence of tampering
- The discovery of any crack, split, wasting of material due to corrosion, or other defect
- The radiation field on contact with the outer package exceeds than the safety marks
- The activity of any non-fixed radioactive material on the external surface of the package exceeds than the applicable limits set out in the Packaging and Transport Regulations under the Nuclear Safety and Control Act when averaged over any area of 300 cm² of any part of the surface (4 Bq/cm² for beta and gamma and 0.4 Bq/cm² for all alpha emitters).

Records of all radioactive packages received and their shipping documents are to be retained for inspection by the CNSC.

Prescribed reports to the consigner and to the CNSC are mandatory within 21 days of discovering any damage or tampering with, a package containing radioactive material with the full particulars of the packing and the manner in which the package failed to satisfy any applicable requirement of the Packing and Transport Regulations under the Nuclear Safety and Control Act; and records shall be retained for inspection for minimum of two years.

7.2.5 Documentation for Received Unsealed Radioactive Materials:

Trained individuals who receive the radioactive materials in the laboratory must enter the following information on the appropriate "Radioisotope Inventory Form" (Appendix C.1):

- date received
- reference date*
- activity on reference date*
- volume received*
- lot number*
- concentration on reference date*
- wipe test results
- room number or storage location
- fridge or freezer number


* this information is stated on the vial and/or technical data sheet

The inventory sheet number must be written on the lid of the vial. This record facilitates tracking the amount of material in each vial when multiple vials are received with the same lot information.

7.2.6 Maintenance of Radioisotope Inventory during Use, Storage and Disposal:

See Section 7.1 "Radioisotope Inventory" for information regarding inventory requirements.

SECURITY, STORAGE, LABELING AND INTERLAB TRANSPORT

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
Section: 7 Part: Security, Storage, Labeling and Interlab Transport Pages: 5	

8. Security, Storage, Labeling and Interlab Transport

Access to radioactive materials must be controlled from the time of acquisition until transfer or disposal. When not in use or not under the direct supervision or control of an authorized worker or Radioisotope permit holder, radioactive materials and radiation devices should be secured in a locked room, area, enclosure or vehicle to facilitate the protection of the University of Winnipeg employees, students and the general public. Door keys for laboratories that store or use nuclear substances and keys for storage freezers or enclosures must be under strict control with a limited number of keys issued only to authorized persons. The date of issue and to whom the keys are issued must be recorded, and these records are to be kept by the Radioisotope permit holder. Individuals must be made aware of potential radiation hazards through the use of signs and labels.

The radioisotope permit holder is responsible for securing nuclear substances in their possession and ensuring the materials are stored in a manner that prevents unauthorized access to or removal of these substances. Radioactive waste must also be stored in a secure area to prevent unauthorized access. The Radioisotope permit holder is responsible for ensuring that his/her designated users maintain surveillance over nuclear substances when in use. If constant surveillance of the nuclear substance cannot be maintained then the nuclear substances must be secured. The Radioisotope permit holder or 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 by the RSO.

8.1. Storage and Labeling of Radioactive Materials

Nuclear Substances in Storage:

- Stock or stock dilutions in storage must be secured from unauthorized removal or access.
- Lock all refrigerators and freezers all times, except when removing or replacing items.
- Secure all storage area (e.g. refrigerator, freezer, cabinets, cupboards, etc.) with a quality security lock.
- Lock the room when a room containing nuclear substances is unoccupied for any period of time such as lunch, meeting etc.

Store radioactive materials in the following locations only:

- Laboratories as stated on radioisotope permits. (Laboratories with radioactive materials must be secured when not occupied.)
- Other areas as stated on the radioisotope permit conditions or approval.

- A locked container during field studies.

Do not store radioactive materials in a fridge/freezer located in a hallway. Label all storage areas with a radiation warning symbol and a list indicating the isotopes that may be stored in the area. Examples of storage areas are refrigerators, freezers, lead castles, and lab cabinets.

Label all storage containers with the radioactive warning symbol, the isotope, the activity and the reference date. Examples of storage containers are:

- Original shipping containers
- Lead pigs
- Test tubes, beakers, etc.


The radiation field outside of the storage area shall not exceed 2.5 $\mu\text{Sv/hr}$. Shielding is required to reduce the field to below 2.5 $\mu\text{Sv/hr}$. The Radioisotope permit holder must notify the Radiation Safety Officer if a radiation field is suspected to be above 2.5 $\mu\text{Sv/hr}$. The Radiation Safety Officer will take the necessary measurements and advise on the appropriate shielding.

8.2. Inter-lab Transport (Movement of Nuclear Substances between laboratories or to/from radioactive storage room)

Radioactive materials may only be transferred between laboratories that are licensed by the Radioisotope Permit Holder. All internal transfer of radioisotopes between Radioisotope Permit Holders must be approved by the RSO. (See section 7.1.4.1 "Internal Transfers".)

Transport radioactive materials in a sealed unbreakable secondary container to prevent contamination of personnel and any public access areas. Consider the use of rolling carts to avoid accidental release.

RADIOACTIVE WASTE DISPOSAL

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
Section: 9 Part: Radioactive Waste Disposal Pages: 5	

9. Radioactive Waste

Radioisotope permit holders are responsible for disposal of all radioactive waste generated according to procedures set out by the University of Winnipeg. Sealed sources for disposal are considered to be radioactive waste. Disposal activities are performed by the Radioisotope permit holder in consultation with the RSO. Animal waste (carcasses or animal tissue) will be considered as radioactive waste when contaminated with radioisotopes.

9.1. Radioactive Waste: Handling and Disposal

Radioactive waste must be handled and disposed of in a way that prevents unreasonable risk to the public or the environment. To comply with licence conditions all disposal records must be maintained and retained. Records should indicate the name of the nuclear substance, form, origin, volume of any waste, activity and disposal method. To reduce the volume of disposed matter, radioactive waste should be segregated by the Radioisotope permit holder based on half-life and level of contamination.

- Radioisotope waste must be disposed of according to specifications set out as conditions of CNSC licence. The acceptable limits of each method of disposal will be specified as conditions of a CNSC licence. Radioactive waste must be monitored before disposal and documented on Radioactive Waste Disposal Authorization form (see Appendix C.3).

Below are the different possible methods of disposal:

(a) Release through the municipal garbage system

This method is for nuclear substances which are in solid form and uniformly distributed in the waste, with a concentration by weight less than the prescribed limit. This method may be authorized if the applicant's total amount of waste is less than three tonnes per year per licensee's address.

(b) Release through the municipal sewage system

This method may be authorized for nuclear substances which are in water soluble liquid form, and if the applicant's total annual quantity of waste is less than the prescribed limit for each building.

(c) Release into the atmosphere

This method may be permitted for nuclear substances which are in gaseous form and which are incidental to the applicant's normal operations. This method is limited to the applicant's disposal of less than three million cubic meters per year. It is not permitted as a deliberate means of disposal unless the applicant obtains prior approval in writing from the CNSC.

(d) Transfer to a CNSC licensee authorize to accept the specified waste

(e) Transfer return to the supplier

All other waste disposal methods will require specific and prior written approval from the CNSC.

9.2. Waste Disposal Containers

The radioisotope permit holder will determine approximate quantities of waste generated per week or per project and contact the RSO to confirm that the method of disposal and proper type of waste container is used.

9.3. Storage of Radioactive Waste Containers

- Store waste containers away from frequently used work areas and TLD badges.
- Make waste containers readily accessible for removal. Any containers that may pose a risk of spillage or injury will be rejected.
- Store radioactive liquid and radioactive waste containers in a spill tray.
- Store liquid waste containers that contain volatile radioactive compounds in a fume hood.
- Do not leave the lid of a liquid waste container open.

Waste storage in the laboratory must not result in laboratory personnel being subjected to radiation levels of 2.5 μ SV (0.25 mRem/h) or greater.

9.4. Segregation of Radioactive Waste for Disposal

Any radioactive waste which contains a Risk Group 1-4 agent, as defined in the Health Canada and Medical Research Council of Canada "Canadian Biosafety Standards and Guidelines", is required to be chemically disinfected before disposal as radioactive waste.

Solid waste

- Place contaminated or possibly contaminated items (scintillation vials not containing liquids, gloves, paper, small disposable equipment gels) in a solid waste container.
- Do not pour liquids in the solid waste containers.
- The container must have a clearance of eight (8) centimeters from the top.
- Record the material contents on the Radioactive Waste Disposal Authorization form (see Appendix C.3).

Please note: do not place animal carcasses/tissues in the solid waste container.

Radioactive contaminated sharps (syringes, needles, scalpels, and blades) must be disposed of in the following manner:

- Do not clip needles.
- Do not remove needles from syringes; syringe and needle should be disposed of as a unit.
- Do not resheath needles.
- Place all sharps in a puncture resistant container such as a metal can with a plastic or metal lid or a plastic jar with a lid.
- Do not use glass containers for sharps.
- Label puncture resistant containers left on the bench for extended use with radiation warning tape and the word “Sharps” on the exterior of the container.
- Seal the puncture resistant container and place in the radioactive waste container. The container must be sealed shut or taped in such a way to prevent opening.
- Record material content on the Radioactive Waste Disposal Authorization Form and the word “Sharps” (see Appendix C.3).

Liquid Waste

- Pour liquid waste into appropriate liquid waste container.
- Do not fill the liquid waste container above useable capacity.
- Do not dispose of unused stock solution and waste to municipal sewer system. Please note that the CNSC licence disposal limits for liquid waste are for incidental releases or washing glass wares and are not intended to allow for deliberate release.
- Radioactive waste should be stored for a pre-determined amount of time based on the half-life, prior to release to main waste stream until the radioactive materials have been significantly decayed based on the longest lives isotope present.
- Consult RSO for disposal when radiation surveys of the waste/unused stock solution at the end of the holding period indicate that radiation level is indistinguishable from background.
- Record the constituents on the Radioactive Waste Disposal Authorization form (see Appendix C.3).

Stock vials

- Deface stock vials prior to disposal and keep out of the solid waste.
- Place the stock vial in its original outer container or in a lead Pig if it arrived in one, and place in a small sealable clear plastic bag beside your radioactive waste container.
- Calculate the activity remaining in the stock vial, based upon the volume remaining in the vial. If the vial is empty (all of the liquid has been pipetted out of the vial) the activity for disposal is 1% of the original activity decayed to the day of pick-up from the laboratory.
- Record the stock vial number on the Radioactive Waste Disposal Authorization Form (see Appendix C.3).

Spoiled Shipments

- Place the stock vial in a plastic bag and complete a Waste Disposal Authorization form (see Appendix C.3).
- Write the inventory number for vial and the words “Spoiled shipment” on the form.
- Record the stock vial number on the Radioactive Waste Disposal Authorization form.

Liquid Scintillation Vials

- Segregate liquid scintillation vials by the type, size of vial, and radioisotopes used.
- Vials that are counted without using any liquid must be placed in the solid waste containers.
- Ensure the lids of LS vials are tight to prevent leakage.

Plastic liquid scintillation vials containing LS fluid

- Place in heavy duty plastic bags for disposal. Do not mix with glass vials.

Glass liquid scintillation vials containing LS fluid

- Place in the original cardboard box and then slide into a plastic liner.
- Keep vials in an upright position. Seal the liner with tyewrap for disposal.
- Do not mix with plastic vials.

Radioactive gases collected or generated during an experimental procedure

- Release into a fume hood after consultation with the RSO. Contact the RSO for CNSC licence conditions regarding discharge quantity concentrations.

Carcasses

Protocols involves radioisotope with a $T_{1/2} > 90$ days in a concentration greater than ONE exemption quantity (Appendix E) per kilogram will not be approved. University of Winnipeg does not have a storage facility or access to a disposal facility for these carcasses.

- Place animal carcasses in double plastic bag to prevent leaks and tears.
- Do not place radioactive tape on the carcasses or bag.
- Place carcasses bag in a storage freezer label with Radiation Warning label.
- Hold animal carcasses until the radioactive materials have significantly decayed based on the longest lives isotope present.
- Consult RSO for disposal when radiation surveys of the carcasses at the end of the holding period indicate that radiation level is indistinguishable from background.

Carcasses must be placed in a freezer. It is the Radioisotope Permit holders' responsibility to obtain a freezer.

9.5. Procedures for Waste Disposal

- Deface all labels, this includes radiation warning symbols and radiation warning tape with the trefoil symbol.
- Use Radioactive Waste Disposal Authorization forms (see Appendix C.3), the disposal section of the inventory record to record the disposal information for liquid waste, stock vials, and carcasses.


- Record the inventory sheet number, isotope and activity on Radioactive Waste Disposal authorization form.
- Seal the bag in the solid waste container with unlabeled (no radiation warning symbol) tape.
- Wipe check the outside of the liquid/ solid waste containers, and any other containers which are to be disposed of, decontaminate as required. Attach wipe results to one of the completed Radioactive Waste Disposal Authorization forms.
- Dispose of the waste as advised by the RSO.
- Maintain Radioactive Waste Disposal authorization forms in Radiation Safety binder.

9.6. Disposal of Shipping Containers and Packaging

- Dispose of plastic wrapping around the stock vial in the solid radioactive waste container. Recycle styrofoam inserts that are free of detectable radioactive contamination in the university recycling program.
- Dispose of shipment boxes that are free of detectable radioactive contamination in the normal garbage, once the Radiation and Transportation of Dangerous Goods markings and/or labels on the shipment boxes have been defaced and the box is collapsed.

