RADIATION SAFETY PROGRAM

Contents

1.0 Purpose

The purpose of this document is to:

- Protect workers, the public, and the environment by ensuring that radiation doses are kept as low as reasonably achievable
- To ensure that regulatory and license requirements are met
- To describe the roles and responsibilities of personnel under the Radiation Safety Program
- To ensure that proper training and instruction are delivered to workers

1.1 ALARA

The University's Radiation Safety Program is designed to ensure that doses to persons are As Low As Reasonably Achievable (ALARA) with social and economic factors being taken into account as required by the Canadian Nuclear Safety Commission (CNSC) and the University's associated license.

"Social and economic factors" include financial costs and loss of employment. Regardless of economic and social consideration, it is mandatory that no person be exposed in excess of regulatory dose limits.

The University is committed to the concept of ALARA and will do so through:

- Providing management oversight to radiation work
- Ensuring all dose limits (both occupational and public) are within the Regulatory Dose Limits as defined by the Radiation Protection Regulations
- Actively promoting a strong safety culture amongst all individuals working with radioactive materials
- Provide training to radiation workers
- Planning for unusual situations

2.0 Scope

This program applies to all radioisotope work conducted under the University of Waterloo including work carried out by researchers, instructors, students, workers, and other individuals.

3.0 Definitions

Annual Limit on Intake (ALI)
The quantity of a nuclear substance that, if ingested or inhaled, would result in a committed effective dose of 20 mSv.

Canadian Nuclear Safety Commission (CNSC)
The established regulatory body governing the use of nuclear substances, radiation devices and nuclear facilities in Canada.

Device
A device that contains more than the exemption quantity of a nuclear substance and that enables the nuclear substance to be used for its radiation properties; and a device that contains radium luminous compound.

Environmental Safety Facility (ESF)

Facility within the University designated for the disposal of all hazardous wastes generated on campus.

Exemption Quantity (EQ)
The amount, as defined by the Nuclear Substances and Radiation Devices Regulation Schedule 1, where activities above may require CNSC licensing.

Non-radioactive Nuclear Substances
Materials that are regulated due to their connection with nuclear energy. Elements including thorium, uranium, plutonium, any element with an atomic number greater than 92. Deuterium, heavy water (deuterium oxide) and any other deuterium compound in which the ratio of deuterium to hydrogen atoms exceeds 1:5,000.

Radiation Safety Committee (RSC)
The committee that evaluates applications for radiation use and maintains surveillance over the use of radioactive materials within the University. The Radiation Safety Committee is a subset of the Laboratory Safety Committee.

Radiation Safety Officer (RSO)
The person(s) designated by the University as being responsible for the management and control of radiation safety.

Sealed Source
As defined by the CNSC, 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.

For the purpose of the University's permit system, sealed sources and devices fall under the same permit type, Sealed Source.

Open Source
Aligns with the CNSC definition of Unsealed Source. Any source that is not a sealed source. Often includes radioactive nuclear substances that are purchased in vials for research use.

4.0 Roles and Responsibilities

4.1 Management Structure

The University uses the following management structure for radiation safety (see Figure 1 and Table 1).

Figure 1: Management Structure

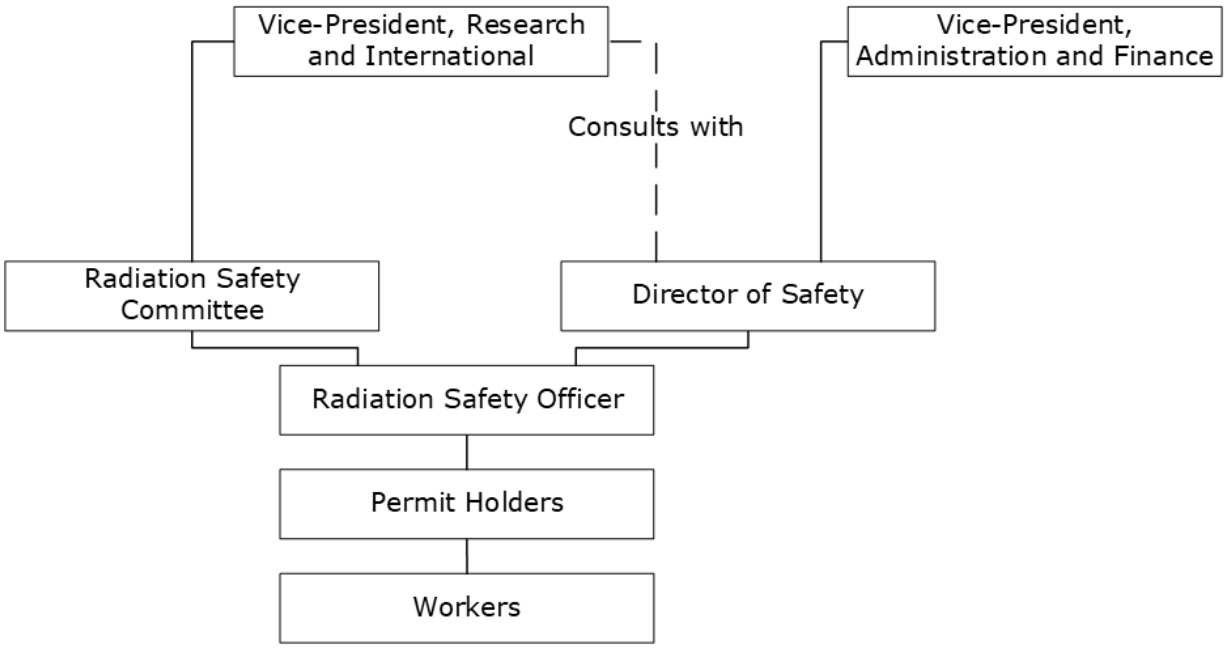

Table 1: Management Structure

Position	Held By
Vice-President Research and International	Charmaine B. Dean
Director of Safety (Note: The Director of Safety also operates as the University's applicant authority.)	Kate Windsor
Radiation Safety Committee	Jamie Joseph Crystal Senko Katelyn Versteeg
Radiation Safety Officers	Katelyn Versteeg Dhananjai Borwankar (Alternate)

4.2 Roles and Responsibilities

4.2.1 Applicant Authority

At the University of Waterloo, the applicant authority is the Director of Safety. Their role includes the following duties:

- Fostering a healthy safety culture
- Appointing a Radiation Safety Officer (RSO) and/or an Alternate Radiation Safety Officer
- Appointing representatives of the applicant or licensee
- Directing resources

- Monitoring the performance of licensed activities

4.2.2 Radiation Safety Officer

The RSO is responsible for:

- Ensuring the health and safety of personnel, the public, and the environment
- Overseeing the daily aspects of the radiation safety program
- Acting as the primary contact with the CNSC for licensing and compliance matters
- Identifying radiation safety problems
- Providing radiation safety advice to workers when requested
- Implementing corrective actions
- Verifying the implementation and effectiveness of the corrective actions
- Ensuring compliance with the CNSC regulatory requirements
- Reporting regulatory non-compliances to the CNSC
- Holding the authority to stop any unsafe work practices and any activity that might result in non-compliance
- Developing procedures and policies related to radiation safety and training
- Assessing the performance of the radiation safety program and sharing the results with the applicant authority
- Acting as the signing authority for CNSC licences

4.2.3 Radiation Safety Committee

The purpose of this committee is to provide oversight regarding activities involving radioactive materials. The committee will focus on the following:

- Review planned laboratory activities to ensure the completion of appropriate hazard identification and risk assessment activities
- Assess requirements and recommend revisions for laboratory users' training and laboratory safety procedures
- Review reports and recommend corrective actions related to laboratory services, activities, incidents, and interventions in laboratory areas.
- Report as required to the Vice-President of Research at the University of Waterloo

4.2.4 Permit Holders

The primary responsibility for the safety of staff, students and the public lies with the permit holder in charge of the research or teaching that involves the use of radioactive materials. Permit holders must follow all the roles of supervisors as per the University's

Health and Safety Management System. In addition to their roles as a supervisor, permit holders must:

- Obtain a Radiation Safety Permit when using radioactive material
- Keep an up-to-date inventory of all radioactive materials, including storage and disposal records in the laboratory
- Maintain area monitoring and/or wipe test records for inspection by the RSO
- Require all personnel under their supervision wear the appropriate radiation dosimetry equipment and participate in any prescribed bioassay monitoring
- Immediately contact and notify the RSO should they become aware of activities that are defined as reportable per the Reporting Section of this program

4.2.5 Workers/Students

Workers and students must follow all the roles of workers and students as per the University's Health and Safety Management System. In addition, they must:

- Immediately inform the permit holder if:
  - They suffer an exposure or believe to have been exposed to a radioactive agent
  - There is a spill of radioactive material
- Immediately inform the Principal Investigator if you are aware of aware of activities that are defined as reportable per 5.11 Reporting
- Wear personal dosimeters, as required

5.0 Procedures

5.1 Permit

A permit system maintains the control of radioactive materials at the University of Waterloo. To receive a permit, the permit holders must be employees of the University and approved by the RSO. Facilities will be owned, rented, or leased by the University with the exception of logging sources. Rented locations require a signed Landlord Owner Acknowledgement Form. A Nuclear Substance and Prescribed Equipment Notification will be submitted to the local Fire Department by the RSO if any of the follow are used off of main campus:

1. Open sources (basic or higher)
2. Sealed sources above 1 EQ
3. Devices above 10 EQ

Local law enforcement will be notified if high or medium risk sealed (Category 1, 2 or 3) sources are onsite.

Radioactive materials can only be used or handled in permitted locations. Before use, notify all personnel expected to be in the area about the use of the material, and take precautions to ensure that the maximum allowable working field of 2.5 uSv/hr in any direction from the source is not exceeded.

Note: 2.5 uSv/hr is based off the assumption that a person working in the area full time while being exposed to a maximum of 2.5 uSv/hr will not exceed the public dose rate of 1 mSv per year.

5.1.1 Applying for a New Permit

Permit applications follow the process as outlined in Figure 2 with important links provided in Table 2. Non-radioactive nuclear substances do not follow this permit application process, instead potential permit holders should contact the RSO to determine if a permit is necessary.

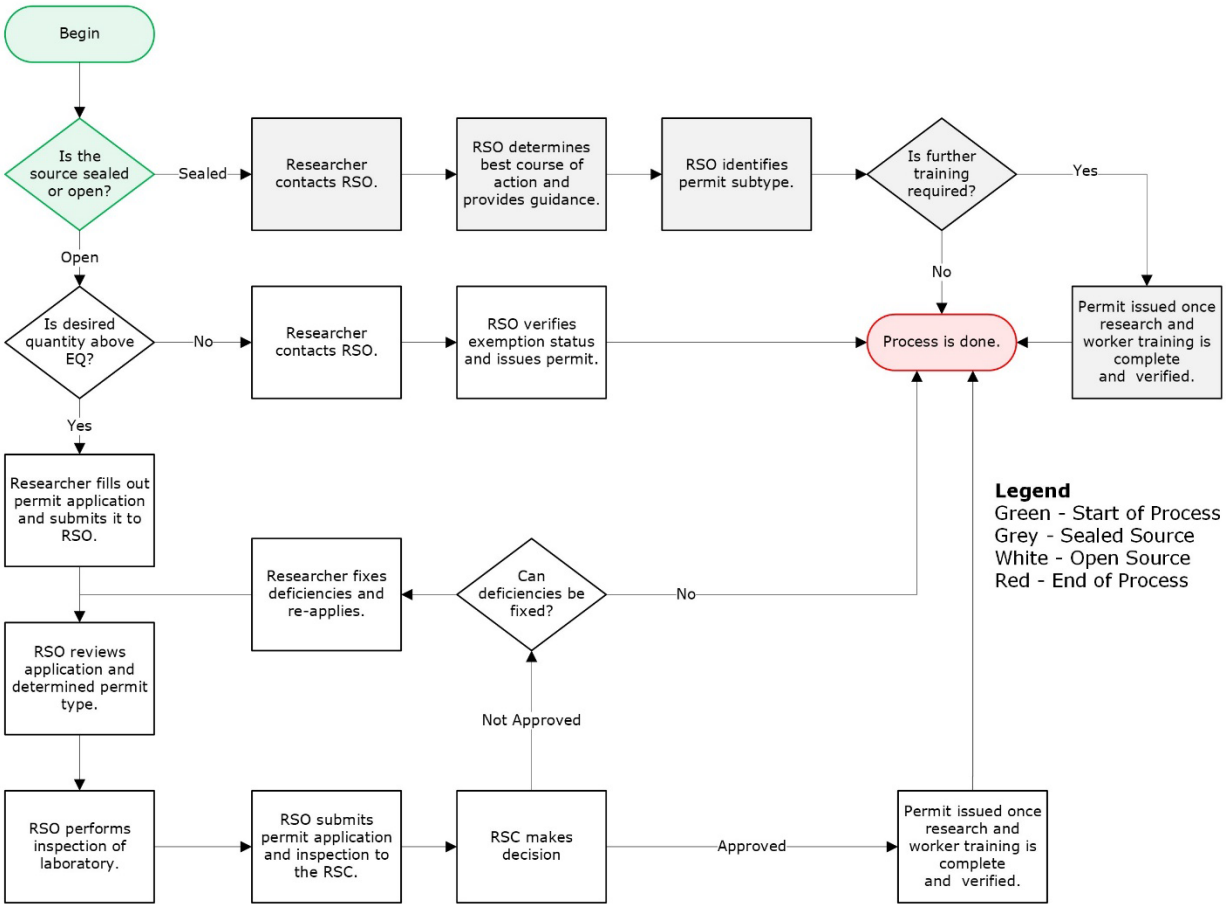

Figure 2 Permit Application Process

Whenever formal permit applications are required as per the process outlined in Figure 2, Safe Operating Procedures (SOP) should be submitted by the PI along with the permit application for review by the RSO. During work, if a change occurs where the work varies from the original SOP, the SOP should be re-submitted to the RSO for approval.

Table 2 Permit Application Documents

Document	When Completed	Completed By	Submitted to
Permit Application Safe Operating Procedure Template	When open source quantity is above 1 EQ for the isotope	Researcher	RSO
Design Assessment Form for Nuclear Substance Laboratories and Nuclear Medicine Rooms	Intermediate level laboratories or higher	RSO	RSC CNSC[1]

Note:

[1]The RSO will contact the CNSC within seven days of commencing work at a new location where licensed activities will be conducted for more than 90 days.

5.1.2 Permit Types

Permits at the University of Waterloo are divided into two types: open and sealed.

Open source permits are any permit working with a nuclear substance that is not encapsulated or contained. Open source permits are further subtyped as per Table 3 below. Open source permits, with the exception of non-radioactive nuclear substances such as deuterium oxide, are classified based on their ALI.

