Radiation Safety Code of Practice and Procedures Manual

May 4, 2021

University of Saskatchewan

Contents

1 Purpose

In accordance with the *Radiation Safety Policy*, the *Radiation Safety Code of Practice* and Procedures Manual is the governing document in the administration of the Radiation Safety Program at the University of Saskatchewan.

The *Radiation Safety Code of Practice and Procedures Manual* specifies the minimum requirements, roles and responsibilities for individuals working with nuclear substance and radiation devices for academics, research, or other activities.

2 Scope

Under the *Radiation Safety Policy*, individuals working with nuclear substance or radiation devices must meet all legislative requirements and must adhere to the administrative procedures and operational rules for their possession, use, storage, transportation, and disposal as set forth in the university's *Radiation Safety Code of Practice* and Procedures Manual and supporting documentation.

The *Radiation Safety Code of Practice and Procedures Manual* applies to all university employees, students, contractors, and visitors.

3 ALARA Principle

The University of Saskatchewan is committed to keeping occupational radiation exposures As Low As Reasonably Achievable (ALARA), social and economic factors being taken into account.

The implementation of management control over work practices, personnel qualification, training, and awareness is necessary to keep the amount of exposure to dose received by individuals as low as reasonably achievable.

The ALARA Principle is the foundation of the Radiation Safety Program.

4 Equipment Registration

The following ionizing and non-ionizing radiation equipment shall be registered with Safety Resources, but do not require a nuclear substance permit.

- X-ray generating equipment;
- Lasers (Class 3b and 4 only);
- Ultrasound equipment;
- Gas chromatographs that contain radioactive sources;
- Liquid Scintillation Counters;
- Magnetic Resonance Imaging equipment.

Select equipment such as X-ray and ultrasound equipment will also require registration with the Radiation Safety Unit of the Ministry of Labour Relations and Workplace Safety. Safety

Resources shall assist the responsible party with the registration of such equipment and with meeting associated regulatory requirements.

Contact the Radiation Safety Officer for operational and safety requirements for ionizing and non-ionizing radiation equipment.

5 X-ray Equipment

Operators of x-ray equipment are responsible for complying with The Saskatchewan Employment Act, The Radiation Health and Safety Regulations, and the owner's manual instructions regarding the use of the x-ray producing equipment.

All x-ray generating equipment must be registered with Safety Resources before use. Safety Resources will notify the Saskatchewan Radiation Safety Unit as required in the regulations.

In cooperation with the Safety Resources, all operators of x-ray equipment must develop a plan for:

- Hazard signage;
- Worker training;
- Equipment inspections and maintenance;
- Dosimetry (as needed).

The ALARA principle should be adhered to when developing x-ray installations and procedures. Records of worker training and equipment maintenance must be maintained by the operator.

X-ray equipment intended to be used on humans or animals has additional regulatory requirements that must be met in addition to internal authorizations.

Safety Resources may inspect x-ray installations with respect to compliance with the listed requirements and may suspend operations if, in their opinion, the above requirements are not being met.

6 Laser Equipment

Operators of laser equipment are responsible for complying with The Saskatchewan Employment Act, The Radiation Health and Safety Regulations, and as applicable the owner's manual instructions regarding the use of the laser.

Lasers of class 3B or 4 must be registered with Safety Resources before use.

National Standards Institute (ANSI) Z136.1-2000, Safe Use of Lasers and American National Standards Institute (ANSI) Z136.3-2004, Safe Use of Lasers in Health Care Facilities outline the requirements for how laser must be installed, operated, labelled, and maintained.

Medical lasers may only be used under the direct supervision of a qualified practitioner as listed in The Radiation Health and Safety Regulations. Non-medical lasers (classes 3B or 4) require an operator that:

- has been formally trained to carry out the procedures for which that laser or laser device is to be used; and
- can demonstrate to the satisfaction of an officer his or her knowledge of the equipment, the biological effects associated with its use, and the necessary safety procedures.

6.1 Laser Safety Officers

For every class 3B or 4 laser the department or principal investigator must appoint a Laser Safety Officer (LSO). The LSO is an individual designated by the employer with the knowledge, authority, and responsibility to evaluate laser hazards and enforce the control of such hazards.
From ANSI Z136.4-2007, the specific duties of the LSO include:

- Establishing a safety plan;
- Classification of laser systems;
- Hazards evaluation;
- Implementing control measures;
- Procedure approvals;
- Ensuring protective equipment is available;
- Safety signage and labels;
- Training operators;
- Medical surveillance (requesting pre-employment eye exams when suitable);
- Inspecting the laser installations; and
- Maintaining records relevant to the above duties.

Safety Resources will support the appointed LSOs as required to help ensure a safe workplace.

6.2 Laser Safety Training

Safety Resources will provide access to online basic laser safety awareness training. LSOs must determine what additional training is relevant for their operators given the identified hazards. LSOs must maintain records of operator training.