Lead containers used for shipping the product should be used as shielding while storing the radioactive materials in the laboratory. If the laboratory has empty lead containers for disposal, the containers must be collected in a small box for recycling. Ensure the removable contamination does not exceed 0.3 Bq/cm^2 . Lead containers must not be disposed of in the radioactive waste container.

RADIATION MONITORING AND CONTAMINATION SURVEYS

 <p>THE UNIVERSITY OF WINNIPEG</p>	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW
Section: 10.1 Part: Radiation Survey Instrument Pages: 2	Revision Date: Revised By: Sangita Shah

10. Radiation Monitoring and Contamination Surveys

10.1. Radiation Survey Instruments

Radiation survey instruments are required for radioisotope permit holders using neutron, gamma, or moderate to high beta emitters. The CNSC regulations (section 20 of the Nuclear Substances and Radiation Devices) require survey meters to be calibrated every 12 months in accordance with the methods approved by the Canadian Nuclear Safety Commission.

Radioisotope permit holders are responsible for purchasing their own radiation survey instruments and are responsible for all calibration costs and quality control.

Not all meters detect all types of radiation. Contact the RSO for advice on suitable radiation detection instruments before purchasing. Test the survey meter and verify that it meets all specifications stated by the manufacturer upon acquisition.

10.1.1. Contamination vs Survey Meters

Radiation detection meters are classified as either contamination meters or survey meters.

Contamination meters

Contamination meters are designed to measure surface contamination. Their thin entrance window make them appropriate for direct monitoring of contaminated surfaces, but not for surveying dose rates.

Survey meter

Survey meters are specifically designed for the measurement of radiation dose rates. They are not as sensitive as contamination meters and therefore are not able to detect surface contamination.

10.1.2. Preoperational meter checks

Before each use of a contamination meter or survey meter, verify that it is functioning by conducting an examination for:

- Battery/power check
- Calibration date (within last 12 months)
- Source/radiation response

10.1.3. Acquiring and maintaining survey Instruments

The radiation safety officer will assess the need for a survey meter and contamination meter upon submission of a new application for a Radioisotope permit. The radioisotope permit holder will be notified of the need for a survey instrument and will also be advised of the specific type and make of the instrument to be purchased. The costs of purchasing the specific instrument and calibration will be the responsibility of the Radioisotope permit holder.

The RSO will instruct the radioisotope permit holder on proper use of the instrument.

It will be the responsibility of the Radioisotope permit holder to notify the RSO if the survey instrument requires repair. Please do not attempt to repair the instrument.



10.2. Radiation Monitoring Requirements

Radiation monitoring is required to detect the presence of radioactive contamination from open sources, to detect leakage from sealed sources, and to detect the presence of exposure fields from radioactive materials. The radioisotope permit holder is responsible for monitoring contamination to ensure internal and external radiation doses are AS LOW AS REASONABLY ACHIVABLE (ALARA).

Contamination surveys must also be performed:

- after spills or leak incidents;
- before equipment is released for non-radioactive use; and
- before a decommissioned room is released for non-radioactive use.

10.2.1 Types of Radioactive Contamination Monitoring

There are two possible methods for detecting and measuring radioactive contamination:

Direct: involves using appropriate portable radiation contamination instrument in areas with low background radiation to measure removable and fixed contamination.

Indirect (wipe test method): involves systematically collecting and counting wipes samples from workplace surfaces and measuring removable contamination.

10.2.2. Surveys for Detecting Surface Contamination

When radioisotopes are in use, Radioisotope permit holders and authorized workers must conduct a general laboratory indirect survey once a week and log the results in the contamination log book, as a CNSC licence requirement.

The radioisotope permit holder is responsible for obtaining the required materials and instruments to conduct the contamination surveys. The areas to be surveyed depend upon the number of users, the frequency of use and the number of areas where nuclear substances are manipulated.

Daily indirect surveys of immediate work areas during and after use of radioisotopes, especially after stock solution transfers, should be performed by the Radioisotope permit holders and authorized workers.

The radioisotope permit holder and authorized workers may conduct a direct survey when gamma or moderate to high-energy beta emitters are in use and an indirect survey (wipe check) when surveying for any isotope. The method and instrument used must be capable of detecting the radioisotope(s) in use.

The Radioisotope permit holder must ensure that the surveys are performed, documented and are available for inspection. Weekly surveys are not required when radioisotopes have not been used in any given week. Mark the log book for that week as "Radioisotopes not in use". Include the print out from the liquid scintillation counter and/or gamma counter and floor plan of the laboratory and surveyed areas (see attached appendix G.1). Results of direct surveys must also be documented.

The following types of surveys must be conducted when working with gamma or moderate to high energy beta emitters:

- *A personal survey* when leaving the immediate work area (lab coats must be included), when the procedure is complete, or when personal contamination is suspected
- *A survey of the immediate work area* prior to beginning a procedure
- *An indirect survey of the immediate work area* upon completion of all procedures
 - The following types of surveys must be completed when working with low energy beta emitters, and all alpha emitters:
 - *A personal survey* when personal contamination is suspected
 - *An indirect survey* of the immediate work area upon completion of all procedures
 - The radioisotope permit holder and authorized workers must conduct an indirect contamination survey of a radioactive work area, including fume hoods, prior to any maintenance work (refer to Section 10.2.4). An indirect survey must be conducted on all equipment used in radioactive work prior to the equipment being removed from the radioactive work area.

10.2.3. Contamination Logbook

A Contamination Logbook must be maintained for each laboratory. Small inner laboratories and equipment rooms do not require individual logbooks, but the results from these areas must be included in the Contamination Logbook for the main laboratory. Contamination Logbooks must be organized to indicate who has done the contamination surveys and date of each survey.

The Contamination Logbooks must include the following:

- A floor plan of the laboratory
- A list of the areas to be wipe checked weekly and monthly
- A Radioactive Contamination Monitoring Record (Appendix G.1)
- The liquid scintillation counter printout results must be dated and placed behind the summary sheet in chronological order
- Post decontamination printout results are to be placed immediately behind the contaminated printout results

The Radioactive Contamination Monitoring Record must be completed when wipe check results are placed in the Contamination Logbook. The following information must be entered:

- Date of the entry or date of wipes
- The name of the individual who conducted the survey

- Notation of the following as appropriate: no radioactive work done, no contamination found, contamination found and removed
- Comment on actions taken; required if contamination was found

The printout results must be dated and placed in the contamination logbook behind the floor plan. All wipe check results for this form must be put in chronological order. Post-decontamination results are to be placed immediately behind the contaminated results.

Note: wipe checks are unnecessary if radioactive materials have not been used in a particular week; however, it is still necessary to make a weekly notation of the date and “No Radioactive Work Done”.

10.2.4. Evaluating Contamination

In keeping with the ALARA philosophy, contamination limits are set at, or below regulatory limits, however every effort should be made to maintain contamination levels at or as close to background levels as possible.

Personal contamination

- All personal contamination including contamination of clothing must be reported immediately to the RSO.
- Treat personal injuries first, and then follow the appropriate decontamination procedures.
- Appropriate decontamination procedures must be performed immediately if there is no personal injury.

Area contamination

- The radioisotope permit holder must ensure that the levels of loose (removable) radioactive contamination for Class A Radionuclide (see section 10.2.5) do not exceed 3.0 Bq/cm² in all labeled areas or on equipment. Contamination in unlabeled areas must not exceed 0.3 Bq/cm². The levels of loose beta and gamma radioactive contamination for all other nuclear substances other than Class A Radionuclides must not exceed 5.0 Bq/cm² on all labeled areas or equipment. Contamination on unlabeled areas must not exceed 0.5 Bq/cm². The area of each wipe check must not exceed 100 cm².
- Appropriate decontamination procedures must be initiated if the contamination is localized. Ensure the information is recorded in the contamination log book.
- Personnel must be warned of the contamination hazard and the RSO must be notified immediately if contamination is widespread or in publicly accessed areas. Please provide as much pertinent information as possible when reporting contamination. The RSO will initiate appropriate assistance.
- For more information refer to “Emergency Response to Radioactive Spill” at the beginning of this manual.

10.2.5. Monitoring Radiation Levels

The radioisotope permit holder should be aware there is a potential for high radiation levels when gamma or moderate to high beta emitters are in use or are not stored appropriately. The radioisotope permit holder must contact the RSO if radiation levels above 25 μSv (2.5 mRem/h) are suspected.

Procedures for Contamination Monitoring

Direct Method

1. Before monitoring radiation levels, follow manufacturer's operational check (battery check, measure a check source (i.e. source of known activity if available)).
2. Measure background radiation levels with the meter set on slow.
3. Measure radiation levels in specific areas with the contamination meter switched on "fast", by passing the detector slowly (less than one inch per second) over the surface, and with the detector face towards the surface. Keep the distance between the detector and the surface as small as possible without touching. If contamination is detected, stop and obtain a measurement with the meter set on slow.
4. Record results in the contamination monitoring records. Decontaminate areas where contamination was found and re-monitor. Include details of any action taken and the results of re-monitoring in the records. Record both the highest and final readings.

Indirect Method

1. Select an absorbent grade of filter paper with a diameter of about 5 centimeter or another suitable material.
2. Wet the paper with water or 50% alcohol. Hold the moistened filter paper on the edge with thumb and index finger and rub lightly over the surface, using the pads of the other fingers to apply light pressure. Try to obtain the sample on the center of the paper. Wipe approximately 100 cm^2 area. Include a blank or background count using an unused wipe.
3. Allow the paper to dry and add scintillation fluid. Follow manufacturer's instructions for count for the radioisotope in use.
4. Record the results in the contamination monitoring records or attach the print out with locations indicated on it for each measurement. Compare the results to the action level for the isotope in use with the lowest counting efficiency. Decontaminate areas where contamination was found and re-monitor. Include details of any action taken and the results of re-monitoring in the records. Record both the highest and final readings.

Contamination in excess of the CNSC surface contamination limit must be reported promptly to the Radiation Safety Officer.

10.2.6. Maximum Permissible Level of Radioactive Contamination

Surface contamination is quantity of radioactivity over a defined area which is usually expressed in Becquerel per square centimeter (Bq/cm^2). Based on the guidelines established by the CNSC, the maximum permissible levels for removable contamination are described in the table below.

Table: Regulatory licence limits and University of Winnipeg limits for radioactive contamination of radioactive work areas and public areas (based on the guidelines established by the CNSC).

Class of Radionuclide	Regulatory licence limit				University of Winnipeg					
	Radioactive control Area limit	Public Areas/ Decommissioning Limit			Limits for Radioactive Work area			Non-Radioactive Areas Decommissioning Limit		
Class A –typically long lived and emit alpha radiation	3 Bq/cm ²	0.3 Bq/cm ²			3.0 Bq/cm ²			0.3 Bq/cm ²		
Class B – typically long lived and emit beta or gamma radiation	30 Bq/cm ²	3 Bq/cm ²			5.0 Bq/cm ²			0.5 Bq/cm ²		
Class C –typically short lived and emit beta and gamma radiation	300 Bq/cm ²	30 Bq/cm ²			5.0 Bq/cm ²			0.5 Bq/cm ²		
Class A Radionuclide	All Alpha emitters and their daughter isotopes									
	Ag-110m	Am-241	Bi-210	Co-56	Cs-134	Cs-137	I-124	Lu-177m	Mn-52	Na-22
	Pb-210	Pu-238	Pu-239	Pu-240	Ra-226	Sb-124	Sc-46	Ta-182	Th-228	Th-230
	Th-232	U-234	U-235	U-238	V-48	Y-88	Zn-65	Zr-89	Co-60	U-naturel

Please note: contamination may be averaged over an area of 100 cm² or less.

Prior to releasing a room for general use, all fixed contamination must be approved by the CNSC, as per licence conditions.

It is good practice to keep contamination levels ALARA. If the contamination measurement shows that the level of contamination exceeds limits, take corrective actions.

10.2.7. Calculating Contamination Level

For Contamination Meters:

$$\text{Surface Contamination (Bq/Cm}^2\text{)} = \frac{\text{CPM} - \text{Bkg}}{\text{Ec} \times 60 \times A}$$

For Indirect Monitoring:

$$\text{Surface Contamination (Bq/Cm}^2\text{)} = \frac{\text{CPM} - \text{Bkg}}{\text{Ec} \times 60 \times A \times \text{Ew}}$$

When swiping area of 100 cm² and assuming wipe efficiency 10% use formula

$$\text{Surface Contamination (Bq/Cm}^2\text{)} = (\text{CPM} - \text{Bkg}) \times \frac{100}{\text{Detector efficiency specific for isotope}(\%)} \times 10$$

WHERE:

CPM = total count rate in counts per minute (CPM) measured directly or on the wipe

Bkg = normal background count rate (in CPM) from the survey instrument or on the blank

60 = sec/min

E_c = instrument efficiency factor for the radioisotope being measured (consult the manufacturer or determine using a radioactive source with a known amount of activity in a counting geometry similar to that used when surveying for contamination)

A = area wiped (not to exceed 100 cm²) or area of the detector in cm² (for direct measurement)

E_w = collection efficiency factor for the wipe (used ONLY when calculating indirect wipe monitoring results), if it is not determined experimentally, a value of $E_w = 0.1$ (i.e. 10%) shall be used

10.2.8. Corrective Action

Any areas found with contamination above the limits specified above are required to be decontaminated to acceptable levels (at minimum). Decontamination results must be documented. Investigation and corrective actions taken to prevent a reoccurrence should also be recorded. Contamination and decontamination results should be communicated to appropriate persons working in the area.