Table 3 Open Source Subtypes

Open Source Subtype	Definition
Non-regulated	Any permit working with a radioactive nuclear substance that is not encapsulated or contained and below 1 EQ.
Basic[1]	The quantity of unsealed nuclear substance used at a single time does not exceed 5 times its corresponding ALI.
Intermediate[1]	The quantity of unsealed nuclear substance used at a single time does not exceed 50 times its corresponding ALI.
High[1]	The quantity of unsealed nuclear substance used at a single time does not exceed 500 times its corresponding ALI.
Containment[1,2]	The quality of unsealed nuclear substance used at a single time exceed 500 times its corresponding ALI.
Nuclear medicine[1]	The nuclear substance is prepared for or administered to a person.
Non-radioactive nuclear substance[3]	Materials that are regulated due to their connection with nuclear energy. Elements including thorium, uranium, plutonium, any element with an atomic number greater than 92 where their activity is below 1 EQ. Deuterium[4], heavy water (deuterium oxide) and any other deuterium compound in which the ratio of deuterium to hydrogen atoms exceeds 1:5,000.
Storage	Any permit where radiation is not actively used but radiation sources or radioactive waste may be stored.

Notes:

[1]As defined by GD-52: Design Guide for Nuclear Substance Laboratories and Nuclear Medicine Rooms.

[2]Prior to use of an unsealed nuclear substance in excess of 10,000 EQ, written approval must first be obtained from the CNSC. The request must include: isotope, quantity, permit holder name and qualification, safe operating procedures and a laboratory design assessment. No isotopes may be ordered until written approval is received by the CNSC.

[3]As defined by A.1 Controlled Nuclear Substances in the Nuclear Non-proliferation Import and Export Control Regulations.

[4]Deuterium is exempt when (1) contained in deuterium lamps, (2) occurs in a contaminant in laundry or equipment, or (3) is used for labelling purposes.

The following vial limits and lab classifications (Table 4) are in use at the University.

Table 4 Vial Limits for Lab Classifications

Isotope	Class[1]	EQ[2] (Bq)	ALI[3] (Bq) (Inhalation)	Vial Size Basic Level (≤5 x ALI)	Vial Size Intermediate (≤50 x ALI)
Ba-133	B	1×10^6 (1 MBq)	1.1×10^7 (11 MBq)	55 MBq	550 MBq
C-14	C	1×10^7 (10 MBq)	1.0×10^9 (1 GBq)	5 GBq	50 GBq
H-3	C	1×10^9 (1 GBq)	1.0×10^{13} (10 TBq)	5 TBq	50 TBq
I-125	C	1×10^6 (1 MBq)	1.4×10^6 (1.4 MBq)	7.5 MBq	75 MBq
Uranium - Natural	A[4]	1000 Bq	3.2×10^3 (32 kBq)	16 kBq	160 kBq
U-234	A	1×10^4 (10 kBq)	Not Listed	Not Listed	Not Listed
U-235	A	1×10^4 (10 kBq)	3.3×10^3 (3.3 kBq)	16.5 kBq	165 kBq
U-238	A	1×10^4 (10 kBq)	3.5×10^3 (3.5 kBq)	17.5 kBq	175 kBq

Notes:

[1]Classes of Nuclear Substances are from REGDOC-1.6.1, License Application Guide: Nuclear Substances and Radiation Devices, Version 2.

[2]Exempt Quantities (EQ) are from Nuclear Substances and Radiation Devices Regulations Schedule 1.

[3]Annual Limits on Intake are from GD-52: Design Guide for Nuclear Substance Laboratories and Nuclear Medicine Rooms.

[4]Not included in REGDOC-1.6.1 but confirmed by licensing specialist

Sealed source permits are for any nuclear substance that is encapsulated and maintained. Permit classification for sealed sources are based on the potential hazard that it could cause. Potential risks include:

1. Radiological risk associated with the source
2. Nature/application of the work
3. Mobility of the source
4. Experience from reported incidents
5. Typical versus unique activities within the application

Sealed source permit types are described in Table 5.

Table 5 Sealed Source Permit Subtypes

Sealed Source Subtype	Definition
Non-regulated	Any permit that contains low-risk sealed radioactive sources (below 1 EQ) and are not further tracked by the CNSC. (i.e. low activity check source)
Sealed source	Any sealed sources in excess of 1 EQ.
Devices	Any devices that require certification from the CNSC as per Certification of Radiation Devices.
Storage	Any permit where radiation is not actively used but radiation sources or radioactive waste may be stored.

Note: permits may be exempt from some portions of the Radiation Program (e.g., authorized workers) if the source is low risk (e.g., liquid scintillation counter, low activity check sources). Exemptions are included on the permit poster and further detailed in the Training section of this Program.

The RSO will contact the CNSC:

- If a device is purchased above 10 EQ
- If a device is purchased but there is no posted certificate
- If a sealed source is purchased above 1 EQ

5.2 Worker Designation and Dosimetry

Workers who are working with radioactivity will be designated as authorized workers and listed on their permit. Additionally, workers may be designated as Nuclear Energy Workers as per the Radiation Protection Regulations and shown in Table 6. At the University, worker performing general laboratory tasks related to research would not expect to receive a whole-body dose in excess of 1 mSv per year and would not be designated a Nuclear Energy Worker.

Table 6 Worker Designations

Person	Period	Effective Dose (mSv)	Inclusion in Dosimetry
Nuclear energy worker[1]	One-year dosimetry period	50	Yes
	Five-year dosimetry period	100	Yes
Pregnant nuclear energy worker[2]	Balance of the pregnancy starting from the date on which the licensee has been informed	4	Yes
Person who is not a nuclear energy worker	One calendar year	1	As needed[3]

Notes:

[1]Includes female nuclear energy worker who is pregnant but has not yet informed the RSO in writing
[2]Who has informed the RSO in writing
[3]Dosimeter use for persons who are not Nuclear Energy Workers is determined based on exposure estimates determined by the amount (activity) of each isotope that an individual will be working with combined with the time working with that specific isotope activity.

Female nuclear energy workers will be informed in writing:

1. Of the risks associated with the exposure of embryos and fetuses to radiation and the risks to breastfed infants from the intake of nuclear substances.
2. Of the importance of informing the licensee, as soon as feasible, in writing, that the female nuclear energy worker is pregnant or breastfeeding.
3. Of the rights of a pregnant nuclear energy worker and the rights of a breastfeeding nuclear energy worker under section 11.
4. Of the applicable effective dose limits for pregnant nuclear energy workers (see Table 6).

In addition to adherence of the effective dose limits, workers will also be kept within the equivalent dose limits (see Table 7).

Table 7 Equivalent Dose Limits

Person	Period	Organ or Tissue	Equivalent Dose Limits (mSv)
Nuclear Energy Worker	One-year dosimetry period	Lens of an eye	50
		Skin	500
		Hands and feet	500
Person who is not a Nuclear Energy Worker	One calendar year	Lens of an eye	15
		Skin	50
		Hands and feet	50

5.2.1 Dosimetry

Dosimeters are used when there is risk of external or extremity radiation hazards. Three types of dosimeters are used on campus:

1. TLD Whole Body Dosimeter – Used to measure external radiation hazards
2. Ring Dosimeter – Used to measure extremity radiation hazards
3. Neutron Dosimeter – Used to measure neutron radiation hazard for logging sources

For more information on dosimeters, reviewing the Worker Personal Dosimetry Guidelines training material.