7 Nuclear Substance Program Roles and Responsibilities

7.1 Radiation Safety Advisory Committee

The Radiation Safety Advisory Committee (RSAC) is responsible for monitoring the university's Radiation Safety Program and for providing advice and guidance on policy, procedures, and guidelines in support of radiation safety and legislative compliance. The RSAC also participates in investigations of serious incidents involving nuclear substances and radiation devices, and serious infractions under the *Radiation Safety Code of Practice and Procedures Manual* or current legislation.

The subcommittee of the RSAC, the Radiation Safety Protocol Approval Committee (RSPAC), is authorized to review and approve protocols involving nuclear substances and radiation devices in accordance with the *Radiation Safety Code of Practice and Procedures Manual*.

The composition and specific responsibilities of the RSAC and RSPAC are outlined in their respective terms of reference.

7.2 Safety Resources

Safety Resources manages and supports health and safety programming, and works with staff, students, contractors, and visitors promoting safety consciousness and a focus on injury prevention.

Under the *Radiation Safety Policy*, Safety Resources is responsible for administering and delivering radiation safety programming for the university in accordance with the *Radiation Safety Code of Practice and Procedures Manual*, current legislation, and best practices. Safety Resources is also responsible for supporting the activities of the RSAC and the RSPAC.

Safety Resources shall conduct formal and/or informal inspections of facilities and activities to ensure compliance with the *Radiation Safety Code of Practice and Procedures Manual*, legislative, and granting agency requirements at a frequency commensurate with the identified risks.

The University's Radiation Safety Officer (RSO) administers the radiation safety program and is an expert resource to the university community on radiation safety. The RSO oversees radiation safety personnel in support of the program and manages the university's licences with the CNSC. The RSO also acts as a resource for the RSAC and RSPAC, and is the primary liaison with provincial and federal agencies, and research granting agencies, as relating to radiation safety. The RSO has the authority to shut down any process or laboratory that he or she considers to be in violation of University policy or applicable government regulations.

7.3 Nuclear Substance Permit Holders

The permit holder is ultimately responsible for ensuring the safe use, storage, and disposal of nuclear substances listed and radiation devices under their nuclear substance permit. The specific responsibilities of a permit holder are outlined below.

7.3.1 Safety Management

It is the responsibility of the permit holder to provide competent supervision of all Authorized Radiation Workers and work activities under the nuclear substance permit. In providing competent supervision, the permit holder shall:

- Comply with legislative and granting agency requirements;
- Comply with university health, safety and environmental protection requirements;

- Comply with requirements set forth in the *Radiation Safety Code of Practice and Procedures Manual*;
- Comply with all nuclear substance permit conditions;
- Implement appropriate safety measures appropriate for the identified risks in accordance with the ALARA Principle;
- Ensure facilities are maintained in accordance with university, and regulatory requirements;
- Ensure instruments and equipment are properly maintained and tested in accordance with university, regulatory requirements, and/or manufacturer specifications;
- Ensure staff and students adhere to procedures, rules and health and safety program requirements for the safe use of nuclear substances and radiation devices;
- Monitor and review work locations and activities and take appropriate action to rectify areas of non-compliance, unsafe acts, or conditions; and
- Cooperate with Safety Resources and any other person exercising duties imposed by university policies or regulatory agencies.

7.3.2 Training

- The permit holder shall inform Authorized Radiation Workers of the specific workplace hazards and ensure that all Authorized Radiation Workers receive appropriate health and safety training.
- As foundational training, all Authorized Radiation Workers are required to take university radiation safety training or possess equivalent training as approved by Safety Resources. U of S radiation safety training is valid for 3yrs. Additional safety training may be required depending on the activities they are engaged in. The permit holder is responsible for identifying what additional training may be required.

7.3.3 Security

- The permit holder shall implement and maintain security measures appropriate for the nuclear substance and/or radiation device in possession, and legislative requirements.

7.3.4 Disposal of Hazardous Materials

- The permit holder shall ensure that all hazardous waste generated under the nuclear substance permit is disposed of in accordance with the *Hazardous Waste Disposal Standard* (http://safetyresources.usask.ca).

7.3.5 Emergency Response

- The permit holder shall develop and implement emergency response measures appropriate for the identified risk of the nuclear substances, radiation devices and activities under the nuclear substance permit and legislative requirements. As appropriate, emergency response measures address:

    - Medical emergencies which include injuries and confirmed or suspected illness from exposure to hazardous materials;
    - Spills of hazardous materials;
    - Containment equipment failures;
    - Loss or theft of hazardous materials;
    - Power outages; and
    - Fire.

- Existing University response plans such as those listed in Section 12 and local Emergency response Plans (ERPs) will be sufficient in most cases, however the permit holder must consider any additional risks that are unique to their situation.