10.2.9. Surveys for detecting airborne contamination:

Work with dry powders and volatile substances must be performed in a fume hood. If an airborne contamination is suspected, the RSO must be notified prior to the start of the procedure.



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10.3. Sealed Source Leak Test

10.3.1. Purpose of Sealed Radioactive Source Leak Testing

Leakage and dispersal of radioactive material from a sealed source can result from a number of causes, including, but not limited to the following: manufacturing defects, corrosion, abrasion, extreme temperatures, impact, mechanical abuse, and involvement in a fire. A leak test will detect leakage from a sealed source allowing users to take prompt action to control dispersal and contamination.

Sealed sources containing radioactive material of less than 50 MBq, gaseous sources or sources of tritium do not require a leak test. Sealed sources containing radioactive material 50MBq or more must be leak tested at the following intervals.

- Every 6 months for regular sealed sources
- Every 12 months for each sealed source in a radiation device
- Every 24 months for a sealed source in storage
- Before using a sealed source removed from 12 months of storage; and
- Immediately following any incident where sealed sources could have been damaged as a result
Prior to transferring to another licensee

The frequency of leak tests on sealed sources will be indicated by the Radiation Safety Officer in the Internal Permit under the Radioisotope Permit Conditions of Approval section. RSO tracks the leak test frequency and when a leak test is required, the permit holder will be sent a leak test sampling kit.

10.3.2. Performance of Leak Test Procedures by Qualified Persons Only

The Radioisotope Permit holder is responsible to develop written step-by-step procedures for wipe sampling of each type or sealed source. If the analysis of samples are performed by the Radioisotope permit holder or authorized workers then the Radioisotope permit holder must also develop procedures on Sample measurement. A copy of these procedures shall be kept in the Radiation Safety binder in the laboratory and a second copy shall be forwarded to the Radiation Safety Officer. Such a procedure may be outlined in an operator's manual or may be available from the manufacturer. Contact the Radiation Safety Office for assistance.

If an agency is used to measure leak tests, the Radioisotope Permit Holder shall keep copies of each Leak Test Sampling Certificate and ensure that a copy is forwarded to the Radiation Safety Officer along with the Leak Test Analysis Report.

10.3.3. General Description of Leak Testing Methods

Radioisotope permit holders or authorized workers who perform wipe sampling and analyze leak test samples must be trained and understand the following conditions:

- Conditions of University Licence
- CNSC Regulatory Expectations for Leak testing of sealed source
- appropriate precautions for radiation protection
- procedures for leak testing
- the operation of the measuring instrument .

10.3.4. Leak Test Sampling Procedures:

If a sample is analyzed by the Radioisotope Permit holder or Authorized Workers they must:

- Follow step-by-step written procedures developed by the Radioisotope Permit holder for wipe sampling.
- Complete all information on the Leak Test Record form Appendix G.2), keeping one copy in the room where the sealed source is stored and forward a second copy to the Radiation Safety Officer.
- Contact the Radiation Safety Officer in the event of any incident that may have caused damage to the source. The possibly damaged source/device shall be immediately taken out of service by the RSO.

If Sample is analyzed by the agency (e.g. Cancer Care Manitoba)


- Follow step-by-step written procedures developed by the Radioisotope Permit holder for wipe sampling.
- Complete all information of the Leak Test Record Form (Appendix G.3) and assign a number to the sample container.
- Ensure the container number corresponds to the sample container number indicated on the certificate.
- Check the wipe samples for gross contamination greater than 2 x background with a radiation monitor. If gross contamination is found, contact Cancer Care Manitoba for further instructions. If gross contamination is not found, courier the samples to Cancer Care Manitoba.
- Do not send leak test samples via Canada Post.

If the removable contamination exceeds the maximum allowable limit of 200 Becquerels, the Radiation Safety Officer must be notified immediately. The RSO will notify the Radioisotope Permit Holder to discontinue use of the radioactive sealed source or radiation device containing the sealed source. The radioactive sealed source or radiation device containing the sealed source will be isolated to prevent the spread of contamination from the leakage. The CNSC must be notified immediately and a full written report must be submitted to the CNSC within 21 days by the Radiation Safety Officer.

10.3.5. Leak Test Record Keeping Requirements:

Copies of the leak test records sampling certificates, the written procedures and the leak test certificates shall be kept in the Radiation Safety Records binder for their location for at least eight years.

Maintenance in Radioisotope Laboratories

 <p>THE UNIVERSITY OF WINNIPEG</p>	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
Section: 11 Part: Requirements for Floor Cleaning and Service Work Pages: 1	

11. Maintenance in Radioisotope Laboratories

11.1. Floor Cleaning of Radioisotope Laboratories

Bee clean (maintenance) staff is not authorized to enter into Radioisotopes laboratories. The cleaning scheduled will be scheduled through the Physical plant office with 48 hours of notice and only if the Authorized worker or Radioisotope permit holder are present. It is the responsibility of the Radioisotope permit holder and authorized workers to ensure that work areas are free of detectable radioactive contamination and other hazards in an approved radioisotope laboratory prior to cleaning work being conducted.

11.2. Requirements for Service Work in Radioisotope Laboratories

This procedure has been developed with the goal of reducing the potential for exposure or contamination to Physical plant staff and all service contractors when performing service or maintenance work in a radioisotope laboratory or storage room.

11.3. Service and Maintenance Clearance

It is the responsibility of the Radioisotope permit holder and authorized workers to ensure that work areas and equipment are free of detectable radioactive contamination and other hazards in an approved radioisotope laboratory prior to service or maintenance work being conducted. Prior to the start of work the Radioisotope permit holder must consult the Radiation Safety Officer.

Transportation and Shipping Radioactive Materials

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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12. Transportation and Shipping Radioactive Materials

Any nuclear substance with an activity greater than 70 kBq/kg (2 μ Ci/kg) is considered radioactive for the purposes of transportation. The packaging and transportation of radioactive materials must comply with the CNSC regulations, the Transportation of Dangerous Goods (TDG) Act and Regulations, and the International Air Transport (IATA) Act and Regulations. The Radiation Safety Officer must be consulted for transportation of all nuclear substances. Canada post does not permit sending of nuclear substances through the mail.

12.1. Packaging of Radioactive Materials for Transport

Packaging requirement very depending on the radioisotope, the form, and the activity. The radioisotope permit holder must contact the RSO for packaging information at least four weeks in advance of the actual shipment date. The radioisotope permit holder will be responsible for obtaining and covering the cost of the appropriate packaging and labels and transportation cost.

12.2. Transportation on Campus

Transportation between buildings on campus may be requiring for collaborative research. The buildings include Richardson College for Environment and Science and Main campus (515 Portage Avenue). Only radioisotope permit holder and authorized workers are authorized to transport the nuclear materials on campus.

Transport radioactive materials in a sealed unbreakable secondary container to prevent contamination of personnel and any public access areas. If applicable consider the use of rolling carts to avoid accidental release.

12.3. Shipping OFF Campus within Canada

Only TDG certified personnel can prepare for shipment and/or ship Type A packages. The request for shipping of Type A packages must be forwarded to the RSO at least four weeks prior to the shipment date. This section will apply for Excepted packages only. Shipping documents for Excepted packages:

- Electronic Way bills - 6-character alpha numeric United Nations (UN) code (see below)
- or
- Paper shipping documents – appropriate UN code number as well as text bearing the words “Radioactive Material – Excepted Package”

UN 2908 – empty Packaging

UN 2909 – Articles manufactured from depleted uranium, natural thorium or natural uranium

UN 2910 - Limited Quantity of Material – the majority of “Excepted packages” shipped from the University will fit into the UN 2910

UN 2911 – Articles or Instrument

- No other special documentation is required

12.4. Shipping OFF Campus Outside of Canada




The University of Winnipeg must apply for an export permit in order to send radioisotopes to specific locations. All export permits are subject to review by the Federal External Affairs department, it can take from several weeks up to nine months to obtain an export permit depending upon the country. If you require sending the shipment outside of Canada please consult the Radiation Safety Officer.

12.5. Classifying Nuclear Substance Packages

The packaging and labeling of nuclear substances is regulated by the Canadian Nuclear Safety Commission's Packaging and Transport of Nuclear Substances Regulations. Nuclear substances may be shipped as “Excepted Packages”, “Low Specific Activity (LSA)”, “Type A”, or “Type B” packages. It is the package design that makes nuclear substance safe for transportation and ensures only an acceptable amount of radiation is released. Therefore, the design and construction of packaging is very strictly controlled.

Excepted packages can contain up to certain limited amount of radioactivity, specified by IAEA regulations. Excepted packages label as an “Excepted Package” label and UN number. They present a very low radiological risk. The safety mark “Radioactive” must be visible upon opening the package and the radiation level at any point on the external surface of the package must not exceed 5 $\mu\text{Sv/h}$.

Type A Packages can contain up to 10^4 times the maximum amount of radioactivity permitted in an excepted packaged with 4 Bq/cm² limit for surface contamination. These and other parameters are specified by International Atomic Energy Agency (IAEA) regulations. Packages are designed to withstand typical accident conditions; prototypes have successfully passed prescribed tests to demonstrate physical integrity. A radioactive label is required on inner container indicating the radionuclide, activity and assay date. Also the outer package must have category I, II or III types of radiation labels affixed to it on both side of package.


Identifying Type A Packages:	
<p>Category I – White</p> <p><i>Category I - White</i></p> 	<p>Does not exceed 5 $\mu\text{Sv/h}$ at any location on the external surface of the package.</p>
<p>Category II – Yellow</p> <p><i>Category II - Yellow</i></p> 	<p>Does not exceed 500 $\mu\text{Sv/h}$ at any location on the external surface of the package and the transport index does not exceed 1.</p>
<p>Category III – Yellow</p> <p><i>Category III - Yellow</i></p> 	<p>Does not exceed 2 mSv/h at any location on the external surface of the package and transport index does not exceed 10.</p>

Transport Index

The transport Index (TI) for a package is the maximum radiation level in micro Sieverts per hour at one meter from the external surface of the package, divided by 10.

Example: 1 $\mu\text{Sv/h}$ at 1 m equals a TI – 0.1

Collaborative Research

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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13. Collaborative Work with External Agencies

The following procedures have been developed to support research at the University of Winnipeg with collaborating institutions. Research activities carried out at the respective institutions must take place under the applicable CNSC licence and comply with all relevant policies and procedures.

13.1. External Individual(s) Working at a Licensed Location in the University of Winnipeg:

All individuals working with radioisotopes shall conduct the work under the supervision of a University of Winnipeg Radioisotope permit holder. The external individual should solicit a University of Winnipeg radioisotope permit holder prior to beginning work.

The Radioisotope permit holder must notify the Radiation Safety Officer (RSO) of the University of Winnipeg and the collaborating institute of any arrangements prior to the commencement of the work.

The University of Winnipeg Radioisotope permit holder shall ensure the collaborating individual becomes an authorized worker by completing all necessary training required by the University of Winnipeg Radiation Safety. The collaborating individual must comply with applicable policies, procedures and regulations while working on the University of Winnipeg campus. The Radioisotope permit holder must apply for a permit amendment to add any new authorized worker to the internal permit (see section 2.1.2 Permit amendment).

All authorized workers require the University of Winnipeg Dosimetry services while working under University of Winnipeg licence.

13.2. Transferring Radioactive Materials/Radiation Devices

Radioisotope permit holders or authorized workers should provide the following information to the University of Winnipeg Radiation Safety Officer and the Radiation Safety Officer at the collaborating institution:


- The University of Winnipeg Radioisotope permit holder name
- Nature of radioactive material
- Isotope and activity
- Reason for transfer
- Location where material will be used and/or stored

- Intended use
- Authorized signature – signature of individual authorized to acquire and handle radioisotopes

The RSO must ensure that the receiving institute has a valid CNSC licence for the material being transferred. A transfer of radioactive materials must not occur until the written approval is acquired from both the University of Winnipeg Radiation Safety Officer and the Radiation Safety Officer at the collaborating institution.

Refer to section 12.2 for transfer of radioisotopes to a laboratory located in another university building and for proper packing of material for shipment.

Sealed Sources and Radiation Devices

 THE UNIVERSITY OF WINNIPEG	Date of Issue: May 24, 2017 Issued by: Safety Office Revision #: NEW Revision Date: Revised By: Sangita Shah
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14. Sealed Sources and Radiation Devices

Sealed sources are radioactive materials that are encapsulated or encased in such a way that prevents spillage or contamination under normal conditions. When properly encapsulated, radiation from sealed sources is unlikely to be absorbed into the body and represents only an external radiation hazard.

Sealed sources incorporated into radiation devices are not removable. Examples of radiation devices are Liquid Scintillation Counters and Gas Chromatograph devices.

14.1. Sealed Sources and Radiation Devices Permits, Acquisition and Record Keeping

The Radiation Safety Officer provides Internal Radioisotope Permits and authorizes the use of sealed sources/radiation devices and the permit conditions of their use. The Radioisotope Permit Holder is responsible for maintaining all documents required by the permit conditions to ensure compliance with regulations and licence requirements.

The purchase and acquisition of all sealed sources and radiation devices, including exempt quantity radioisotopes, must be approved by the RSO to ensure regulatory compliance.

An inventory of sealed sources and radiation devices must be maintained by the Radioisotope Permit Holder, including the type of radioisotope, activity, serial number, calibration date, storage location and manufacturer name.

The inventory must be updated and verified at least annually by the Radioisotope Permit Holder. Verification of the physical inventory will be performed by the RSO in presence of the Radioisotope Permit Holder.