5.2.2 Bioassay

Radioisotope workers using Iodine 125 exceeding the following criteria (in a 24 hour period) must participate in a bioassay monitoring as per the recommended limits for activity handled daily throughout a 1-year period described in REGDOC-2.7.2, Dosimetry Volume 2: Ascertaining Occupational Dose:

Table 8 Bioassay Requirements

Operation	Gases and Volatile Liquids[1]	I-125 Maximum Activity
Open Bench[2]	≥ 2 × ALI	2.8 MBq
Fume Hood	≥ 200 × ALI	280 MBq
Glove Box (vented)	≥ 20000 × ALI	28000 MBq
Sealed Vials and Syringes	≥ 50 × ALI	70 MBq
Involved in a Spill[3]	Not Applicable	2 MBq
External Contamination[3]	N/A	Any

Note:

[1]I-125 will be treated as a volatile liquid for purposes of bioassay.

[2]Processes which involve the generation of significant quantities of volatile iodine must be carried out in a fume hood.

[3]The University of Waterloo does not have the resources at this time to complete I-125 thyroid monitoring. As a result, McMaster University has agreed to complete thyroid monitoring for the University of Waterloo radiation as part of the Radiation Safety Program should it be required.

5.2.3 Action Levels

The University will follow administrative control levels for worker exposure over the calendar year (see Table 9).

Table 9 Administrative Control Levels

Dose (mSv)	Actions Taken by the RSO
0.2 mSv[1]	1. Reports cumulate dose to the workers
0.5 mSv[1]	1. Conduct an investigation to determine the magnitude of the dose and establish the causes of the exposure 2. Identify and take action to prevent similar occurrence of the incident 3. Report the findings to the RSC and the worker
1 mSv[1]	1. Immediately notify the worker and the CNSC of the dose 2. Require the person to leave work if the work is expected to add to the dose 3. Conduct an investigation to determine the magnitude of the dose and to establish cause of the exposure 4. Identify and take action to prevent similar occurrence of the incident 5. Within 21 days after becoming aware of the dose limit has been exceeded, report to the CNSC the results or progress 6. Report the findings to the RSC and the worker
10 kBq[2]	1. Immediately notify the worker and the CNSC of the dose 2. Conduct an investigation to determine the magnitude of the dose and establish the cases of exposure 3. Identify and take any action to prevent the occurrence of a similar incident 4. Report the findings to the CNSC, RSC and worker

Notes:

[1]As reported by dosimetry
[2]As reported by thyroid screening

5.3 Signage

The following signs (see Table 10) will be posted depending on permit type.

Table 10 Signage Required by Permit Type

Signage Type	Permit Type							
	Open				Sealed			
	Basic or Higher	Deuterium Oxide	Non-Regulated	Storage	Sealed Source	Device	Non-Regulated	Storage
Permit Poster[1]	X	X[2]	X	X	X	X	X	X
Basic Level Poster[3]	X							
Door Label[1]	X				X	X		
Spills Procedures Poster[3]	X		X	X				
Portable Gauge Door Label[1]					X[4]	X[4]		
Responding to Accidents Involving Portable Gauges[3]					X[4]			

Notes:

[1]Internal university poster
[2]Permit poster is available online but not posted.
[3]CNSC provided poster
[4]For portable gauges only

5.4 Purchasing

5.4.1 Purchase Request

Purchase requests are made through Unit4 as per the instructions outlined in Procedure for Ordering Radioisotopes. Purchases cannot be made until the Permit Application Process (Figure 2) is complete.

5.4.1 Purchase Approval

Purchase requests made through Unit4 are forwarded to the RSO for approval. Approval is contingent on:

- Isotope must be on permit holders internal permit
- Package quantity can not exceed limits on the permit
- Sealed Sources above 1 EQ must be approved for use by the CNSC

- Requested isotope is listed on CNSC license and within limits
- Requested device/source is list on the CNSC license

If any of these items are not met, the purchase is denied until the items are met and a amendment must be requested by the permit holder.

5.5 Shipping and Transportation

5.5.1 Package Receipt

Upon receipt of an order containing radioactive isotopes at Central Stores (mail service), Central Stores employees have been instructed to call the RSO. The RSO will bring the material to the ESF. If the radioactive isotope is to be used at a laboratory not on main campus and requires specific transport packaging, the RSO will complete the leak tests in the laboratory (rather than ESF) to ensure that the package is unopened for transportation. The RSO will check the material for leakage/contamination. Sealed source leakage will be documented on a Package Contamination Form, and open source leakage will be documented on the appropriate Inventory Form. Open source inventory forms are to be used as follows:

- Inventory (Radioactive Isotopes) – Open sources regulated under the NRSD license but are not regulated as per Safeguards and Nuclear Material Accountancy agreements.
- Inventory (Safeguarded Solids) – Open sources regulated under both NSRD license requirements and Safeguards and Nuclear Material Accountancy agreements and are used in solid form.
- Inventory (Safeguarded Solutions) - Open sources regulated under both NSRD license requirements and Safeguards and Nuclear Material Accountancy agreements and are used in liquid form or dilutions.

If leakage is found then the CNSC is notified and the investigation is initiated. The package will remain secure in the ESF until the investigation is complete. If no leakage is found, the RSO will deliver the package and appropriate inventory form to the permit holder. A Package Receipt Record will be maintained by the RSO. All information will be entered into the UW Radiation database under the appropriate permit.

5.5.2 Transfer of Radioisotopes

Radioisotopes can only be transferred to other institutions/companies that have active CNSC licenses. Prior to transfer, the permit holder in cooperation with the RSO will complete the Report on Transfer documentation and Shipping documents.

For transfer of devices with more than 10 EQ the RSO will contact the CNSC in advance with the Report on Transfer, applicable CNSC licenses, approval from the other institution, and shipping documents to provide notification.

Transferring radioactive materials within the University can only occur once all permit requirements are met. This includes:

- Isotope must be on permit
- Individual is reported to the CNSC

Open source transfers shall be documented using the Package Receipt Record.

Alternatively, the Sealed Source Sign Out may be used when sealed sources (e.g. check sources) are moved between locations on a permit to track inventory.

5.5.3 Shipping

When shipping radioisotopes, all sources must be:

- Transported in an appropriate package (e.g. Type A) with necessary labels and placards as per the regulations
- Accompanied by TDG Shipment Form (including emergency instructions, description of source)
- Include wipe tests (for unsealed sources) reported on the Package Contamination Form.
- Valid driver certificate
- Copy of University of Waterloo Radioisotope License (unless shipping is being completed as part of a transfer and the material has been transferred to another license)
- Special Forms Certificate (for sealed sources)

When University staff/students are transporting radioisotopes:

- Driver must complete all necessary training
- Transport must occur in closed vehicle owned by the University of Waterloo with insurance specified for transporting of radioactive materials
- Transport documents must be kept on the seat beside the driver or int eh door pocket and one copy to stay with the radioactive materials
- The source should be stored as far as possible to the passengers to minimize dose
- If the driver stops during transport the transport documents must be left on the drivers seat with the source locked in the vehicle

The RSO will contact the CNSC if there is:

- A vehicle involved in an accident while transporting radioactive material

- Radioactive material has leaked from the package or means of containment during transport.

5.6 Work Practices

5.6.1 Time, Distance, Shielding

Radiation exposures should be reduced using the concepts of time, distance, and appropriate shielding. Review the Radiation Protection Manual for more information on these controls.

5.6.2 Personal Protective Equipment

When working with open sources of radiation the following clothing requirements must be met:

- Jewelry, especially rings, must be removed to prevent contamination. Jewelry that does get contaminated may not be able to be worn again.
- Long pants should be worn to provide splash protection to the lower limbs.
- Closed toed shoes must be worn for all lab work.

When working with open sources of radiation the minimum personal protective equipment always includes:

- Double gloves (disposable gloves are prone to fail, so double gloves are required).
- Lab coat
- Safety glasses with side shield
- Goggles

Face shield should be worn when splash risk is present.