- The permit holder shall immediately report to Safety Resources all incidents including confirmed or suspected illnesses resulting from exposures to hazardous materials, spills, containment equipment malfunctions, or loss or suspected theft of permitted materials.

7.3.6 Decommissioning of Permitted Facilities

- When a nuclear substance permit is to be cancelled or will not be renewed, the permit holder is responsible for decommissioning all work and storage areas listed under the nuclear substance permit.

- All decommissioning must be completed prior to the permit expiry/cancellation date in accordance with the University of Saskatchewan *Facility Decommissioning Standard* (http://safetyresources.usask.ca).

- The Radiation Safety Officer shall advise permit holders on the proper decontamination of work areas and equipment and shall confirm that facilities are decontaminated to accepted levels. Safety Resources shall support the removal and disposal of hazardous materials including biological, chemical, and radioactive.

7.3.7 Records

It is the responsibility of the permit holder to maintain all records associated with a nuclear substance permit. This includes, but is not limited to:

- A copy of the current nuclear substance permit;
- Approved Work procedures;
- Contamination monitoring records;

- Up-to-date inventory records of nuclear substances and radiation devices;
- Procurement records for nuclear substances and radiation devices;
- Transport (TDG) records for radiation devices;
- Equipment maintenance and certification records;
- Disposal of waste records; and
- Decommissioning records.

Nuclear substance permit records may only be disposed of in consultation with the Radiation Safety Officer, and in accordance with applicable regulations.

Safety Resources shall maintain copies of records associated with all nuclear substance permits at the university.

7.4 Authorized Radiation Workers

Authorized Radiation Workers are responsible to:

- Commit to the ALARA Principle;
- Conduct work in a safe and responsible manner to protect the individual's health and safety, as well as others that may be affected by the individual's acts or negligence;
- Comply with legislative and granting agency requirements;
- Comply with university health, safety and environmental protection requirements;
- Meet with requirements set forth in the *Radiation Safety Code of Practice and Procedures Manual*;
- Immediately report to the permit holder all incidents including, spills, containment equipment malfunctions, loss or theft of radioactive materials;
- Cooperate with Safety Resources and any other person exercising duties imposed by university policies or regulatory agencies.
- Comply with all nuclear substance permit conditions;
- Follow rules and procedures under the nuclear substance permit; and
- Immediately report to the permit holder any deviations from or changes to the nuclear substance permit and the associated procedures.

Nuclear Energy Workers (NEWs), a designated subgroup of Authorized Radiation Workers are also responsible to:

- Strongly encouraged to inform the Radiation Safety Officer if they become pregnant or are breastfeeding.

8 Compliance Enforcement

Safety Resources is authorized to conduct inspections and audits of facilities and activities to ensure compliance with the *Radiation Safety Code of Practice and Procedures Manual*, regulatory, and granting agency requirements. The permit holder is responsible for rectifying deficiencies identified during said inspections and audits.

The frequency and scope of lab inspections will vary based on risk factors such as lab level, recent purchases, identified hazards, and previous findings. High and containment level labs can expect to be inspected at least annually, whereas lower level labs may have a decreased frequency at the discretion of the RSO. Inspections may be arranged in advance when worker participation is required or may take place as an informal drop-in to confirm contamination monitoring results, for example. The CNSC may also conduct inspections at the site of licenced activities, the RSO will accompany the CNSC inspectors to each location.

In accordance with Compliance Enforcement Pertaining to Hazardous Agents Policy, the University of Saskatchewan will take specific and prompt action in order to enforce compliance with the terms and conditions of various licenses issued to the university, and also with the applicable federal and provincial statutes pertaining to the use, handling, storage, and disposal of hazardous agents.

Individuals failing to adhere to the requirements contained within the *Radiation Safety Code of Practice and Procedures Manual*, university policies and legislative requirements, are subject to compliance enforcement up to and including suspension of privileges to work with nuclear substances or radiation devices at the university.

When, in the opinion of Safety Resources, there is unacceptable risk to employees, the public, the environment, or university property, Safety Resources is authorized to take appropriate action which may include the immediate suspension of research activity, prohibited entry to a laboratory, and/or the removal of hazardous material from the premises.

Compliance enforcement related to nuclear substance permits shall be carried out in consultation with the Radiation Safety Advisory Committee (RSAC).

Safety Resources may notify the Research Services and Ethics Office, regulatory agencies, and research granting agencies of compliance issues in accordance with their respective reporting requirements. Safety Resources will maintain records relating to inspections.

Administrative Monetary Penalties (AMPs) may be imposed by the CNSC without court involvement, for the violation of a regulatory requirement. AMPs can be applied against any individual or corporation subject to the *Nuclear Safety and Control Act*.