14.2. Procedures for Working with Sealed Sources

The Radioisotope Permit Holder and Authorized workers are responsible for following the principal of ALARA wherever sealed sources/radioactive materials are handled or stored to prevent unnecessary exposure as well as being responsible for ensuring the security of sealed sources. Sealed sources must be kept in locked storage and usage must be supervised. The RSO must approve all purchases of sealed sources, even if in exempt quantities, in order to ensure compliance.

- Be familiar with the specific hazards of the radioactive materials present prior to beginning work with sealed sources or devices containing sealed sources.

- Radioactive materials must not be accessible to unauthorized staff/students or the general public. Radioactive material must be locked in a secured area or enclosure. Radioisotope laboratories must not be left unattended – an authorized Radioisotope permit holder/Authorized worker must supervise the area/lab if radioactive material is in use and not in a secure area or enclosure.
- Only Authorized workers listed on the internal permit shall have access to the permitted radioisotope room/laboratory. Students are not authorized to enter the radioactive storage room.
- Store radioactive materials in such a way that radiation fields in accessible operating areas do not exceed 25 mSv/hr and in areas adjacent to radioactive working area do not exceed 2.5 mSv/hr.
- Preplan the procedures to minimize the time spent in close proximity to the radioactive material to reduce the time of exposure.
- Utilize procedures which maximize the distance between people and the sealed source.
- Follow manufacturer's instructions for storage (shielding), leak test procedures and manipulation of the sealed source.
- Report all incidents (damage, theft, loss) involving sealed sources immediately to the RSO.

14.3. Sealed Sources Requiring Leak Tests

See Section 10.3 for sealed source leak test requirements.

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Glossary of Terms

Absorbed Dose

Energy absorbed per unit mass (1 Joule per kg). The energy imparted to matter by ionizing radiation per unit mass of irradiated material.

1Gy – 1 Joule 1 rad = 0.01 Joule/kg

Absorption

The process by which radiation transfers some or all of its energy to any material through which it passes.

Activity

The number of nuclear transformations occurring per unit of time, as measure in becquerels.

Action Level

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.

As Low As Reasonably Achievable (ALARA)

Principle of radiation protection that exposures to radiation is kept as low as reasonably achievable, with social and economic factors taken into account.

Alpha Particle

A positively charged particle emitted from the nucleus of an atom having a mass and charge equal in magnitude of a helium nucleus; i.e. two protons and two neutrons.

Annual Limit of Intake (ALI)

The derived limit for the amount of nuclear substance taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a *committed effective dose equivalent* of 50 mSv or a *committed equivalent dose* of 50 mSv to any individual organ or tissue.

Atom

Smallest particle of an element that cannot be divided or broken up by chemical means. It consists of a nucleus (which contains protons and neutrons) and electrons orbiting the nucleus.

Atomic Number (Z)

The number of protons in the nucleus of an atom. The atomic number determines the chemical properties of the element.

Attenuation

The process by which a beam of radiation is reduced in intensity when passing through some material.

Background Radiation

Radiation from cosmic sources, naturally occurring nuclear substances, radon and global fallout as it exists in the environment from the testing of nuclear explosive devices.

Basic Level Laboratory

A room where nuclear substances are used and where the total quantity of each nuclear substance used at one time does not exceed five (5) times its corresponding Annual Limit of Intake (ALI).

Becquerel

A unit, in the International System of Units (SI), of measurement of radioactivity. It is equivalent to 1 disintegration per second.

Beta Particle

A negatively charged particle emitted from the nucleus of an atom, with a mass and charge equal in magnitude to that of the electron.

Bioassay:

The detection of internal contamination by the direct (in vivo) measurement of radioactivity in a person's body or by measurement of biological samples (in vitro) from the person.

Bremsstrahlung

Secondary photon radiation produced by sudden deceleration of charged particles passing through matter.

Contamination (fixed)

Contamination that can not be readily removed from the surface. Depending on the radioisotope and activity, fixed contamination may pose an external radiation hazard.

Contamination (removable)

Contamination that can be readily removed from the surface. Removable surface contamination is of the greatest concern as it is transferable to other surfaces. This can result in widespread surface contamination and lead to internal contamination due to the intake of nuclear substances into the body.

Contamination (Radioactive)

Deposition of nuclear substances in any place where it is not desired.

Critical Organ

The body organ receiving a radionuclide or radiation dose that results in the greatest overall damage to the body. For example, ¹²⁵I and ¹³¹I, the critical is the thyroid due to the preferential uptake of iodine by that gland and its susceptibility to radiation damage.

Contamination meter

A radiation-detection instrument designed to measure surface contamination; it is not designed to measure radiation dose or dose rate.

Curie (Ci)

A unit of activity. One Curie equals 3.70×10^{10} nuclear transformations per second, which is approximately the rate of decay of 1 gram of radium.

Decay Constant (λ)

The fraction of the number of atoms of a radioisotope which decay in unit time. It is expressed as the reciprocal of time (e.g. seconds⁻¹) and is related to the half life by the following equation: $\lambda = 0.693/T_{1/2}$.

Decay, Radioactive

The decrease in the activity of any nuclear substance with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha, beta particles, or gamma radiation.

Deterministic Effects

Effects characterized by a severity that increases with dose above some clinical threshold. The severity of the syndrome that occurs following the administration of the radiation will depend on the number of cells damaged and the total equivalent dose received by the individual.

Dose

A generic term denoting the quantity of radiation or energy absorbed.

Dosimeter

A device that is worn or carried by an individual for measuring a dose of radiation received by that person.

Dosimetry period (one year)

As defined in section 1 of the Radiation Protection Regulations, the period of one calendar year beginning on January 1 of the year following the year in which these regulations come into force, and every period of one calendar year thereafter. The CNSC regulations came into force in May 2000, therefore the first dosimetry period began on January 1, 2001.

Dosimetry period (five year)

As defined in the Radiation Protection Regulations, the period of five calendar years beginning on January 1 of the year following the year in which the CNSC regulations come into force, and every period of five calendar years thereafter. The CNSC regulations came into force in May 2000, therefore the first five year dosimetry period began on January 1, 2001

Effective Dose

Effective Dose is the sum of the doubly weighted absorbed dose in all the tissues and organs of the body. The weighting factors for this purpose are called the radiation weighting factor and tissue weighting factor. This unit is in joules per kilogram with the special name Sievert.
 $1 \text{ Sv} = 100\text{Rem}$

Equivalent Dose

Equivalent Dose is the absorbed dose averaged over a tissue or organ and weighted for the radiation quality that is of interest. The weighting factor for this purpose is called the radiation weighting factor. This unit is in joules per kilogram with the special name Sievert.

Electromagnetic Radiation

Traveling waves of radiation resulting from changing electric and magnetic fields.

Electron Volt (eV)

A unit of energy equivalent to the energy gained by an electron in passing through a potential difference by one volt.

Energy

Capacity for doing work. "Potential energy" is the energy inherent in a mass because of its spatial relation to other masses.

Exemption quantity

The quantity of a radioactive nuclear substance as defined in the Nuclear Substances and Radiation Devices Regulations.

Exposure

A measure of ionization produced in air by gamma or x-radiation. The unit of exposure is coulombs per kilogram of air.

Gamma Ray (γ)

High energy, short wavelength, electromagnetic photon emitted from the nucleus.

Genetic Effect

An effect in a descendant resulting from the modification of genetic material in a parent.

Geometry Factor

The fraction of the total solid angle about the source of radiation that is subtended by the face of the sensitive volume of a detector.

Gray

The International Systems of Units (SI) unit of absorbed dose. This is the energy absorbed per unit mass. $1 \text{ Gy} = 1 \text{ J/kg} = 100 \text{ Rad}$

Half Life, Biological

The time required for the body to eliminate half of the nuclear substance taken in by natural biological means.

Half Life, Effective

Time required for a radionuclide in a body to reduce its activity by half as a result of the combined action of radioactive decay and biological elimination. The effective half life is a mathematical combination of the physical and biological half lives of the particular radionuclide.

Half Life, Radioactive

Time required for a nuclear substance to lose 50 percent of its activity by decay. The time in which half the atoms of a nuclear substance disintegrate to another nuclear form. Each radionuclide has a unique half life.

Half Value Layer

The thickness of a specified substance which, when introduced into the path of a given beam of radiation, reduces the exposure rate by one half.

Ion

An atom that has too many or too few electrons, causing it to carry a net negative or positive charge.

Ionization

The process by which a neutral atom or molecule acquires a positive or negative charge. The process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions.

Intermediate Level Lab

A room where the total quantity of a nuclear substance used at one time does not exceed 50 times its corresponding ALI.

Isotopes

Nuclides having the same number of protons in the nuclei, and hence the same atomic number but differing in the number of neutrons; therefore, in the mass number.

Linear Energy Transfer (LET)

A measure of the ability of biological material to absorb ionizing radiation; specifically, for charged particles traversing a medium. The energy lost per unit length of path as a result of those collisions with electrons in which the energy loss is less than a specified maximum value. A similar quantity may be defined for photons.

Licensed activity

An activity described in paragraphs 26 (a) to (f) of the Nuclear Safety and Control Act that the licence authorizes the licensee to carry on.

Location

Any room, area, enclosure, land or base(s) of operations the licensee occupies where the licensee uses or stores nuclear substances for more than 90 consecutive days per calendar year. It may be identified by a postal address or GPS coordinates.

Neutron

A nuclear particle having a mass similar to a proton but having no electrical charge.

Nuclear energy worker (NEW)

A nuclear energy worker (NEW) as defined in the Nuclear Safety and Control Act is a person who is required, in the course of the person's business or occupation in connection with a nuclear substance or nuclear facility, to perform duties in such circumstances that there is a reasonable probability that the person may receive a dose of radiation that is greater than the prescribed limit for the general public.

Nuclide

A general term referring to all known isotopes, both stable and unstable of the chemical elements.

Nuclear substance

In accordance with the Nuclear Safety and Control Act a nuclear substance is defined as:

- deuterium, thorium, uranium or an element with an atomic number greater than 92
- a derivative or compound of deuterium, thorium, uranium or of an element with an atomic number greater than 92
- a radioactive nuclide

- a substance that is prescribed as being capable of releasing nuclear energy or as being
- required for the production or use of nuclear energy
- a radioactive by-product of the development, production or use of nuclear energy
- a radioactive substance or radioactive thing that was used for the development or production, or in connection with the use, of nuclear energy

Open Source

An open source is any unsealed nuclear substance. This could be in the form of a liquid, gas, or solid. Such a source is most likely to cause contamination.

Photon

A quantum of energy emitted in the form of electromagnetic energy. Gamma rays and x-rays are examples of photons.

Package

The design, fabrication and maintenance of packaging, and the preparation and consigning of packages for transporting nuclear substances and radiation devices.

Possess

To have the care and control of a nuclear substance or radiation devices; to have possession is distinct from ownership.

Possession Limit

The total quantity for each unsealed nuclear substance in storage, in use and being held before disposal. The maximum quantity in possession for each unsealed nuclear substance as specified on the licence that may not be exceeded at any time.

Radiation

Energy in motion, in the form of waves or particles.

Radiation, External

Radiation from a source outside the body--the radiation must penetrate the skin.

Radiation, Internal

Radiation from a source within the body (as a result of deposition of radionuclides in body tissues).

Radiation Weighting Factor (RWF)

A modifying factor used in the derivation of equivalent dose. This factor is selected for the type and energy of the radiation incident on the body. Used to allow comparison of different types of radiation.

Radioactive Decay

The decrease in the amount of any nuclear substance with the passage of time, due to the spontaneous emission from the atomic nuclei of either alpha, beta particles, or gamma radiation.

Radioactivity

Spontaneous emission of radiation, generally particles or gamma radiation from the nucleus of an unstable isotope.

Radioisotope

An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5000 natural and artificial radioisotopes have been identified.

Radionuclide

A radioisotope.

Radiotoxicity

The term referring to the potential of a radioisotope to cause damage to living tissue by the absorption of energy from the disintegration of the nuclear substance that is within the body.

Radiation device

A device certified for use in Canada that contains: more than the exemption quantity of a nuclear substance and that enables the nuclear substance to be used for its radiation properties

- a radium luminous compound.

Radiation survey meter

An instrument that is capable of measuring radiation dose rates ($\mu\text{Sv/h}$ or mSv/h) but not contamination.

Radon

A radioactive element that is one of the heaviest gases known. Its atomic number is 86, and its mass number is 222. It is a daughter of radium.

Roentgen

The amount of x or gamma radiation required to produce a specific amount of ionization in 1 cc of air. One roentgen equals 2.58×10^{-4} coulomb per kilogram of air.

Sealed source

A radioactive nuclear substance in a sealed capsule or in a cover to which the substance is bonded, where the capsule or cover is strong enough to prevent contact with or the dispersion of the substance under the conditions for which the capsule or cover is designed.

Sievert (Sv)

The (SI) unit for equivalent dose. See equivalent dose. $1 \text{ Sv} = 100 \text{ rem}$

Storage

Possession of nuclear substances and radiation devices for storage only

Somatic Effect

Effects of radiation limited to the exposed individual. Somatic injury affects the current generation but is not passed on to future generations.

Store

To put in storage; to hold for safekeeping; a quantity or supply kept for use as needed.

Specific Activity

Total activity of a given nuclide per gram of a compound, element or radioactive nuclide.

Transfer

To change the possession of a nuclear substance or radiation devices from one person to another, or to move a nuclear substance or radiation devices from one place to another.

Stochastic Effects

Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without a threshold. Hereditary effects and cancer incidences are examples of stochastic effects.