Radioactive contaminated PPE such as gloves and lab coats are prohibited from being worn outside of the lab.

5.6.3 Contamination Monitoring

Method of radioactive contamination monitoring is determined by the RSO based on the isotope used and equipment sensitivity. All instruments used for contamination monitoring must be approved by the RSO prior to use. Prior to purchasing isotopes a method for contamination monitoring must be available for the isotope to be used. All laboratories unless otherwise approved by the RSO will complete wipe tests for their contamination monitoring. In addition, basic laboratories or higher must have a portable contamination meter where substances other than C-14 or H-3 are used for quick checks of contamination. Laboratories where only substances permitted under “Non-radioactive nuclear substance” as per (Table 3, pg. 10) will not require contamination monitoring.

5.6.3.1 Service and Checks

Non-portable instruments used for counting wipe tests such as liquid scintillation counters should be routinely serviced by the equipment owner as per manufacturer's instructions. Service records are to be maintained by the equipment owner. When applicable, instrument checks such as calibration standards should be run with each measurement.

5.6.3.2 Calibration

The RSO will maintain a list of all survey meters and non-portable instruments used for radiation contamination monitoring. Non-portable instruments will be calibrated as needed by the manufacturer with records maintained by the instrument owner. Survey meters will be calibrated by an external contractor with records maintained by the RSO. Contamination meters will either be calibrated by an external contractor or calibrated internally by the RSO with records maintained by the RSO. When calibrated internally, the contamination will be checked for efficiency, minimal detectable activity, uncertainty and operational checks by the RSO annually with records stored by the RSO. A sticker will be affixed to the meter with the efficiency and the MDA for the isotopes used in calibration. For contamination meters, the calculations as shown in Table 11 will be completed as part of the calibration process.

Table 11 Calibration Calculations

Item	Formula[1]
Absolute Efficiency[2]	$\frac{Detector\ Count\ Rate - Background\ Count\ Rate}{Known\ Activity\ of\ Standard\ Source}$
Minimal Detectable Activity (MDA)	$\frac{2.71 + \left(4.66\sqrt{NB\ x\frac{T}{60}}\right)}{E \times T \times A \times F}$
Uncertainty (2σ)[3]	$\frac{2.71 + \left(8.12\sqrt{NB\ x\frac{T}{60}}\right)}{E \times T \times A \times F}$

Note:
[1]Formulas as defined by REGDOC-2.7.1 Radiation Protection, Appendix C where
E = Instrument Efficiency
T = Counting Time or Detector Response Time
A = Area of Wipe (100 cm^2)
N = Total Count Rate in cpm
NB = Normal Background Count Rate
[2]Expressed as a percentage or decimal
[3]Where uncertainty is expressed on a pass fail in comparison against the calculated MDA and a contamination limit of 3 Bq/cm^2

5.6.3.3 Frequency

Contamination monitoring must be completed:

- At least weekly when working with radioisotopes
- After a spill or incident
- Before equipment, rooms or permits are decommissioned

5.6.3.4 Maximum Levels of Contamination

Contamination must be limited to the limits outlined for the appropriate isotope class as per REGDOC-1.6.1 License Application Guide: Nuclear Substances and Radiation Devices, Version 2, Appendix Y. For limits for unsealed sources see Table 12. UW follows the limits for public locations in both permit and non-permit locations.

Table 12 Contamination Monitoring Limits

Class	Isotope(s)	Limit
A	U-234 U-235 U-238 Natural Uranium	0.3 Bq/cm^2
B	Ba-133	3 Bq/cm^2
C	C-14 H-3 I-125	30 Bq/cm^2
Notes: limits as defined by REGDOC-1.6.1 License Application Guide: Nuclear Substances and Radiation Devices, Version 2, Appendix Y		

The Detector Factor if a precalculated factor of Ex60xAxF where:

- E is the instrument efficiency as determined during calibration
- A is the area of the wipe (100 cm^2)
- F is the efficiency of the wipe (10%), when required

All contamination monitoring should include a record of a blank and standard (when appropriate) with the results.

5.6.3.5 Monitoring Records

Monitoring records will be completed as per the Contamination Monitoring Form and stored by the Permit Holder. Monitoring records will be provided to the RSO when the vial is completed and sent for waste.

5.6.4 Work Areas

Proper work areas must be identified prior to purchasing open source isotopes. Contact the RSO before work to review the research plan. Contamination free plans include:

- Working on a tray with absorbent material rather than directly on the benchtop
- Working in a fume hood that is maintained yearly
- Working away from sinks
- Wipe testing freezers and fridges to test for contamination

Any work area that is potentially contaminated with radioactivity must be identified using radioactive tape. Additionally, storage areas including fridges and lockboxes should be identified with radioactive tape.

5.6.5 Labels

Original vials or any material removed from the original shipping vial and stored for more than one day must be labelled with at minimum isotope name, activity and lot number and radiation warning system. In addition, samples should also include date and either individual name or project name.

5.6.6 Access and Control

All opensource laboratories designated as Basic or higher and sealed source with sources higher than 1 EQ must be kept locked at all times when they are unoccupied. Open source isotopes are to be kept in the freezer/fridge in a locked container. When a laboratory is not in use radioactive sources are to be stored in containers. They must be sufficiently shielded to ensure that the radiation field 15 cm (6") from any accessible point on the outer surface of the container is less than 2.5 uSv/h.

5.6.7 Surface Decontamination

Decontamination is the process of removing residual radiation from surfaces. For personnel contamination refer to 5.7.3 .

Methods for cleaning the surfaces include washing, scrubbing and abrasion. Always progress from least aggressive to most aggressive. Never use methods such as grinding, sanding, scraping as it may cause the to become airborne. For cleaning contaminated surfaces, always use disposable materials such as paper towels or absorbent pads. To clean surfaces, decontamination products can vary based on the radioactive material. In most cases options include:

- 2 tablespoons of Alconox or Sparkleen dissolved in water to make a paste

- Fantastik

To decontaminate a surface:

1. Don the minimum PPE as outlined in 5.6.2 Personal Protective Equipment
2. If the contamination is on equipment, disassemble the equipment, if reasonably possible, to make ridges and joints more accessible.
3. Start at the edge and work your way inwards OR start at the area with the highest contamination readings. Complete one to two passes with the absorbent material and cleaning solution. Every one to two passes discard the absorbent material as radioactive solid waste.
4. Frequently monitor surfaces using a Geiger Counter or wipe tests. Some permits may require the use of wipe tests prior to decommission an item. Record results on the Contamination Monitoring Form.
5. Items that cannot be decontaminated must be labelled as radioactive and treated as such.
6. Once Geiger counter or wipe tests are within the limit for the isotopes class, remove your gloves, wash hands, and monitor yourself for contamination. For isotope class and, see REGDOC-1.6.1 License Application Guide: Nuclear Substances and Radiation Devices, Version 2, Appendix Y.

5.6.8 Leak Testing

To ensure that sealed sources are not leaking, leak tests will be performed on all sealed sources greater than 50 MBq by the RSO. Leak testing will be performed by a service provider that has the capability to detect 200 BQ of radioactive contamination or less.

Leak tests frequencies are identified in the table below.

Table 13 Frequency of Leak Tests

Type of Sealed Source	Frequency[1]
Immediately	After any incident that could result in damage OR After removal from 12 months of storage
6 months	Where the sealed source is not located inside of a radiation device.[2] OR All other sealed sources not otherwise listed and greater than 1 EQ
12 months	Where the sealed source is located inside of a radiation device.
24 months	Storage
Notes: [1]Frequency as defined by REGDOC-1.6.1, License Application Guide: Nuclear Substances and Radiation Devices, Version 2, Appendix AA. [2]Sealed sources contained in a static eliminator that has been retained by the licensee for less than 15 months are exempt	

Leak tests with more than 200 Bq of activity must be reported by the RSO to the CNSC immediately. The sealed source or device will be secured and taken out of service.