9 Nuclear Substance Permits

9.1 Nuclear Substances and Radiation Devices Requiring a Permit

The University of Saskatchewan requires that all groups intending to possess, use, store, transport or dispose of any sealed or unsealed nuclear substance or radiation device obtain a nuclear substance permit. The Principal Investigator is assigned the role of Permit Holder, staff and students working under their supervision are listed as Authorized Radiation Workers (ARWs) under the same permit.

9.2 Nuclear Substance Permit Application and Approval

To Apply for a Permit:

1. Complete the Application Information section of the *Nuclear Substance Permit Application Form*.

2. Prepare a list of requested radionuclide(s) including the radiochemical form and maximum amount required in possession at one time.

3. Prepare a brief abstract followed by a generalized workflow showing the maximum activities handled and the waste streams anticipated.

4. Prepare a list of the areas, rooms, and enclosures where the nuclear substance or radiation device will be used or stored.

5. Prepare a list of the equipment used to monitor for contamination or radiation exposure. Include the type of the equipment (e.g. contamination meter, liquid scintillation counter), manufacturer and model number. If acquiring new monitoring equipment contact the Radiation Safety Officer before purchasing the selected equipment.

6. Prepare a list of individuals, who will be working on the research protocol and with the permitted materials.

   All individuals to be listed on the nuclear substance permit must have completed U of S Radiation Safety Training or possess equivalent training, as approved by Safety Resources.

7. Submit the *Nuclear Substance Permit Application Form* and supporting documentation to the Radiation Safety Officer. Where practicable, application information is to be submitted electronically.

9.3 Nuclear Substance Permit Application Review Process

1. All new nuclear substance permit applications involving more than one exemption quantity (EQ) of a nuclear substance (see section 14), must be reviewed and approved by the Radiation Safety Protocol Approval Committee (RSPAC). Work involving more than 10,000 EQ at one time will also require CNSC approval as a special project.

2. The Radiation Safety Officer (RSO) will initially review the permit application for completeness. Upon review, the RSO may request further information from the applicant. The RSO will communicate with the CNSC as required to ensure the proposed work is consistent with the CNSC licensed amounts and conditions.

3. The Radiation Safety Officer or designate will conduct an inspection of all work areas identified in the permit application to ensure proper containment and that all necessary

radiation safety measures are in place. Some lab requirements are dependent on the end use.

4. A nuclear substance permit shall be issued by the RSO only when all university, legislative and funding agency requirements have been met.

5. Upon approval of a permit application by the RSPAC, the Radiation Safety Officer will issue a University of Saskatchewan Nuclear Substance Permit to the individual. As deemed necessary, the Radiation Safety Officer and RSPAC may stipulate conditions on the nuclear substance permit which must be adhered to by the permit holder.

   Nuclear substance permits are valid for a period of up to two years and may be renewed.

6. Prior to beginning work, the Radiation Safety Officer will meet with the permit holder to review their responsibilities under the *Radiation Safety Code of Practice and Procedures Manual* and the Nuclear Substance Permit.

9.4 Amendment of a Nuclear Substance Permit

All proposed amendments to an active nuclear permit shall be made in writing to the Radiation Safety Officer. A permit amendment is required for the following types of changes:

- Addition of a new research protocol and/or changes to an existing research protocol;
- The addition or removal of a nuclear substances listed on the permit;
- The increase in quantity of a nuclear substance listed on the permit;
- The addition or removal of a radioactive work area;
- Changes to ARWs listed under the permit;
- Changes to work or storage areas listed under the permit; and
- Changes to contact information or signing authority under the permit.

A permit amendment is also required when a permit holder intends to go on sabbatical or a leave of absence greater than three months, and/or is no longer able to competently supervise the research protocol or activities under the nuclear substance permit.

To Amend a Permit:

1. Complete a *Nuclear Substance Permit Amendment Form* with required supporting information and submit the application to the Radiation Safety Officer.

2. The Radiation Safety Officer will review the application for completeness and compliance with the *Radiation Safety Code of Practice and Procedures Manual*, legislative requirements and granting agency requirements. Depending on the nature of the proposed amendment, the RSPAC may review the application. Work involving more than 10,000 EQ at one time will also require CNSC approval as a special project.

3. All amendments to active nuclear substance permits require approval by the Radiation Safety Officer and/or the RSPAC prior to implementation. An amendment shall be granted only when all university, legislative and funding agency requirements have been met. As deemed necessary, the Radiation Safety Officer and RSPAC may stipulate conditions on the permit which must be adhered to by the permit holder.

4. Upon approval from the RSPAC or the RSO, the Radiation Safety Officer will issue an amended nuclear substance permit to the permit holder.

5. New nuclear substance permits shall be posted in permitted locations. Expired nuclear substance permits must be removed from permitted locations.

Safety Resources radiation safety staff is available to assist permit holders at all stages in the permit amendment process.