Tissue Weighting Factor

Tissue Weighting Factor represents the relative contribution of that organ or tissue to the total detriment due to the effects resulting from uniform irradiation of the whole body.

Transport

The handling, carriage, storage in transit and receipt at the final destination of packages. Transport includes normal and accident conditions encountered in carriage and in storage during transit.

Unsealed source

Nuclear substances in a physical form where dispersion of the radioactive material is possible during use or handling; also referred to as open sources. They are usually in liquid form but may also be in solid, powder or gaseous form.

Wipe test

An indirect form of contamination monitoring that involves wiping a suspect surface and measuring the nuclear substances collected on the wipe sample.

Worker

A person who performs an activity that is referred to in the licence.

Yield

The percentage of radiation emitted from a radioisotope with a particular energy. Example for Iodine-125: 35% of the radiation is 35 keV gammas. 93% is internally converted.

PART C

APPENDICES

APPENDIX A: Radioisotope Permit Applications, Permits and Conditions of Approval

- A.1 Radioisotope Internal Permit Application
- A. 2 Application for in Vivo Radioisotope use in Animals
- A.3 Sample Radioisotope Permit
- A.4 Conditions of Approval – Sealed and Open Source Radioactive Material A-1
- A. 5 In Vivo Use Conditions of Approval A-2

RADIOISOTOPE INTERNAL PERMIT APPLICATION

INSTRUCTIONS:

- a) All PI/Faculty members planning to use Radioactive Materials at locations controlled by the University of Winnipeg are required to apply and obtain an approved Internal Radioisotope Permit.
- b) All new Authorized Workers and Permit holders must be registered with the Safety Office.
- c) Complete answers to the following questions are required to assess your application and implement appropriate safety procedures. Attach additional pages if required.
- d) Return completed application to: Radiation Safety Officer, Safety Office, University of Winnipeg. Phone: (204) 789-1439.

Application for: Renewal of existing permit or New Internal Radioisotope Permit
Anticipated start date for working with radioisotopes _____ (Allow up to four weeks for processing)

Personal Information:

Last Name:	First Name:
Position:	Department:
Office (Room # Bldg):	
Telephone #: Office	Home: Lab:

Summary of training and experience working with radioisotopes (include radioisotopes, training dates, course duration and location, date and length of time which you last did work with radioisotopes:

1. Intended Use of Radioactive Materials:

- a) **Statement of Intended use of radioisotopes** (Describe the radioisotopes and experimental protocols; attach additional pages, if necessary):
- b) **Waste Disposal:** list the form of waste materials that will be produced as a result of your experiments and the proposed method of disposal (attach additional pages, if necessary)

Radioisotope	Type of Waste	Proposed Method of Disposal

2. Radioisotopes: List all isotopes that you are applying to be permitted to use or store. There are two types of permits – sealed source or open source. List activities in MBq (1 mCi = 37 MBq).

- a) **Sealed Source permits** allow purchase, use and storage of radioactive materials that are encapsulated or encased in such a way that it is extremely unlikely to be absorbed into the body. Sealed sources may be in the form calibration sources, moisture density gauges, and electron capture chromatographs etc. Attach additional sheets if required.

Radioisotope	Activity and Calibration date	Source Serial Number	Complete this section for Sealed Sources incorporated into Devices		
			Device Manufacturer	Device Model #	Device Serial#

Note: Leak testing of Sealed sources containing more than 50 MBq (1.35 mCi) activity is mandatory.

- b) **Open Source Permits** allow the purchase, use and storage of radioactive materials in the form of solid, liquid or gas. These sources are provided in a container designed to allow the removal of extraction of some or the entire radioactivity such as a vial, ampoule or bottle. The information supplied by the applicant will be used to assess the containment level of the laboratory as per CNSC regulations. Maximum activity in storage and requested possession limit include the total activity of all stock solutions, samples and waste in the possession of the permit holder (attach additional pages, if required).

Radioisotope	Maximum activity in use at a single time	Maximum activity per vial/container	Maximum activity in storage	Requested Possession limit	Approved possession limit (this column is for RSO use only)

3. Locations (Room and Building) where radioactive materials will be stored and/or manipulated:

Locations for storage and manipulation:
Locations for storage only:
Locations for manipulation only:

4. Instruments for Contamination monitoring and Sample Counting: (List all instruments that you might use (yours or borrowed) – You Must demonstrate that you have access to appropriate instruments for monitoring.

a) Bench Top Counters (beta or gamma counters)

Make and Model of counter	Serial # of counter	Location (Room & Bldg)

b) Portable Survey Meters

Make and Model of meter	Make and model of probe (s)	Location (Rm & Bldg)	Calibration Check Source (if you have one)			Ownership
			Radioisotope	Activity/Date	Int. Std. Serial #	

5. In Vivo Radioisotope Usage

Indicate the approved animal care protocol number (s):

Attach a copy of the protocol and complete a copy of Application for In Vivo Radioisotope Use in Animals.

6. Radiation Laboratory Supervisor (RLS) the RLS must indicate their agreement to act on behalf on the Permit Holder by completing the RLS declaration of this form.

Name:
Office Phone #:
Room # & Building:
Summary if training and experience using radioisotopes (include radioisotopes, training dates, course duration, location and contents, date and length of item which you last dis work with radioisotopes:

7. Authorized Workers:

List all personnel who, in addition to the permit holder, may be working with radioactive materials. Attach additional sheets if required.

First Name	Last Name	Job Title	Date Added/Deleted	Radioisotopes Used and Length of Experience	Radiation Safety Training	
					Date	Location

8. Declarations:

Department Head:

_____ (Signature of Department Chair)

Date: _____

I, the Applicant, warrant the statements contained herein to be true and agree that the radioisotopes supplied against this application shall be used for the purpose and in the manner authorized by the University of Winnipeg Radiation Safety Committee. I hereby agree to comply with the rules and procedures material outlined in the University of Winnipeg Radiation Safety Policy and Procedure Manual.

_____ (Signature of Applicant)

Date: _____

Related Notes:

- Requests for amendment of the following information should be submitted in writing to the Radiation Safety Officer (RSO), Safety Office for subsequent approval by the Radiation Safety Committee.
- Records required as outlined within the conditions listed on the Internal Radioisotope Permit and Internal Radioisotope Permit itself are the property of the University of Winnipeg and must be returned to the Safety Office upon request.
- If the permit holder wishes to cancel a permit they are required to indicate such intent to the RSO, Safety Office as soon as possible, and submit a completed "Radioisotope Permit Decommissioning Form".

APPLICATION FOR IN VIVO RADIOISOTOPE USE IN ANIMALS

INSTRUCTIONS:

Application will not be processed unless accompanied by an application for Radioisotope Permit or an Application for Radioisotope Permit Amendment. Additionally a copy of the corresponding research plan of animal Research must accompany this application.

Please note: Carcasses containing a radioisotope with a T ½ > 90 days in a concentration greater than one discharge quantity per kilogram will not be accepted. University does not equipped with long term storage unit.

Last Name:	First Name:
Position:	Department:

University Animal Care Committee Protocol Number:

Protocol Title:

New Internal Radioisotope Permit Amendment

What species of animals will be involved in the studies	
What radioisotope and compound will be administered?	
Is the chemical compound volatile?	
What activity will be administered?	
What is the typical weight range of chemicals? Minimum weight specified must be accurate as it is used for calculating disposal criteria.	
How many vivo radioisotope studies will be conducted per year?	
How many animals will be administered radioisotopes per study?	
Where will the animals be housed following administration?	
Where will the animal be euthanized?	
What radioisotope activity will be in the carcass?	
What is the storage location of animal carcass before waste pick up?	



THE UNIVERSITY OF WINNIPEG

The Radiation Safety Committee
Winnipeg, Manitoba, Canada R3B 2E9

RADIOISOTOPE PERMIT

Location(s) approved under this Permit:	Date of Issue: September 1, 2013 Date of Expiry: August 31, 2014
--	---

Name, Address, and Telephone Number of Permit Holder:
--

Authorized workers List:

Authorized Students:

Approved Isotopes:
Open Sources and Possession Limit:
Sealed Sources:

Serial Number	Isotope	Reference Activity	Present Activity (kBq)	I.D. Marks

Radiation Devices:						
Manufacturer	Model	Serial Number	Nuclear Substance	Serial Number	Activity	Reference Date

Approved Usage:

Waste Disposal: Contact Radiation Safety Officer.
--

Radiation Safety Conditions: (see Appendix A2)

This Radioisotope Permit is issued under the authority of the University of Winnipeg Radiation Safety Committee and is subject to the conditions outlined in the <i>University of Winnipeg Radiation Safety Policy and Procedures</i>.	
<u>Desiree Vanderwel</u> Chair, Radiation Safety Committee	_____ Date

Conditions of Approval- Sealed and Open Source Radioactive Material A-1

Sealed and Open Source Radioactive Material

1. The Radioisotope permit holder and user(s) listed on this radioisotope permit shall comply with the radiation protection responsibilities outlined in the University of Winnipeg Radiation Safety Policy and Procedures Manual.

Training

2. The radioisotope permit holder shall ensure that all users complete the University of Winnipeg Radiation Safety Training prior to using radioactive materials in any laboratory at the University of Winnipeg. Only students who have received appropriate radiation safety training and who are aware of the hazards involved are allowed to use radioactive material with direct supervision.
3. The names of authorized workers shall be added or deleted from the internal permit as necessary. The Radioisotope permit holder shall assist the Radiation Safety Officer (RSO) in maintaining the list and keeping it up to date.
4. Radiation safety training documentation shall be filed with the RSO, and kept in the binder in the lab. These documents shall be made available during internal or external inspections.

Signage

5. Appropriate radiation warning signs shall be posted whenever and wherever radioactive materials are used or stored. Signage shall display the nature of the radiation hazard present.
6. The radiation warning symbol shall also be displayed on devices containing a sealed radioactive source.
7. Radioisotopes shall be stored in a secure container marked with a radiation warning symbol. Contact the Radiation Safety Officer for signage details.
8. Radioisotope laboratories or storage rooms/enclosures (e.g., refrigerator) shall display the following: the radiation warning symbol, the words "Caution Radiation Hazard", list of radioisotopes and possession limit, emergency contact name(s) or job title, and 24 hr. emergency telephone numbers.
9. Radioisotope laboratories where radioactive devices are used or stored shall display emergency contact name(s) and 24 hr. emergency telephone numbers.

Licence and Permit Posting

10. A valid copy of this radioisotope permit and a notice stating that "A copy of the University of Winnipeg Radioisotope CNSC licence can be obtained from the Radiation Safety Officer (phone # 204-789-1439), Safety Office, 1C05, 515 Portage Avenue", shall be conspicuously posted at all approved locations where radioactive materials are used or stored.
11. A copy of "General Laboratory Rules for Working with Radioisotopes" shall be posted and the rules adhered to by all workers and supervisors.

12. Radioisotope laboratories where radioactive devices are used or stored shall display emergency contact name(s) and 24 hr. emergency telephone numbers.

Usage

13. All personnel authorized to handle the radioisotopes listed on this permit shall do so in accordance with permit conditions, as well as the radiation hygiene and safety practices outlined in the Radiation Safety Policies and Procedures Manual.
14. Radioactive materials shall only be handled or stored in an approved radioisotope laboratory or storage room as specified in the permit.
15. Fume hoods shall be used for all volatile work.
16. It is the responsibility of the Radioisotope Permit holder for making a calibrated survey meter available to radioisotope users to survey the dose rate and a portable contamination meter where unsealed sources are handled or stored.
17. It is the responsibility of the Radioisotope Permit holder for obtaining an appropriate emergency spill kit for each radioisotope laboratory where open sources are used and/or stored.
18. Radioactive substances authorized by this permit are not to be used in or on human beings.
19. Radiation intensity levels in radioactive material usage and storage areas, normally occupied by any other person, other than a nuclear Energy Worker, shall not exceed 2.5 micro Sieverts per hour. Area monitoring shall be carried out in the storage room and during experiments and records of monitoring shall be maintained.
20. All leak and wipe tests shall be recorded in quantitative fashion along with the corresponding background count. The frequency of leak test of sealed source () will be - _____.

Personal Monitoring

21. Whole body dosimeters shall be worn by personnel working with high energy beta, gamma and neutron emitters to measure whole body and skin dose. The Radioisotope permit holder is responsible for the cost of unnecessary, lost, damaged or late (those are not returned on time) dosimeters. It is the responsibility of the Radioisotope Permit holder or Laboratory supervisor to pick up the dosimeters beginning of each wearing period and then return them to the Radiation Safety Officer for the analysis. Dosimetry results for individuals subjected to personal radiation monitoring are available from the RSO **on request**. Each authorized worker will receive their dose estimates in writing from the RSO **ONLY** if they are exceeding their exposures with the recommendations on control measures.

Contamination Surveys

22. Weekly contamination monitoring surveys of the areas where nuclear substances are manipulated shall be conducted when unsealed sources are in use, and all results shall be placed in the Contamination Logbook.
23. Monthly contamination surveys of fridge, freezer interiors shall be performed, and all results shall be placed in the Contamination Logbook.

24. Contamination surveys results of work areas and personnel shall be logged after each procedure.

Inventory

25. An up-to-date inventory shall be maintained for all radionuclides purchased under this permit. A separate inventory record is required for each shipment.