5.7 Emergency Procedures and Incident Reporting

Any situation, especially involving personal contamination, MUST be immediately reported to one of the RSO's on campus. During regular work hours, (8:30am to 4:30pm) RSO contact information is as follows:

Table 14 RSO Contact Information

Primary RSO:	Secondary RSO:
Katelyn Versteeg Phone: 37900 Email: radiation@uwaterloo.ca	Dhananjai Borwankar Phone: 36268 Email: radiation@uwaterloo.ca
Note: the RSOs can also be reached via Safety Office reception at ext. 33587. In all cases, never leave a message in an emergency, if you can't contact the RSO, contact UW Special Constables at 519-888-4911 or ext. 22222.	

If an incident occurs after hours, contact UW Special Constables at ext. 22222 and they will contact whichever RSO is available. No work shall resume after an incident until one of the RSOs has indicated the site is permitted to continue work.

The RSO will immediately report to the CNSC Duty Officer any incident as defined by the General Nuclear Safety and Control Regulations articles 29 and 30(1), Packaging and Transport of Nuclear Substances Regulation article 37 and the Radiation Protection Regulations article 16. The report will include the nature of the incident, location, and any action taken by the University or posed to be taken (see 5.11.2 Incidents).

Investigation reports will be provided to the CNSC within 21 days after the University was made aware of the incident.

5.7.1 Loss, Theft or Attempted Break-In

Individuals should immediately report the loss, theft, or attempted break-in to the RSO. The RSO will file a report with the CNSC and begin an investigation.

5.7.2 Spills

Spill response requires sufficient spill preparation. Labs with open isotopes must have the minimum spill kit as per the Hazardous Materials Spills documents. Additionally, radiation spill kits should contain a wax pencil and a supply of contamination monitoring materials as determined for your permit with the RSO.

If there is any reason to believe there is risk of airborne radioisotopes, if possible, cut off the source of contaminations, and call Plant Operations to place the building on 100% fresh air (ext. 33793).

General Precautions:

1. When a spill has occurred, inform the persons in the area that a spill has occurred and clear the room to keep them away from the contaminated area.
2. Cover the spill with absorbent material to prevent the spread of contamination.
3. For spills involving more than 1 EQ (Table 4, pg. 11), personnel contamination, or volatile compounds, contact the RSO prior to cleaning up the spill.

Spill Response Steps:

1. Proceed if you feel comfortable with cleaning up the spill, if not, contact the RSO for help.
2. Put on two pairs of disposal gloves, lab coat and respiratory protection if the substance is volatile or aerosol generation is suspected.
3. Mark the location of the spill with a wax pencil and begin spill clean up.
4. To clean the spill, start by picking up the loose material from the spill:
    a. If the spill is wet: place absorbent material on the spill and avoid rubbing or spreading the material. Place the contaminated material in the radioactive solid waste.
    b. If the spill is powder, wet the powder with water or organic solvent and place the absorbent material on wetted material. Place the contaminated material in the radioactive solid waste.
5. To decontaminate the remaining area, mix a cleaning solution (see 5.6.7 Surface Decontamination) and working from the outside in, wash the area in batches of 1-2, trading out the absorbent material every batch to prevent extra contamination.

Between batches, complete contamination monitoring to evaluate the extent of the spill.

6. If an individual was contaminated, in consultation with the RSO, follow the 5.7.3 Personnel Contamination procedures.
7. When decontamination is complete, confirm the decontamination with wipe tests (if required as per your permit) and document the results. Check personnel involved in the spill clean up for contamination including hands, clothing and shoes.
8. If the spill cannot be cleaned-up, contact the RSO.
9. Report the spill and clean up to the permit holder and the RSO within 24 hours. Record names of all individuals or witnesses of the spill. Note details of personal contamination.
10. Record spill details and results of contamination monitoring in the Contamination Monitoring Form. Adjust inventory records.
11. Submit an Incident Report to the RSO within 24 hours of the incident.

The RSO will contact the CNSC immediately and file a report within 21 days if the major spills involved more than 100 EQ, significant personnel contamination, release of volatile material, or unplanned release into the environment.

5.7.3 Personnel Contamination

Personal contamination is either external (usually a splash or spill) or internal (accidental ingestion or injection). When personnel contamination occurs, immediately contact the RSO and follow the instructions as outlined in

Table 15. Following the incident, submit an Incident Report to the Safety Office and the RSO within 24 hours of the incident.

Table 15 Personnel Contamination

External (Skin)	External (Orifices)
▪ Use mild soap and warm water. DO NOT use hot or cold water. Hot water opens pores and increases blood flow (increased absorption). Cold water may not be effective. ▪ Rub for 2 to 3 minutes. RUB DO NOT SCRUB – scrubbing may cause abrasions in skin (potentially causing internal contamination). Work from center of body outward ▪ If hands are contaminated, pay special attention to fingernails. ▪ Monitor body. Repeat washing if contamination is still present.	▪ Eyes – Rinse at an eyewash station for 15 minutes. ▪ Mouth – Rinse mouth with water but DO NOT SWALLOW. ▪ Nose – Blow nose and keep tissue for further monitoring. The nose filters can filter much of the particulate and aerosols that are inhaled. ▪ Ear – Tilt head and allow liquid to drain out on a tissue. Keep for monitoring.
Contaminated Wounds	**Contaminated Clothing**
▪ Remove gloves and turn inside out. Save item that cause the wound. Gloves and item will be used for contamination monitoring. ▪ Allow wound to bleed. Flush gently with water. ▪ Bandage and cover wound.	▪ Put on a clean pair of gloves. Carefully remove all contaminated clothing and turn inside out as you remove. ▪ This will help to prevent further spread of contamination. ▪ After removal, monitor all exposed skin areas. ▪ Bag contaminated clothing and provide to RSO for further action.

For individuals working with I-125, it is particularly imperative to notify the RSO immediately of any personal contamination. Personal contamination of I-125 requires thyroid screening to be completed on the contaminated individual within 24 hours (see 5.2.2 Bioassay).

5.7.4 Sealed Source Leaks

If sealed source leaks occur or are suspected to occur such as if a sealed source does not return (e.g. logging source is stuck in borehole) to its sealed location in the device:

1. Discontinue using the sealed source and or the device
2. Take measures to limit the spread of radiation contamination such as:

a. Cordoning off the room
b. Use tong or forceps to place the source in temporary shielded container
c. Testing for personnel contamination

3. If personnel contamination occurs, follow the emergency procedures as outlined in 5.7.3 Personnel Contamination5.7.3 .
4. If a spill occurs, follow the emergency procedures as outlined in 5.7.2 Spills.

Upon controlling of the leak, the leak will be reported to the CNSC by the RSO.

5.8 Amending a Permit

Follow the steps below to amend a permit.

1. Make a list of the radioisotopes you wish to add to or remove from the permit.
2. If adding isotopes, identify what activity you would like to perform with each of the additional isotopes.
3. Contact the RSO and provide the isotopes and the activities to them.
4. Depending on the breadth of the amendment, the RSO may require a new permit application.

5.9 Decommissioning

When an open source permit holder wants to decommission their permit or a room of their permit, they should contact the RSO.