9.5 Nuclear Substance Permit Renewal

University of Saskatchewan nuclear substance permits are valid for up to two years. To facilitate permit administration, all permits, regardless of when issued, are renewed collectively on the same two year cycle.

Permit holders intending not to renew, or to cancel their nuclear substance permit, must notify the Safety Resources at least one month prior to the expiry date or intended cancellation date of the permit. The permit holder must include a schedule to decommission all work and storage areas listed under the permit.

Safety Resources shall initiate and manage the renewal of nuclear substance permits in accordance with this procedure. Upon completion of the permit renewal process, the Radiation Safety Officer shall issue new nuclear substance permits to permit holders.

Safety Resources radiation safety staff is available to assist permit holders at all stages in the nuclear substance permit renewal process.

1. Safety Resources shall send a nuclear substance permit renewal memorandum with a *Nuclear Substance Operating Permit Renewal Form* to all active permit holders in advance of the permit expiry date.

2. Permit holders shall review the existing nuclear substance permit to ensure that the information listed on the permit is correct. Any required amendments can be noted on the renewal form.

3. The permit holder shall sign the *Nuclear Substance Operating Permit Renewal Form* confirming that the permit information is correct with any listed amendments, and that the permit holder wishes to renew the permit, or that the permit can expire, and no nuclear substances will be handled after the expiry date.

4. The permit holder must return the signed *Nuclear Substance Operating Permit Renewal Form* to Safety Resources prior to the expiry date of the permit.

5. The Radiation Safety Officer shall review the permit renewal application, and issue a new nuclear substance permit, as applicable.

6. New nuclear substance permits shall be posted in permitted locations. Expired nuclear substance permits must be removed from permitted locations.

Nuclear substance permits that are not renewed prior to the expiration date shall be suspended.

Safety Resource may be able to store nuclear materials for permit holder who wish to suspend their nuclear substance permit for a period of inactivity. For more information contact the Radiation Safety Officer.

9.6 Cancellation of a Nuclear Substance Permit

The Radiation Safety Officer must be notified at least one month prior to the intended cancellation date of a nuclear substance permit. The notification must include a schedule to decommission all work and storage areas listed under the nuclear permit.

When a nuclear substance permit is cancelled, the permit holder is responsible for decommissioning all work and storage areas listed under the nuclear substance permit.

All decommissioning must be completed prior to the permit expiry/cancellation date and in accordance with the *Facility Decommissioning Standard*.

The Radiation Safety Officer shall advise permit holders on the decontamination of work areas and equipment and will confirm that facilities are decontaminated to accepted levels. Safety Resources will support the removal and disposal of hazardous materials including biological, chemical, and radioactive.

For more information on the cancellation of a permit, contact the Radiation Safety Officer.

10 Operational Practices for Working with Radioisotopes

10.1 Lab and Storage Room Requirements

Rooms where unsealed nuclear substances are used in industrial, medical, or academic research settings are classified by the CNSC as basic, intermediate, high, or containment-level laboratories, or as nuclear medicine rooms, depending on the amount of nuclear substances handled in the room and on the nature of the work performed. If the area, room, or enclosure is used only for storage of unsealed nuclear substances or for the use or storage of sealed nuclear substances or radiation devices, the classifications do not apply.

Areas where more than one exemption quantity (EQ) of an unsealed nuclear substance is used at a single time are classified by the RSO using the table below. The Annual Limit on Intake (ALI) is the activity, in Becquerels, of a radionuclide that will deliver an effective dose of 20 mSv during the 50-year period after the radionuclide is taken into the body of a person 18 years old or older or during the period beginning at intake and ending at age 70 after it is taken into the body of a person less than 18 years old. A listing of ALIs and EQs can be found in Section 14.

Table 1 Room Classification Guide

Room Classification	Description
Basic Level Laboratory	The quantity of unsealed nuclear substance used at a single time does not exceed 5 times its corresponding annual limit on intake (ALI).
Intermediate Level Laboratory	The quantity of unsealed nuclear substance used at a single time does not exceed 50 times its corresponding annual limit on intake (ALI).
High Level Laboratory	The quantity of unsealed nuclear substance used at a single time does not exceed 500 times its corresponding annual limit on intake (ALI).
Containment Level Laboratory	The quantity of unsealed nuclear substance used at a single time exceeds 500 times its corresponding annual limit on intake (ALI).
Storage	Unsealed radioactive sources may be stored but not used in these areas.

Required signage appropriate to each lab classification can be found in Sections 15, 16, 17, and 18. The appropriate signage will be placed by Safety Resources as part of the room commissioning process.

10.2 Procurement of Nuclear Substances and Radiation Devices

Permit holders are authorized to acquire only those nuclear substances listed on their nuclear substance permit. The Radiation Safety Office authorizes the procurement of all nuclear substances and radiation devices before an order is placed to ensure total acquisitions are within the CNSC licence limits. Safety Resources manages the procurement logistics for the nuclear substance or radiation device.