Waste Disposal

26. A waste stream analysis and record shall be made of all waste generated and its location.

Emergencies, Theft, Loss or Spills

27. The Radiation Safety Officer shall be notified immediately if any radioactive material has been involved in an accident or fire.
28. Theft or loss of any radioactive material shall be immediately reported to the Radiation Safety Officer.
29. The Radiation Safety Officer shall be notified of any occurrence of a radioactive spill. Spill procedures outlined in the University of Winnipeg Radiation Safety Policies and Procedures Manual shall be followed.

Security

30. Radioactive materials shall not be accessible to unauthorized staff/students or the general public. Radioactive material shall be locked in a secured area or enclosure. Radioisotope laboratories shall not be left unattended – an authorized Radioisotope permit holder/authorized workers shall supervise the area/lab if radioactive material is not in a secure area or enclosure.
31. Radioisotope Permit holder and authorized workers on the main campus shall maintain the radioactive sealed source log kept in the storage room (2C36).
32. Only authorized workers listed on the internal permit shall have access to the permitted room/lab.
33. Radioactive devices shall not be accessible to unauthorized staff/students or the general public.

Transfer and Transport of Radioactive Material

34. Transfer or transport of radioactive materials to/from another organization or another building on the campus is prohibited without prior approval from the Radiation Safety Officer.

Purchases

35. The radioisotope procurement procedure outlined in the University of Winnipeg Radiation Safety Policies and Procedures Manual shall be followed. All purchase requisition for radioactive materials shall include:
 - a. University of Winnipeg CNSC Radioisotope Licence number
 - b. Radioisotope Permit Holder name
 - c. Authorized Radioisotope Permit holder or designate signature
 - d. The words "Radioactive Material"
 - e. Authorization from the Radiation Safety Officer

Receipt of Radioactive Shipments

- 36. Only Class 7 TDG (Transportation of Dangerous Goods) trained workers receive packages containing nuclear substances.
- 37. Only trained and authorized workers shall open packages containing nuclear substances and radiation devices. All workers and supervisors shall always wear suitable gloves, safety glasses and lab coat when handling and opening a shipment of unsealed radioactive materials. Any anomalies (radiation level in excess of the package labeling, incorrect TI, incorrect safety marks, contamination, leakage, short or wrong shipment, etc.) shall be reported to the supervisor in charge for notification of the consignor, supplier and the Radiation Safety Officer.
- 38. A copy of each radioactive shipment packing slip shall be submitted to the Radiation Safety Officer.
- 39. Radioactive shipments shall be placed in a secure area as soon as possible after delivery. "Procedures upon Receiving Radioactive Materials" in the University of Winnipeg Radiation Safety Policies and Procedures Manual shall be followed.

Animal Usage

- 37. Approved Project – Protocol # -
- 38. Use of Animal Care facility shall be cleared with the Director of Animal care facility.
- 39. Refer to Radioisotope Permit Part III in Vivo Use of Conditions of Approval.

Permit Amendments and cancellation

- 40. Any requests for amendments/cancellation to this radioisotope permit shall be submitted in writing to the Radiation Safety Officer.

I understand and agree to follow procedures and comply with all conditions of approval listed above.

X

Permit Holder/ Laboratory Supervisor

X

Permit Holder/ Laboratory Supervisor

Date: _____

Date: _____

In Vivo Use Conditions of Approval A-2

Protocol #:

Approved Isotopes:

Approved Possession Limit:

Approved Species:

1. The Radioisotope permit holder must ensure that the staff of the animal care facility is aware of the potential hazards and that they are aware of the required precautions.
2. A copy of the internal permit, in Vivo use conditions of approval and appropriate radiation warning signs (door signs and radiation warning symbols) shall be posted outside any room that is authorized to use for the experiment, including animal holding rooms.
3. Access to all areas of animal housing and experimental rooms must be restricted. Only authorized workers and Radioisotope permit holder are allowed to enter to these areas.
4. The administration of radioactive materials to/into animals and the subsequent dissection of those animals should be performed in trays lined with absorbent padding.
5. Animals containing radioisotopes must be housed in separate enclosures.
6. Cages that house animals containing radioactive materials must be labeled with the name of the radioisotope, activity per animal, date of administration, and Authorized worker's name and radiation warning sign
7. All areas of animal housing must be monitored, cleaned, decontaminated and decommissioned before being reoccupied.
8. Volatile and readily dispersible radioactive materials should be administered in a fume hood. Subsequent work with animals may also be best handled within the fume hood.
9. Radiation warning tape must be placed on enclosures and equipment used for radioisotope work.
10. Appropriate personal protective equipment must be worn when handling radioactive work.
11. The Radioisotope Permit Holder must ensure that contamination levels on labeled cages and equipment do not exceed 5 Bq/cm² while in use. Upon completion of the experiment the room cages, equipment and experimental rooms must be decontaminated so that contamination does not exceed 0.5 Bq/cm².
12. Radiation intensity levels in animal holding and experiment room, normally occupied by any other person, other than a Nuclear Energy Worker, shall not exceed 2.5 microSieverts per hour.
13. Animal carcasses must be double bagged and stored until decay in a storage freezer dedicated for radioactive materials labeled with Radiation Warning label.
14. Excreta which contain approved isotopes may be disposed of into the sewer system or into regular waste unless other there is other environmental consideration (chemical, biological). It must be disposed of according to specifications set out as conditions of a CNSC licence. Consult the RSO for

CNSC licence disposal specifications. Log the method of release and quantities released to the sewer system or into regular waste.

15. Radioactive animal tissue/carcasses must be disposed as stated in the section 9.4 of Radiation Safety and Procedures manual.

Please note:

A change of species, isotope, or activity or changes which affect waste disposal or handling precautions may void this authorization. Contact Radiation Safety Officer before such changes are implemented.

Appendix B: Personnel and Nuclear Energy Worker Forms.

- B. 1 Personnel Registration Form
- B.2 Nuclear Energy Worker Notification Form
- B.3 Nuclear Energy Worker Declaration of Pregnancy
- B.4 Application for Dosimetry Services
- B.5 Employee's Dose History Summary (EDHS) Request Form

**University of Winnipeg
Personnel Registration Form**

1. Personal Information:

Last Name:		First Name:	
Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female			
Job Title:		Department:	
Office Location: Building:		Office #:	
Phone #:		Email:	
24 hour contact information for emergency purposes (ONLY for Internal Permit Holder and Radiation Laboratory Supervisor): Home: Cell:			
Alternate: Home:		Cell:	

2. Training:

University of Winnipeg Radiation Safety Training Course Date:
Other Radiation Safety Training (Organization, date and length):

3. Consent:

<p>I hereby agree to work in a responsible and reasonable manner, in accordance with the University of Winnipeg policies and procedures. I am aware that the Canadian nuclear Safety Commission has the authority to fine me personally if I do not comply with the University of Radiation Safety manual (as of July 3, 2013). I agree to be designated by the University of Winnipeg as a:</p> <p><input type="checkbox"/> Permit Holder <input type="checkbox"/> Authorized Worker <input type="checkbox"/> Authorized Nuclear Energy Worker</p> <p>Signature of Registrant: _____ Date: _____</p>

Authorization from the Permit Holder:

<p>As the permit holder, I request that the following person to be added to my internal permit(s).</p> <p>Radioisotope Permit Holder Name:</p> <p>Signature: _____ Date: _____</p>
--

The information on this form is collected under the authority of the University of Winnipeg Act, and in accordance with The Freedom of Information and Protection of Privacy Act. It is collected to register and contact workers. Telephone numbers are collected for emergency purposes and will be shared only with Security Services and the Safety Office. Contact the Information & Privacy Officer at 204.968.7538 if you have any questions about the collection or use of this information.

Nuclear Energy Worker Notification

At the University of Winnipeg users of nuclear substances (radioactive materials) designated as Nuclear Energy Workers (NEW) are required to provide specific information under Nuclear Safety and Control Act.

Nuclear Energy Worker who must use TLD will be informed by the Radiation Safety Officer when a dose is received. The Dose limit for NEW for a one-year dosimetry period must not exceed 50 mSv, the dose limit for a five-year dosimetry period must not exceed 100 mSv. A pregnant NEW must notify Radiation Safety Officer once pregnancy is determined and the Dose limit for the remainder of the pregnancy must not exceed 4mSv.

TO BE COMPLETED BY INDIVIDUAL:

First Name	Middle Name	Last Name	Previous Last Name
Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female			
Province/State of Birth:		Country:	
Radioisotope Permit Holder:			
Supply Dose Record(s) if received anywhere other than at the University of Winnipeg:			
Date	Location:	Dose Received (History):	
Acknowledgement: As required by the <i>Radiation Protection Regulations</i> , I have been informed by the Radioisotope Permit Holder of: <ul style="list-style-type: none"> • The risks associated with radiation to which I may be exposed during the course of my work, including the risk associated with the exposure of an embryo and fetus • The applicable dose limits as specified in the regulations • My expected radiation dose levels • For females, my rights and obligations should I become pregnant In accordance with the <i>Radiation Protection Regulations</i> , this is to inform you that you are a nuclear Energy Worker (NEW). As defined in the Nuclear Safety and Control Act, a NEW is a person who is require, in the course of person's business or occupation in connection with a nuclear substance or nuclear facility, to perform duties in such circumstances that there is reasonable probability that the person may receive a dose of radiation is greater than the prescribed limit for the general public. <p>I understand the risks my obligations and the radiation dose limits and levels that are associated with being designated as a NEW.</p> Signature: _____ Date: _____			

TO BE COMPLETED BY THE RADIATION SAFETY OFFICER:

_____ is informed as a Nuclear Energy Worker and is now authorized to use nuclear substances. Registered on _____ by Radiation Safety Officer. (year/month/day)
Notification sent to Radioisotope Permit Holder _____ Date _____

The information on this form is collected under the authority of the University of Winnipeg Act and the Nuclear Safety and Control Act, and in accordance with The Freedom of Information and Protection of Privacy Act. This information will be provided to the Dosimetry service provider, the Canadian Nuclear Safety Commission, and the Radiation Protection Branch of Health Canada. The S.I.N will be provided to the Dosimetry service provider of Health Canada only. If you have any questions about the collection or use of this information, contact the Information & Privacy Officer at 204.988.7538.

Nuclear Energy Worker Registration – Declaration of Pregnancy

TO BE COMPLETED BY WORKER:

First Name	Middle Name	Last Name
		Due Date (Year/Month/Day) / /
Telephone Number:		Department:
Radioisotope Permit Holder:		
<p>Acknowledgement: I am declaring myself to be pregnant as of the date of completion of this form. I understand the following:</p> <ul style="list-style-type: none"> • Occupational radiation exposure to my unborn child will not be allowed to exceed 4 mSv during the remainder of the pregnancy. • Meeting the lower dose limit may require a change in job, or job responsibilities during my pregnancy but I will remain employed by the University of Winnipeg. • I am responsible to forward this declaration to the Radiation Safety Officer. • I am responsible to make an appointment to speak with the Radiation Safety Officer about my radiation exposure as soon as possible. • I am responsible to inform my supervisor as soon as practical if I find out I am not pregnant, or if for any reason my pregnancy is terminated. <p>Signature of Pregnant Worker: _____ Date: _____</p> <p>List any and all restrictions in job duties to limit dose to the unborn child. Indicate the controls that are required. Document the assessment of potential exposure and your understanding of the specific controls. Consult with the Radiation Safety Officer if necessary. Add lines if necessary.</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 		

TO BE COMPLETED BY THE RADIOISOTOPE PERMIT HOLDER:

I acknowledge receipt of the declaration of pregnancy by signing this statement for the above individual and have discussed the potential risks to the unborn child that could occur from radiation exposure.	
Name	Phone #:
Signature: _____	Date: _____

TO BE COMPLETED BY THE RADIATION SAFETY OFFICER:

I acknowledge the receipt of the declaration of pregnancy for above individual by signing the statement. I have evaluated her prior exposure to ensure appropriate controls have been established to limit the dose to her unborn child and are in accordance with above stated limitations and the ALARA program, and that appropriate monitoring is being provided.
Signature: _____ Date: _____

The information on this form is collected under the authority of the Freedom of Information and Protection of Privacy Act. It is required for the registration of Nuclear Energy Workers. This information will be provided to the Canadian Nuclear Safety Commission and Radiation Protection Branch of Health Canada. Contact the Radiation Safety officer at (204) 789-1439 if you have any questions about the collection or use of this information.

**University of Winnipeg
Application for Dosimetry Service**

(N.B. The National Dosimetry Service charges additional fees for ad hoc dosimeter requests. Please allow a minimum of 4 weeks for order processing.)

1. Personal Information

Last Name:	First Name:
Job Title:	Radiation Safety Training Course Date:
Phone #:	Email:
Date of Birth: (Year/Month/Day)	Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female
Place of Birth: Province: _____ Country: _____	
Social Insurance Number: _____	(Note: the National Dose Registry maintains records by S.I.N.)

2. Dosimeter Type

Please indicate type of dosimeter(s) you are applying for.

- Whole Body/Torso Left Wrist Right Wrist
 Left Ring Right Ring Pregnant Worker

3. Please list the maximum activity that you will be using at any one time in a procedure for each isotope you will be using:

Isotope	Max. Activity	Isotope	Max. Activity	Isotope	Max. Activity	Isotope	Max. Activity

4. Dosimeter Storage

Dosimeter storage location: Building: _____ Room #: _____

5. Prior Dosimetry Service

Have you worn a dosimeter before? (If yes, please indicate where you lived when it was worn.)

- Yes No Province: _____ If outside Canada, please indicate the country: _____

6. Authorization

Radioisotope Permit Holder Name: _____ Department: _____

Signature of Radioisotope Permit Holder: _____

Signature of Registrant: _____

The permit holder is responsible for the cost of unnecessary, lost, damaged or late (those are not returned on time) dosimeters.