In cooperation with permit holder, the RSO will:

1. Remove all radioactive sources
2. Remove all radioactive waste containers
3. Remove all signs and labels indicating radioactivity from the lab
4. Confirm that any contamination levels are below the public contamination level for the class of nuclear substance.
5. Remove all inventories and monitoring records to be stored by the RSO
6. Complete a Decommissioning Report and a Contamination Monitoring Form and circulate the results to the permit holder and the RSC
7. Contact the CNSC within 7 days of discontinuing licensed activities at a location

5.10 Radioactive Waste

5.10.1 Open Sources

Within the lab, open source waste is categorized as liquid or solid waste. All waste should be segregated by isotope. Waste containers

Scintillation cocktail vials will be treated as chemical waste and disposed of as per the Hazardous Waste Standard.

When the original vial is no longer needed it will be provided to the ESF along with the inventory form and Contamination Monitoring Forms. The following information will be added to the inventory form.

- Date of Disposal
- Waste Container Number

The vial will be marked for disposal in the UW Radiation Database. Records of disposal, inventory and contamination monitoring results will be maintained by the RSO.

Open source waste will be disposed of as either sewage municipal garbage, municipal sewer, atmosphere, or to an approved CNSC carrier in line with the disposal limits (Table 16).

Table 16 Disposal Limits

Nuclear Substance	Solids to Municipal Garbage System (qty/kg)	Liquids (water soluble) to Municipal Sewer System (qty/year)	Gases to Atmosphere (qty/m^3)
Ba-133	0.037 MBq	1 MBq	n/a
C-14	3.7 MBq	10000 MBq	n/a
H-3	37 MBq	1 TBq	37 kBq
I-125	0.037 MBq	100 MBq	n/a
Natural Uranium	0.01 MBq	1.4 kg	n/a
Notes: Limits are defined in the Appendix of the University's Radiation License as provided by the CNSC. In the case of Natural Uranium, kg refers to the weight of the uranium, rather than the weight of the solution.			

Open source disposal to the municipal garbage system will be documented and records maintained by the RSO. Records will include at a minimum: drum number, isotope, and either substance weight or activity, as provided by the CNSC provided disposal limits.

5.10.2 Sealed Sources and Devices

When sealed sources and devices are no longer needed the permit holder should contact the RSO to determine best course for disposal. For disposal of sealed sources and

devices the radioactive source must either be removed and sent to an approved carrier or the entire device/source must be returned to the manufacturer or approved carrier.

Table 17 Documentation of Sealed Source Disposal

Disposal Method	Documentation System
Returned to Manufacturer	Report on Transfer
Source Removed by RSO	Report on Device Decommissioning
Disposed of Via Carrier (either source or device)	Copy of Transport Documents
Notes: Sealed source disposal is also documented via the UW ESF Database along with other hazardous wastes including the date of disposal and method of disposal.	

When decommissioning devices the RSO will use the following procedure for removing sources:

1. Prior to decommissioning device ensure any chemical or biological hazardous material has been removed
2. Wear appropriate PPE including:
    a. Long pants
    b. Laboratory coats
    c. Close toed shoes
    d. Gloves
    e. Goggles or Safety Glasses
    f. Dosimeter
3. To remove the source, remove all loose materials from the equipment using the appropriate tools
4. Use a Geiger counter to identify the source
5. Remove the source from the instrument. If the source is kept in a lead container, remove the source with the lead when possible.
6. After source is removed, check equipment for signs of contamination (Geiger counter for solid sources, wipe test for liquid sources)
7. If no source is present, remove all radioactive labels from the equipment.
8. Dispose of sealed source through the hazardous waste stream and the equipment through regular asset disposal.
9. Complete and store the Report on Device Decommissioning

If all sealed sources have been removed from the permit, this permit is considered to be decommissioned and the RSO will notify the RSC of the decommissioning.

5.11 Reporting

The RSO will immediately contact the CNSC (or within the specified timeline) in the event of the following reportable activities.

5.11.1 Permit Management

- Within 7 days of commencing work at a new location where licensed activities are to be conducted for more than 90 days
- Within 7 days of discontinuing licensed activities at a location
- Transfer of equipment containing a nuclear substance in excess of 10 exemption quantities to another license holder.
- Prior to purchasing equipment containing a nuclear substance in excess of 10 exemption quantities not listed on the Nuclear Substance and Radiation Devices Licence issued to UW.

5.11.2 Incidents

Equipment

- Any operation to recover a sealed source stuck in a borehole
- Leak test on a sealed source detects leakage in excess of 200Bq of a nuclear substance.
- Accidental removal of the sealed source from the equipment

Transportation

- A vehicle involved in an accident while transporting a radioactive material
- A package shows evidence of damage or tampering
- Radioactive material has leaked from the package or means of containment during transport

Injury or Exposure

- Any dose received by a worker in excess of the radiation dose limits prescribed by the Radiation Protection Regulations.
- Unplanned exposures to workers that may exceed the radiation dose limits prescribed by the Radiation Protection Regulations.
- Unplanned release of a nuclear substance into the environment.
- Serious injury as a result of the licensed activity.

Security

- Theft or loss of a nuclear substance.
- Attempt or breach of security where nuclear substances are used or stored.
- Actual or planned work disruption by workers.

5.11.3 Records

- Prior to disposal of records

6.0 Record Keeping

Records will be maintained as per the CNSC's Record Retention Period Summary and be available to the CNSC and RSC upon request. The RSO will contact the CNSC for permission prior to disposing of any records.

7.0 Compliance

7.1 Inspection Protocol for Open Source Laboratories

Open source radiation permits will be inspected every term (approximately every four months) by the RSO or designate. The results of these inspections are available for the RSC for review.

The following items will be included in an open source inspection:

- Signage
- Worker Training
- Contamination Monitoring
- Work Practices
- Fume Hood / Infrastructure
- Inventory Control and Security

Non-radioactive sources such as deuterium oxide will not follow the open source inspection process and instead will be inspected on a yearly basis for inventory control and security.

7.2 Inspection Protocol for Sealed Source Laboratories

Sealed source radiation permits will be inspected every year by the RSO or designate. The results of these inspections are available for the RSC for review.

The following items will be included in a sealed source inspection:

1. Signage
2. Worker Training
3. Leak Tests (as required)
4. Security
5. Transportation Documents (as required)

7.3 Non-Compliance

Infractions will be dealt with in the following ways:

1. The RSO may stop unsafe work at any time.
2. For minor infractions:
    a. First infraction by a worker will result in notification by the RSO of the infraction to the Permit Holder and a verbal warning to the worker/student.
    b. With a repetition of the infraction, the RSO notifies the Permit Holder and worker of the consequences of a third infraction and instructs the worker to undergo retraining prior to resuming work with radioisotopes.
    c. With a third infraction, the RSO will ask the Permit Holder to prohibit the worker/student from working with radioisotopes for a period of time to be determined by the Radiation Safety Committee or alternatively the Permit Holder and all workers/students working with radioisotopes may undergo retraining.
3. Refusal of the Permit Holder to enforce these penalties will result in removal of the Radioisotope Permit by the Safety Office in consultation with the Radiation Safety Committee and, if need be, Department Chair.

7.4 Renewal of Permits

During the schedule inspections by the RSO the permit will be renewed. The RSO may contact the permit holder to confirm whether or not wish to keep the permit active (in use).

7.5 Program Reviews

The radiation program will be reviewed through CNSC inspections, CNSC Annual Compliance Report, RSC review, and annual program updates.

7.5.1 CNSC Inspections

CNSC inspection items will be sent to the RSC for review and comment. The RSO will ensure that all inspection items of non-compliance are corrected with the input of the RSC. The RSO will reply to the CNSC within the allotted time as specified by the inspection.