To Procure:

1. Complete a Nuclear Substance Requisition Form. The form must include all required information, including a CFOAPAL number and an authorized signature, to be processed in a timely manner.

2. Submit the completed requisition form to the Radiation Safety Officer at Room 150, Research Annex.

3. On behalf of the permit holder, Safety Resources will place the order with the supplier.

4. If there are additional regulatory requirements associated with the requisition request, Safety Resources will contact the permit holder and facilitate any additional licensing or regulatory requirements with regulatory agencies.

5. All nuclear substances and radiation devices are delivered directly to the Safety Resources lab unless special requirements require delivery elsewhere on campus. Safety Resources personnel shall receive and inspect packages in accordance with Transportation of Dangerous Goods regulations.

6. Safety Resources shall contact the permit holder and arrange delivery of the nuclear substance or radiation device, shipping documents, and inventory sheet.

For assistance with procurement, contact the Radiation Safety Officer or their designate.

10.3 Transfer of Nuclear Substances

Nuclear substances and radiation devices may only be transferred or gifted to another permit holder at the University of Saskatchewan or to an individual in another organization with prior approval from the Radiation Safety Officer.

10.4 General Nuclear Substances Safety Rules

Every worker shall comply with these measures established by the University to protect the environment, the health and safety of personnel, and to maintain security.

1. Only persons properly trained to work with nuclear substances and informed of the hazards involved are permitted to work with nuclear substances or operate devices containing nuclear substances.
2. Nuclear substance work shall be conducted only in a laboratory or area authorized as a radioactive work area.
3. Ensure the internal authorization (permit) is posted near the entrance of the radioactive work area is correct and the associated approved procedures are current.
4. Keep radiation exposure as low as reasonably achievable.
5. Comply with CNSC and University regulatory requirements.

6. Restrict access to nuclear substances and work areas to authorized staff only. Never leave nuclear substances including waste unattended, unless in a locked room or enclosure.
7. Do not eat, drink, or store food in laboratories.
8. No nuclear substances shall be used in or on human beings.
9. If issued by the RSO, wear a dosimeter at all times while in the radioactive work area. Dosimeters shall be stored in designated locations away from sources of radiation.
10. In case of a radioactive spill or incident involving a nuclear substance, follow emergency procedures and notify the Radiation Safety Officer.
11. Wear appropriate personal protective equipment (PPE) (i.e. gloves, safety glasses, lab coat) when working with nuclear substances. No bare legs or open toe/heel shoes.
12. No person shall possess a container or device that contains a radioactive nuclear substance unless the container or device is labelled with a radiation warning, the name, quantity, date of measurement and form of the nuclear substance in the container or device. The warning will include the wording “RAYONNEMENT — DANGER — RADIATION” and the radioactive trefoil symbol.

    This does not apply if the container is:
    - used to hold nuclear substances for current or immediate use and are under the continuous direct observation by an authorized worker;
    - used to hold nuclear substances in quantities less than or equal to 1 exemption quantity;
    - used exclusively for transporting nuclear substances and labelled in accordance with the *Packaging and Transport of Nuclear Substances Regulations*.
13. Clearly identify and mark working surfaces used for handling nuclear substances.
14. Place radiation warning symbols on access doors to storage locations (cold rooms, fridges, freezers, cupboards, etc.)
15. All equipment and other items that may become contaminated during a procedure with nuclear substances shall be labelled with the appropriate radiation warning labels. Be mindful to avoid frivolous use of the warnings.
16. Monitor equipment used for radioactive work to ensure that it is not contaminated prior to it being used for non-radioactive work.
17. Prior to using a meter for contamination monitoring, workers shall ensure they understand how to use the meter. Workers shall ensure the meter used to monitor for radiation contamination is function tested every 12 months.
18. Work in a fume hood when handling volatile substances.
19. Work in a glove box when handling radioactive dry powders.
20. Cover radioactive work surfaces with disposable absorbent materials (i.e. bench coat). Disposable absorbent material should be replaced on a regular basis.
21. Monitor the laboratory for removable contamination following radioactive work or at least weekly. Decontaminate any surface where contamination was found as soon as possible. Keep a record of all monitoring and decontamination results.
22. Maintain up-to-date inventory, usage and disposal records of all nuclear substances.
23. Dispose of radioactive waste on a regular basis and in accordance with the Hazardous Waste Disposal Standard.
24. Wash hands thoroughly before leaving the laboratory. When possible, monitor the hands for contamination.

25. PPE, such as lab coats, shall be removed when leaving the laboratory or designated lab coat area.
26. Prior to leaving the University, ensure all radioactive substances are disposed of properly.