For Radiation Safety Officer Use only: Date Dosimeter Issued: _____

Delivered by: _____

The information on this form is collected under the authority of the University of Winnipeg Act and the Nuclear Safety and Control Act, and in accordance with The Freedom of Information and Protection of Privacy Act. It is required for the acquisition of dosimeters to measure personal radiation dose estimates. This information will be provided to the Dosimetry service provider, the Canadian Nuclear Safety Commission, and the Radiation Protection Branch of Health Canada. The S.I.N will be provided to the Dosimetry service provider of Health Canada only. If you have any questions about the collection or use of this information, contact the Information & Privacy Officer at 204.988.7538



National Dose Registry (NDR) Employee's Dose History Summary (EDHS) Request Form

Please follow the instructions provided when preparing your request in order to ensure accurate completion of each entry and avoid unnecessary delays in processing. The NDR will require up to 10 (ten) working days to evaluate and process any Employee's Dose History Summary request.

1 CLIENT SECTION

Company Name		Date of request (yyyy/mm/dd)	
Company Address			
Contact Person Name			
Telephone number ()		E-mail	

2 EMPLOYEE'S DOSE HISTORY SUMMARY REQUEST DETAILS

Dose History Summary Request for a Single Employee

Dose History Summary Request for Multiple Employees (provide a consent for release of dose information for each employee)

3 CONSENT FOR RELEASE OF EMPLOYEE'S DOSE INFORMATION

Legal Name <small>(as it appears on your Social Insurance Number card)</small>	First :		
	Last :		
Social Insurance Number (SIN)			
Date of Birth (yyyy/mm/dd)	Gender	Date of Request (yyyy/mm/dd)	
	<input type="checkbox"/> F <input type="checkbox"/> M		

Applicant's Signature (mandatory) I _____
authorize Health Canada, National Dose Registry to provide my radiation dose history summary to the above organization's contact person as indicated on this form.

4 EMPLOYEE'S DOSE HISTORY SUMMARY (EDHS) RETURN INSTRUCTIONS

For security and confidentiality reasons, the NDR can only release an Employee's Dose History Summary by traditional post mail or FAX. Please indicate your preference below. A Dose History Summary contains personal information; please ensure that you are comfortable in receiving your EDHS at the FAX number you provided.

FAX : ()

Post Mail Address :

PRIVACY - The personal information you provide is collected under the authority of the Department of Health Act for the purpose of providing you with an employee's radiation dose history summary. Requests from a third party for an employee dose history will only be provided with the written consent of the employee. This collection of personal information is described in Info Source under the Personal Information Bank (PIB) HC PPU 080 - National Dose Registry for Occupational Exposures. Health Canada will be unable to process your request if you fail to complete the required fields in this request form. The Privacy Act gives you the rights of access to, correction of and protection of your personal information.

Appendix C: Radioisotope Purchase, Transfer, Inventory and Disposal Forms

- C.1 Original Stock Vial – Radioisotope Inventory Form
- C. 2 Sub Stock vial Inventory Form
- C. 3 Radioactive Waste Disposal Authorization Form
- C. 4 Radioisotope Purchase Authorization Form
- C. 5 Radioisotope Transfer Form

ORIGINAL STOCK VIAL – RADIOISOTOPE INVENTORY

Use a separate radioisotope inventory sheet for each stock vial and keep track until it is disposed of entirely.

Permit Holder: Radionuclide and compound: Lot/Batch Number:
 Activity ordered (mCi or MBq): Volume Received (μ l or ml):
 Reference date (DD/MM/YY): Activity on Reference date ((mCi or MBq): Concentration on reference date:
 Date Received: Supplier:

Upon arrival in the lab each vial in the must be swipe tested for contamination AS SOON AS POSSIBLE – Vial Swipe Results NET CPM -

Storage location of stock vial (building and room):

RECORD OF USE					PRODUCT INFORMATION				DISPOSAL ACTIVITIES					SWIPE CHECKS		
Date Used	Usage Location	Name of User	Stock Vial		Experimental Procedure	Sub stock # OR Storage Location	Volume and/or activity stored as Experimental Product	Product Disposal Date DD/MM/YY	Solid Waste Form and Amount	Liquid Waste Form and Amount	Aqueous Sewer	Carcass	Lab Container Disposal Date DD/MM/YY			
			Volume and/or Activity Used	Volume and/or Activity Remaining												
Comments:								Legend: A= Aqueous S = Solid G=glass/sharps O=Organic B=Biohazardous LSV=Liq. Scint. vials								

Date Stock vial Disposed (DD/MM/YY): Activity in Stock vial disposed: (KBq or MBq)
 Send inventory sheet to the Radiation Safety Officer once all waste has been disposed of from the laboratory. Keep a photocopy for your records.

SUBSTOCK VIAL – RADIOISOTOPE INVENTORY

Permit Holder: _____ Radionuclide and compound: _____ Lot/Batch Number: _____
 Sub Stock Number: _____ Date (DD/MM/YY): _____ Activity (mCi or MBq): _____ Storage Location: _____

RECORD OF USE					PRODUCT INFORMATION				DISPOSAL ACTIVITIES				SWIPE CHECKS	
Date Used	Usage Location	Name of User	Stock Vial Volume and/or Activity Used	Volume and/or Activity Remaining	Experimental Procedure	Sub stock # OR Storage Location	Volume and/or activity stored as Experimental Product	Product Disposal Date DD/MM/YY	Solid Waste Form and Amount	Liquid Waste Form and Amount	Aqueous Sewer	Carcass		Lab Container Disposal Date DD/MM/YY
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
														<input type="checkbox"/>
Comments:								Legend: A= Aqueous S = Solid G=glass/sharps O=Organic B=Biohazardous LSV=Liq. Scint. vials						

Date Sub Stock vial Disposed (DD/MM/YY): _____ Activity of Stock at time of disposal: _____ (KBq or MBq)



INSTRUCTIONS:

1. Complete this form for each radioactive waste disposal.
2. Record the total weight for solid waste, the total volume for liquid waste or the total volume of liquid scintillation fluid in the container (i.e. volume per vial x: #vials; this will be used to calculate the specific activity).
3. Return this form to Radiation Safety Officer for documentation.

Note: 1. Perform a swipe check on each waste container that will be removed from the lab to ensure that no contamination is present.

2. Attach contamination survey and liquid scintillation counter report.

Permit Holder:	Department:
Signature of the Permit Holder:	Date:

Lab/Room #:		
Radioactive Waste Type		
Radioisotope(s):		
<input type="checkbox"/> Liquid (total volume):	<input type="checkbox"/> Solid (total weight):	<input type="checkbox"/> Gas (concentration):
<input type="checkbox"/> Sharps	<input type="checkbox"/> Stock Vials	<input type="checkbox"/> Spoiled Shipments
LSV (Liquid Scintillation Vials) : <input type="checkbox"/> Plastic vials <input type="checkbox"/> Glass vials <input type="checkbox"/> Other – specify		
Total volume of scintillation fluid in container:		

Add lines as necessary:

Lot OR Vial #	Activity (μCi or MBq)	Disposal or Radiation Safety Officer Pick up Date	Final Disposal Method
Total Activity			

Disposed by: **Signature:**

 THE UNIVERSITY OF WINNIPEG	Radioisotope Purchase Authorization Form
---	---

The Radiation Safety Officer must approve all purchases of radioactive materials.

Complete all sections of this order form. Attach any supporting documentation (quote number from a vendor and contact person).

Send the completed form to the Radiation Safety Officer, phone: (204) 789-1439.

Permit Holder:		Date:	
Department:			
Contact Person:		Phone:	Email:
Delivery Location:			
Budget Code:			
Permit Holder Signature:			
Vendor:			
Quote Number (if applicable):			
Vendor Contact Person (if applicable):			
Vendor Phone Number:			
Catalog Number:			

Isotopes: (Add lines as necessary)

Isotope	Form/Chemical Form	Activity		Cost	Requested Delivery Date	Quantity of Isotope currently on inventory in Becquerels
		In curies	In Becquerels			

(Do not fill this section)

Date Approved:

RSO Signature: Sangita Shah

 THE UNIVERSITY OF WINNIPEG	Radioisotope Transfer Form
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The Radiation Safety Officer must approve all transfer of radioactive materials.

Radioisotope may be transferred between Radioisotope Permit Holders Only when the recipient has the radioisotope stated on the Radioisotope Permit and possession limits will not be exceeded. The transfer must also be documented on the lender's Radioisotope Inventory Sheet (radioisotope, volume and activity transferred).

Send the completed form to the Radiation Safety Officer, phone: (204) 789-1439.

Radioisotope, Activity and Volume:	
Original Reference Date:	
Chemical Name and Material Borrowed:	
Date of Transfer:	
TO BE COMPLETED BY EACH RADIOISOTOPE PERMIT HOLDER	
Transfer From Radioisotope Permit Holder:	Transfer From Radioisotope Permit Holder:
Department:	Department:
Building and Room Number:	Building and Room Number:
Contact Person:	Contact Person:
Contact Person Telephone Number:	Contact Person Telephone Number:
Signature: _____	Signature: _____

Appendix D

D.1 Radioisotope Laboratory Inspection Checklist

Radioisotope Laboratory Inspection Checklist

Permit Holder:	Lab Contact Name:	Auditor: Sangita Shah	Inspection Date:
Permit Holder/Lab staff/RSC member accompanied auditor Name:	Room # & Classification:	List of Nuclides Used: Check if radionuclides have not been used since the last survey	

Compliance Items (check YES if in compliance, NO if in violation) N/A – not applicable; NF – not found

General Safety	Y	N
1. Radioactive Lab Card posted at each entrance to the lab		
2. Lab security (lab doors locked and secured when lab is unoccupied)		
3. Permit and emergency contact numbers are posted – inside the lab (clearly visible)		
4. Lab rules and CNSC applicable info bulletins are posted – inside the lab (clearly visible)		
5. Radiation Safety Policy and Procedures Manual available in the lab		
6. Emergency procedures available		
Personnel		
7. List of individuals authorized to access the labs is in the Radiation Safety Policy and Procedures Manual		
8. Training records for NEW and non-NEW available (retained for three years after termination)		
9. Lab coats worn when in the lab		
10. Protective gloves worn when handling radioactive materials		
11. Dosimeters worn when working with radioactive materials		
Usage, storage and disposal		
12. Nuclear substance storage area labeled (radiation warning symbol and listed isotopes stored inside)		
13. Nuclear substance storage area secured (fridge/freezer is lockable and is locked at all times)		
14. Nuclear substances not left unsupervised, unless room locked		
15. Radiation warning symbol on containers of radioactive materials		
16. Clearly identified working surfaces for handling radioactive materials (warning tape on 4 sides)		
17. Radiation warning symbol on equipment within the radioactive work area		
18. Radioactive work surfaces covered with disposable absorbent covers		
19. Radiation warning signs are not posted (where there are no nuclear substances or plans to use)		
20. Up-to-date inventory, usage, (room, procedure, user name, date, amount, disposal)		
21. Radioactive waste disposal authorization from available (copies available – 8 years)		
22. Work in fume hood as required by conditions of approval		
Contamination control		
23. Contamination monitor operational – batteries		
24. Monitoring/swipes of packages of incoming nuclear substances (recorded on inventory sheet)		
25. Contamination log book (for each room, floor plan, list of areas to be checked)		
26. Contamination logbook entries at least weekly		
27. Liquid scintillation printouts records kept (8 years in chronological order)		
28. Monitoring of radioactive equipment after use to ensure contamination criteria not exceeded. Less than 100 cpm above background)		
29. Removal of lab coat and washing of hands before leaving laboratory		

Remarks: Refer to item no. /include violations corrected by Auditor or Radioisotope User.) Note:

Use	Surveys
Radiation Safety Officer (RSO) Sangita Shah	Written Notification of Corrective Action Sent on:
	Permit Holder's Reply Received on:

Appendix E: ALIs, EQs and Intermediate Level Lab Limits

E.1 ALIs, EQs and Intermediate Level Lab Limits

Regulatory Exemption Quantities, ALIs & Basic/Intermediate Limits

Radioisotope	EQ (MBq)	ALI (MBq/y)	Basic Level Lab (MBq)	Intermediate Level Lab (MBq)
Am - 241	0.01	0.1	0	
Ba- 133	1	20	100	1000
C-14	10	34	170	1700
Ca-45	10	20	100	1000
Cd-109	1	9	45	450
Ce-141	10	20	100	1000
Co-57	1	95	475	4750
Cr-51	10	530	2650	26500
Cs-137	0.01	1	5	50
Fe-55	1	100	500	5000
H-3	1000	1000	5000	50000
I-125	1	1	5	50
I-131	1	1	5	50
In-111	1	70	350	3500
Na-22	1	6	30	300
Nb-95	1	30	150	1500
Ni-63	100	100	500	5000
P-32	0.1	8	40	400
P-33	100	80	400	4000
Ra-226	0.01	0.07	0.35	3.5
S-35	100	26	130	1300
Tc-99m	10	900	4500	45000

Contact the RSO or refer to CNSC Nuclear Substances and Radiation Devices Regulations SOR 2000/207 for further information on exemption quantities.