7.5.2 CNSC Annual Compliance Report

The CNSC Annual Compliance Report will be completed by the RSO and sent to the CNSC by the specified date for the license. The Annual Compliance Report is available for the RSC to review.

7.5.3 RSC Review

Inspection reports are made available for the RSC for review and comment.

7.5.4 Program Updates

The Radiation Safety Program will be updated and reviewed annually.

8.0 Training

Prior to working with radioactive sources, all individuals must be at least 18 years of age and receive the training as outlined by their worker authorizations (below).

In addition to the training outlined below, the permit holder or a competent designate should provide additional laboratory specific practical radiation safety training. It should encompass the specific procedures used in the laboratory for the handling, use, and disposal of radioactive material. It should also include training on emergency procedures, the use of the emergency equipment, and reporting protocols used in the laboratory.

It is the responsibility of the permit holder to track and document the training they provide to their workers and students. The Site Specific Training Form is available for permit holders to use as a template for tracking practical training.

8.1 Open Source Workers

Open source workers are defined as individuals who have been trained in the safe use of open source radioisotopes under the supervision of a permit holder.

Training includes:

1. Working with Radiation – Open Sources (SO2030-O) Online Course
2. WHMIS 2015 Online Course
3. Practical Training with the RSO including:
    a. Ordering, inventory, storage, and handling of radioisotopes
    b. Radioactive monitoring including personal dose, contamination, and survey monitoring
    c. Emergency procedures

Once training is completed, workers will be added to the associated radioactive permit. Refresher training is required every three years.

Note that training and worker authorization is not required for non-radioactive nuclear substances such as deuterium oxide.

8.2 Sealed Source Workers

Sealed source workers training requirements are divided based on the permit subtype and the associated risk.

8.2.1 Sealed Source and Devices

Permits designated as “Sealed Source” or “Devices” unless otherwise indicated in their training exemption and required to complete training including:

1. Working with Radiation – Sealed Sources (SO2030-S) Online Course
2. Practical Training with the RSO including:
    a. Operation and handling of the source
    b. Short and long term storage
    c. Responding to emergencies

Individuals who will be transporting their sources (e.g. Neutron Probes) will also need to take.

1. Transportation of Dangerous Goods Class 7 Online Course (provided externally)
2. An additional Practical Training component with the RSO on transportation.

Once training is completed, authorized workers will be added to the associated radioactive permit. Refresher training is required every three years.

8.2.2 Training Exemptions – Check Sources and Antistatic Devices

Check sources and antistatic devices may be provided with a practical training exemption if they are low risk and low activity.

Remaining training includes:

1. Working with Radiation – Sealed Sources (SO2030-S) Online Course

Once training is completed, authorized workers will be added to the associated radioactive permit. Refresher training is required every three years.

8.2.3 Training Exemptions – Low-Risk Devices

Some devices are exempt from radiation training when their risk of radiation exposure is low (e.g. liquid scintillation counters and gas chromatographs). Training exemptions are determined by the RSO and documented on the radiation permit.

8.2.4 Training Exemptions – Courses

When radiation is used in teaching labs, alternative training arrangements may be made for students in consultation with the RSO. Still, the course instructor and TA’s must take any radiation training required by the radiation safety program.

8.3 Laboratory Support Workers

Laboratory support workers are individuals who will not be working with radioisotopes but support laboratories with radioisotopes. This includes all service and custodial staff. Training will be provided each term by the Safety Office with recommended refresher training of 3 years.

9.0 Resources

9.1 Forms

Roles and Responsibilities

- Health and Safety Management System

Permitting Materials

- Permit Application
- Safe Operating Procedure Template
- Design Assessment Form for Nuclear Substance Laboratories and Nuclear Medicine Rooms
- Landlord Owner Acknowledgement Form
- Nuclear Substance and Prescribed Equipment Notification

Purchasing, Shipping, Transportation and Transfer

- Procedure for Ordering Radioisotopes
- Inventory (Radioactive Isotopes)
- Inventory (Safeguarded Solids)
- Inventory (Safeguarded Solutions)
- Package Contamination Form
- Package Receipt Record
- Report on Transfer
- TDG Shipment Form
- Sealed Source Sign Out

Work Practices

- Radiation Protection Manual
- Contamination Monitoring Form
- Equipment Detection Factors

Emergencies

- Incident Report
- Hazardous Material Spills
- Contamination Monitoring Form

Decommissioning

- Decommissioning Report
- Contamination Monitoring Form

Radioactive Waste

- Hazardous Waste Standard
- Report on Transfer
- Report on Device Decommissioning
- Asset Disposal

Training Materials

- Radiation Protection Manual
- Worker Dosimetry Guidelines
- Site Specific Training Form
- WHMIS 2015 Online Training
- Working with Radiation – Open Sources (SO2030-O)
- Working with Radiation – Sealed Sources (SO2030-S)

9.2 Legislation

- Nuclear Safety and Control Act
- General Nuclear Safety and Control Regulations
- Nuclear Substances and Devices Regulations
- Nuclear Non-proliferation Import and Export Control Regulations
- Packaging and Transport of Nuclear Substances Regulations
- Radiation Protection Regulations

9.3 CNSC Resources, Regulatory Documents and Guidelines

- Certification of Radiation Devices
- GD-52: Design Guide for Nuclear Substance Laboratories and Nuclear Medicine Rooms
- Record Retention Period Summary
- REGDOC-1.6.1, License Application Guide: Nuclear Substances and Radiation Devices, Version 2
- REGDOC-2.7.1, Radiation Protection
- REGDOC-2.7.2, Dosimetry, Volume I: Ascertaining Occupational Dose
- Sealed Source Tracking

10.0 Record of Revisions

Date	Author/Editor	Change	Version
December 2024	Katelyn Versteeg	• Inventory forms added for safeguarded materials • Natural uranium added, P-32 removed • Open Source Disposal form and Calibration SharePoint removed. Reporting described.	Radiation Safety Program V.5.3 D**EC**2024
May 2024	Katelyn Versteeg	• Retitled to Radiation Safety Program	Radiation Safety Program V.5.2 MAY2024
March 2024	Katelyn Versteeg	• Minor revisions to contamination monitoring	Radiation Safety Program V.5.1 MAR2024
February 2024	Katelyn Versteeg	• Major update to move radiation license appendices into Radiation Safety Program	Radiation Safety Program V.5.0 FEB2024
January 2023	Katelyn Versteeg	• Section 7.0 New training introduced • Section 9.2 Table 4 Updated to RSO of Katelyn Versteeg and Dhananjai Borwankar • Section 9.5 Thyroid Screening for 1-25 personnel contamination added • Appendix A – irrelevant exemption quantities removed	Radiation Safety Program V.4.0 JAN2023
January 2022	Katelyn Versteeg	• Section 4 Added links to legislation • Section 7.0 New links in training added details on laboratory training • Section 8.0 addition of SOPs for permit application requiring permits • Section 9.1 Work practices condensed • Removal of Section 9.1.5 Time Distance Shielding and Appendix E and moved to resource document Radiation Protection Manual. • Appendix B minor reformatting • Appendix D Contamination Forms removed and moved to Website	Radiation Safety Program V.3.0 JAN2022
September 2020	Greg Friday	• Added an "Introduction" section that introduces ALARA • Added an ALARA Appendix	Radiation Safety Program v.2.0 SEP2020
September 2019	Dhananjai Borwankar and Greg Friday	• Training moved to LEARN • Added section 12.0 Record of Revisions	Radiation Safety Program v.1.0 SEP2019