In the use of nuclear substances, consideration must be given to other physical, chemical and biological hazards, which may be present in addition to the radiation hazard.

10.5 Good Work Practices for the Use of Nuclear Substances

Proper handling precautions serve as the primary barrier to prevent the spread and subsequent adverse effects of contamination. The following tips will aid in handling nuclear substances safely.

1. Keep laboratory neat and tidy. Radioisotope work areas should be kept free of any articles that are not relevant to the work carried out during the procedure. Laboratory books, laptops, and personal electronics should be kept away to prevent possible contamination.
2. Prior to conducting a new procedure involving nuclear substances, a dry run using non-radioactive material should be performed to test the procedure.
3. Use the minimum quantity of nuclear substance necessary to satisfy the objective of the procedure.
4. If a radiation monitor is available in the laboratory, it should be kept on during the procedure to monitor for radiation.
5. If heating is necessary, nuclear solutions should never be heated directly over a flame. If it is necessary to look into a beaker containing nuclear substances during this procedure, safety glasses or a face shield shall be worn.
6. A radioactive solution shall not be poured from one container to another but shall be transferred carefully with a pipette or funnel.
7. Radioactive work should be confined to an area or bench in the laboratory with minimal traffic. If possible, activities requiring the handling of nuclear substance should be grouped in one area of the laboratory.
8. Where possible, only one sink should be used for the washing of contaminated glassware and equipment.

10.6 General Nuclear Substances Safety Procedures for Portable Gauges

1. An authorized worker transporting a nuclear gauge must be certified to transport Class 7 dangerous goods.
2. A required Radiation Safety Course is provided by Safety Resources specifically for Nuclear Gauge users. Workers will review CNSC document *Working Safely With Nuclear Gauges* INFO-9999-4 (E) Revision 2 as a training document.
3. The RSO must be notified before the gauge is transported off campus.
4. Emergency response will be as per CNSC poster *Responding to Accidents Involving Portable Gauges*. A copy of the poster must accompany the gauge when transported off campus.
5. When travelling to areas more than 2 hours from campus, a portable survey meter must accompany the gauge.

10.7 Storage of Nuclear Substances

1. All nuclear substances shall be stored in a secure location to prevent unauthorized access to the substance. If the storage room, cabinet, refrigerator or freezer can be easily accessed by unauthorized persons it must be locked at all times (i.e. freezer in a hallway).
2. All storage rooms, cabinets, refrigerators or freezers used for the storage of nuclear substances must be labelled with a radiation warning sign. The RSO will supply appropriate signage on request.
3. No food or drink shall be stored in the same enclosure with any hazardous substance.
4. Unless used to hold nuclear substances in quantities less than or equal to 1 exemption quantity; all stored nuclear substances shall be labelled with the radiation warning sign, indicate the amount of activity, date and name of the radioisotope. The warning will include the wording “RAYONNEMENT — DANGER — RADIATION” and the radioactive trefoil symbol.
5. Storage locations must not have a dose rate that exceeds 2.5 μSv/h at any occupied area outside of the storage area, room, or enclosure.
6. Fume hoods shall not be used for the storage of materials except where those materials may produce hazardous discharges.
7. For storage of waste containers, refer to the Hazardous Waste Disposal Standard.

10.8 Transporting Nuclear Substances

The transportation of nuclear substances within Canada is done in accordance with performance safety standards set by the CNSC. These standards are based on international safety standards developed by the International Atomic Energy Agency (IAEA) of the United Nations.

10.8.1 Between Laboratories

When transporting nuclear substances between laboratories in the same building the instructions listed below shall be followed:

- Unsealed nuclear substances shall be transported in a two-container package. The primary container shall be securely sealed and labelled with the radioactive warning symbol.
- Enough absorbent material shall be placed between the primary and secondary container to contain a spill. Glass containers are prohibited.
- Sealed nuclear substances shall be transported in their original transport containers, which are labelled and marked accordingly. If no original shipping container is available a holding container with the radiation warning symbol label shall be used.
- Walk or use a cart to transport the nuclear substance.
- Select a route that is the shortest and has the least amount of risk for an incident to occur.