Appendix F – CNSC Info Bulletins

- F.1 Basic Level – Use of Unsealed Nuclear Substances
- F. 2 Intermediate Level – Use of Unsealed Nuclear Substances
- F.2 Proper Care and Use of Personal Dosimeters
- F.3 Spill Procedures
- F.4 Guidelines for Handling packages Containing Nuclear Substances

BASIC LEVEL

Use of Unsealed Nuclear Substances

Canada's Nuclear Regulator



This room has been classified as basic level for the use of unsealed nuclear substances in accordance with Canadian Nuclear Safety Commission requirements. Below is a list of safe work practices to be followed when working in this room.

24-hour emergency contact (name and phone number)

Room identification

- Do not eat, drink, store food, or smoke in this room.
- Use protective clothing and equipment when working with nuclear substances.
- Clearly identify work surfaces used for handling nuclear substances.
- Check all packages containing nuclear substances for damage upon receipt.
- Store nuclear substances in a locked room or enclosure when not in use.
- In case of a spill or incident involving a nuclear substance, inform others in the area, follow emergency procedures and notify the radiation safety officer immediately.

Notes

A room is classified as basic level for the use of unsealed nuclear substances where more than one exemption quantity is handled and where the largest quantity (in becquerels) of a nuclear substance handled by any worker does not exceed five times its corresponding annual limit of intake (in becquerels). Contact your radiation safety officer for a list of annual limits of intake.

For more information, contact:
Directorate of Nuclear Substance Regulation
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, ON K1P 5S9
Telephone: 1-888-229-2672
Fax: 613-995-5086

nuclearsafety.gc.ca



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de sûreté nucléaire

INTERMEDIATE LEVEL

Use of Unsealed Nuclear Substances

Canada's Nuclear Regulator



This room has been classified as intermediate level for the use of unsealed nuclear substances in accordance with Canadian Nuclear Safety Commission requirements. The following is a list of safe work practices to be followed when working in this room.

24-hour emergency contact (name and phone number)

Room identification

- Do not eat, drink, store food, or smoke in this room.
- Wear dosimetry as required by your radiation protection program.
- Wear appropriate protective clothing and equipment when working with nuclear substances.
- Clearly identify work surfaces used for handling nuclear substances.
- Wash hands regularly and monitor them for contamination frequently.
- Monitor work area for contamination after working with nuclear substances.
- Check all packages containing nuclear substances for damage upon receipt.
- Store nuclear substances in a locked room or enclosure when not in use.
- In case of a spill or incident involving a nuclear substance, inform others in the area, follow emergency procedures and notify the radiation safety officer immediately.

Notes

A room is classified as intermediate level for the use of unsealed nuclear substances where the largest quantity (in becquerels) of a nuclear substance handled by any worker does not exceed 50 times its corresponding annual limit of intake (in becquerels). Contact your radiation safety officer for a list of annual limits of intake.

For more information, contact:
Directorate of Nuclear Substance Regulation
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, ON K1P 5S9
Telephone: 1-888-229-2672
Fax: 613-995-5086

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PROPER CARE AND USE OF PERSONAL DOSIMETERS

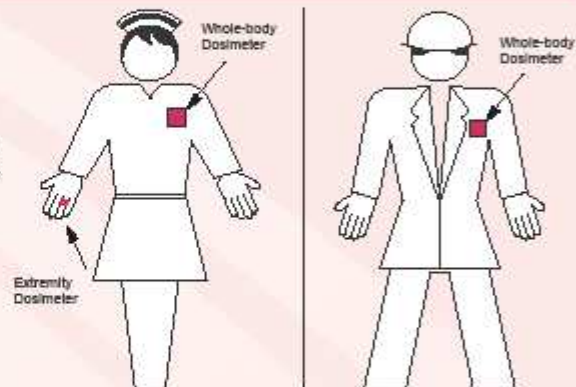
This poster gives useful tips for the proper handling, wearing and storage of whole-body and extremity dosimeters. These are commonly referred to as thermoluminescent dosimeters (TLDs) or optically stimulated luminescent (OSL) dosimeters. Your dosimeter measures the amount of radiation to which you are exposed.

Handling

1. Follow manufacturer recommendations for the care and use of your dosimeter. Do not expose the dosimeter to high temperatures, water, direct sunlight or fluorescent light.
2. Change the dosimeter plaques in a clean, dry area away from direct light, and avoid direct skin contact, if necessary.

Wearing

3. Clip your whole-body dosimeter firmly to your clothing between your waist and neck.
4. Extremity dosimeters should be worn facing the source of radiation.
5. If necessary, wear a second dosimeter on the area of your body most likely to receive the highest dose. In these cases, special arrangements must be made with the dosimetry service provider to ensure doses are assigned properly.
6. If you lose or damage your dosimeter, you should stop working with radiation until you receive a replacement.
7. Do not share your dosimeter.



Storage

8. Store your dosimeter in a manner recommended by the manufacturer when not in use.
9. It is good practice to keep extra dosimeters as replacements for lost or damaged ones and for visitors.
10. When not in use, dosimeters are best stored in a low-radiation background area. Dosimeters should be protected from direct light and heat.

For more information, contact:
 Directorate of Nuclear Substance Regulation
 Canadian Nuclear Safety Commission
 P.O. Box 1046, Station B
 Ottawa, ON K1P 5S9
 Telephone: 1-888-229-2672
 Fax: 613-995-5086

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SPILL PROCEDURES

Name and telephone number of the person responsible for enforcing safe work practices with nuclear substances in this work area:

Radiation safety officer

Telephone number

24-hour emergency contact

Telephone number

General precautions

1. Inform people in the area that a spill has occurred. Keep them away from the contaminated area.
2. Cover the spill with absorbent material to prevent the spread of contamination.

Minor spills (typically less than 100 exemption quantities of a nuclear substance)

1. Wear protective clothing and disposable gloves, clean up the spill using absorbent paper and place it in a plastic bag for transfer to a labelled waste container.
2. Avoid spreading contamination. Work from the outside of the spill towards the centre.
3. Wipe test or survey for residual contamination as appropriate. Repeat decontamination, if necessary, until contamination monitoring results meet the nuclear substances and radiation devices licence criteria.
4. Check hands, clothing, and shoes for contamination.
5. Report the spill and cleanup to the radiation safety officer or the person in charge.
6. Record spill details and contamination monitoring results. Adjust inventory and waste records appropriately.

Major spill procedures should be implemented whenever minor spill procedures would be inadequate.

Major spills (Major spills involve more than 100 exemption quantities, or significant contamination of personnel, or release of volatile material)

1. Clear the area. Persons not involved in the spill should leave the immediate area. Limit the movement of all personnel who may be contaminated until they are monitored.
2. If the spill occurs in a laboratory, leave the fume hood running to minimize the release of volatile nuclear substances to adjacent rooms and hallways.
3. Close off and secure the spill area to prevent entry. Post warning sign(s).
4. Notify the radiation safety officer or person in charge immediately.
5. The radiation safety officer or person in charge will direct personnel decontamination and will decide about decay or cleanup operations.
6. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and mild soap.
7. Follow the procedures for minor spills or proceed in accordance with authorized procedure.
8. Record the names of all persons involved in the spill. Note the details of any personal contamination.
9. If required, the radiation safety officer or person in charge will arrange for any necessary bioassay measurements.
10. If required, submit a written report to the radiation safety officer or person in charge.
11. The radiation safety officer or person in charge must notify the CNSC immediately and submit a full report within 21 days.

If an exposure may have occurred that is in excess of applicable radiation dose limits, the CNSC shall be notified immediately as required by section 16 of the *Radiation Protection Regulations*.

For more information, contact:

Directorate of Nuclear Substance Regulation
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, ON K1P 5S9
Telephone: 1-888-229-2672
Fax: 613-995-5086

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GUIDELINES FOR HANDLING PACKAGES CONTAINING NUCLEAR SUBSTANCES

Identifying Packages Containing Nuclear Substances

The packaging and labeling of nuclear substances is governed by the Canadian Nuclear Safety Commission's *Packaging and Transport of Nuclear Substances (PTNS) Regulations*. Nuclear substances may be shipped in "Excepted Packages", "Type A" or "Type B" packages, "Industrial Packages I, II, III", and packages for "Fissile Material". The "radioactive" category labels also show radiation dose rates.

On Excepted Packages, no external labeling is required, and the safety mark "RADIOACTIVE" must be visible upon opening the package. The radiation level at any point on the external surface of the package must not exceed 5 µSv/h. All other packages must be categorized by radiation level and display the corresponding radiation warning labels as follows:



Category I-WHITE
Does not exceed 5 µSv/h at any location on the external surface of the package



Category II-YELLOW
Does not exceed 500 µSv/h at any location on the external surface of the package and the transport index does not exceed 1.



Category III-YELLOW
Does not exceed 2 mSv/h at any location on the external surface of the package and the transport index does not exceed 10.

The transport index is the maximum radiation level in microsieverts per hour at one metre from the external surface of the package, divided by 10.

Example: 1 µSv/h (0.1 mrem/h) at 1 m equals a TI = 0.1.

Upon receipt of a package containing nuclear substances, keep your distance. Examine the package for damage or leakage. If the package is damaged or leaking, contain and isolate it to minimize radiation exposure and contamination, and comply with Section 19 of the PTNS Regulations.

Opening Packages Containing Nuclear Substances

Radiation Safety Officer	Phone Number

1. If an appropriate survey monitor is available, monitor the radiation fields around the package. Note any discrepancies.
2. Avoid unnecessary direct contact with unshielded containers.
3. Verify the nuclear substance, the quantity, and other details with the information on the packing slip and with the purchase order. Log the shipment details and any anomalies in the inventory record.
4. Report any anomalies (radiation levels in excess of the package labeling, incorrect transport index, contamination, leakage, short or wrong shipment) to the Radiation Safety Officer.

When opening packages containing unsealed nuclear substances, additional steps should be taken:

5. Wear protective clothing while handling the package.
6. If the material is volatile (unbound iodine, tritium, radioactive gases, etc.) or in a powder form, open the package in a fume hood.
7. Open the outer package and check for possible damage to the contents, broken seals, or discoloration of packing materials. If the contents appear to be damaged, isolate the package to prevent further contamination and notify the Radiation Safety Officer.
8. If no damage is evident, wipe test the inner package or primary container which holds the unsealed nuclear substance. If contamination is detected, monitor all packaging and, if appropriate, all locations in contact with the package, for contamination. Contain the contamination, decontaminate, and dispose in accordance with the conditions of the Nuclear Substances and Radiation Devices licence.

For more information, contact: Directorate of Nuclear Substance Regulation, Canadian Nuclear Safety Commission, P.O. Box 1046, Station B, Ottawa, ON K1P 5S9. Telephone: 1-888-229-2672. Fax: (613) 995-5086.

Appendix G: Radioactive Contamination Monitoring Record; Leak Test Forms

G.1 Radioactive Contamination Monitoring Record

G. 2 Leak Test Sampling and Analysis Form

G. 3 Leak Test Sampling Form (to be sent to Cancer Care Manitoba)

Radioactive Contamination Monitoring Record Form

Date:	Name:	Location:	Radioisotope(s) used:
Record the type of contamination survey (direct or indirect) and the make/model of the counting instrument used in the appropriate section below (i.e. contamination meter, liquid scintillation counter etc.), and if this is a post-procedure or weekly survey.			
<input type="checkbox"/> No radioactive work done	<input type="checkbox"/> No contamination found	<input type="checkbox"/> Contamination found and removed	
Direct Survey: Contamination Meter: Detector:	Check one: <input type="checkbox"/> Post-procedure <input type="checkbox"/> Weekly	Indirect Survey: Liquid Scintillation Counter: Gamma Counter:	Check one: <input type="checkbox"/> Post-procedure <input type="checkbox"/> Weekly

Record the background, measure and net counts per minute for each surveyed location. Compare the net CPM with the appropriate contamination limit chart. If contamination is found, decontaminate immediately, re-swipe and record the result.

Sample #	Description	CPM (Measured)	CPM (Net)	Contamination Found (Yes/No)	Decontamination Results	Comments
BKG						
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						

BKG: Background
CPM: Counts per Minute
Net CPM = Measured CPM- Background CPM

Radioactive Contamination Monitoring Record Form

Record the background, measure and net counts per minute for each surveyed location. Compare the net CPM with the appropriate contamination limit chart. If contamination is found, decontaminate immediately, re-swipe and record the result.

Sample #	Description	CPM (Measured)	CPM (Net)	Contamination Found (yes/No)	Decontamination Results	Comments
17.						
18.						
19.						
20.						
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						
31.						
32.						
33.						
34.						
35.						
36.						
37.						
38.						
39.						
40.						

BKG: Background
CPM: Counts per Minute
Net CPM = Measured CPM- Background CPM

LEAK TEST

Date Reported	
Name of Measurer	
Sample Method	
Date Sample Taken	
Measuring Instrument Make, Model and Serial #	
Radionuclide	
Source Serial #	
Background Measurement	
Sample Measurement	
Conclusion	
Initials	

Only trained permit holder or authorized workers who are familiar with the conditions of University Licence, CNSC Regulatory Expectations for Leak Testing of Sealed Source, operation of the source, appropriate precautions for radiation protection, procedures for leak testing and familiar with the operation of the measuring instrument may perform and analyze leak sampling.

Develop written step-by-step procedures for wipe sampling of each type of sealed source and measuring and forward a copy to the RSO.

File a copy in the Radiation Safety binder and forward a copy to the Radiation Safety Officer. Keep records at least for eight years.

If a sealed source wipe sample has contamination exceeds the leakage criteria of 200 Bq the person who analyzed the swipe sample must immediately advise the Radiation Safety Officer at 204.789.1439.

***CNSC sealed source leak test criteria = <200 Bq**

If leak test is >200 Bq, then the licensee shall be notified