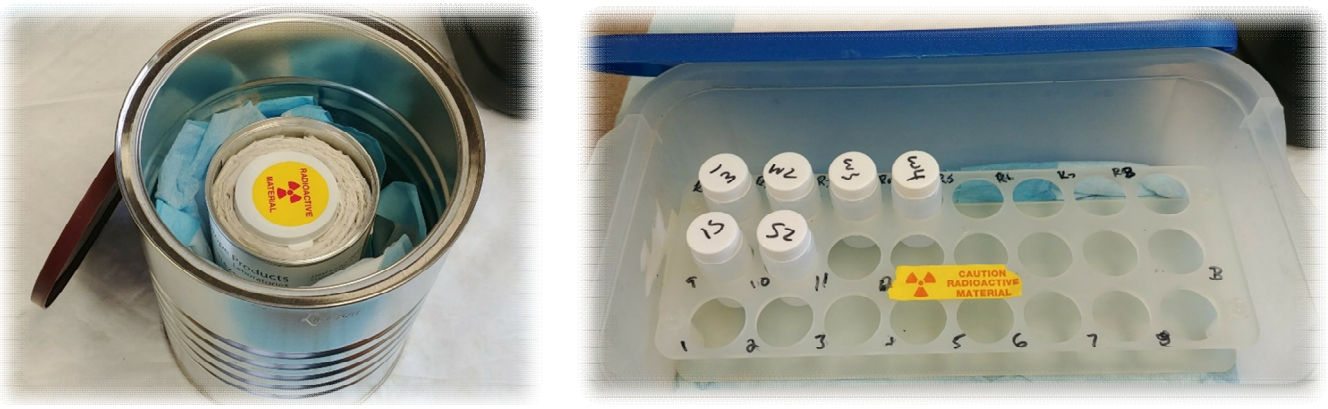


Figure 1 Two-container package examples

10.8.2 Between Buildings

When transporting nuclear substances between buildings:

- Unsealed nuclear substances shall be transported in a two-container package. The primary container shall be labelled with the radioactive warning symbol.
- Enough absorbent material shall be placed between the primary and secondary container to contain a spill.
- Sealed nuclear substances shall be transported in their original transport containers, which are labelled and marked accordingly. If no original shipping container is available a holding container with the radiation warning symbol label shall be used.
- Walk or use a cart to transport the nuclear substance.
- Select a route that is the shortest and has the least amount of risk for an accident to occur.
- If a vehicle is required to transport the nuclear substance contact the Radiation Safety Officer.

10.8.3 Off Campus

- Any person packaging and transporting of a nuclear substance off campus must hold a valid Class 7 Transportation of Dangerous Goods certificate.
- Contact the Radiation Safety Officer for assistance with the packaging, marking, labelling and documentation.

10.9 Contamination Monitoring

Radioactive contamination is the presence of nuclear substances in any place where it is not desired. Contamination can be further classified as removable or fixed.

Personnel should regularly monitor themselves and their work area for fixed and removable contamination in order to:

- Ensure that contamination is not transferred to non-radioactive areas;
- Provide feedback as to the effectiveness of contamination control measures;
- Prevent unnecessary radiation exposure resulting from contamination.

10.9.1 Removable Surface Contamination

Removable surface contamination is nuclear substances in a form that is easy to spread.

There are three potential exposure problems with removable contamination:

- It might be inadvertently ingested.
- Loose surface contamination might become airborne and be made available for inhalation.
- The possibility that it might be spread beyond the boundaries of the licensed area and cause undue stress.

Radioactive surface contamination is primarily caused by poor handling techniques and housekeeping. Accidental spills or leaks of nuclear substances are another source of surface contamination.

10.9.2 Fixed Contamination

Fixed contamination is that which cannot be readily removed. Depending on the radioisotope and activity, fixed contamination may pose an external radiation hazard. When contamination is significant, the surface or equipment may have to be disposed of or if the radionuclide has a short half-life it may be stored until the radiation field is no longer a problem.

10.9.3 Frequency for Contamination Monitoring

Contamination monitoring must be recorded at least weekly during periods of use.
When radioactive substances are not used for a prolonged period of time, contamination monitoring is not required, but such a period should be identified in the records with an entry acknowledging that no radioactive work has done in each of the skipped weeks.

10.9.4 Contamination Limit

<u>Controlled Areas (Posted Labs)</u>
Non-fixed contamination in all areas, rooms or enclosures where unsealed nuclear substances are used or stored does not exceed:

3 Bq/cm^2 for all Class A radionuclides
30 Bq/cm^2 for all Class B radionuclides
300 Bq/cm^2 for all Class C radionuclides, averaged over an area not exceeding 100 cm^2

<u>Public Areas (Outside Posted Labs)</u>
Non-fixed contamination in all other areas does not exceed:

0.3 Bq/cm^2 for all Class A radionuclides
3 Bq/cm^2 for all Class B radionuclides
30 Bq/cm^2 for all Class C radionuclides, averaged over an area not exceeding 100 cm^2

A list of isotope classifications is included in Section 14.

However, as many instruments don't give a readout in Bq/cm^2, any location monitored for contamination with a result greater than **TRIPLE** the background may be considered contaminated and should be cleaned. It is the users responsibility for ensuring that the instrument and the counting parameters used are sufficient to detect contamination below the regulatory limit if using the triple the background rule for the isotope in question.

10.9.5 Indirect Monitoring Method

Indirect monitoring means surveying an area for removable contamination that can be transferred to a wipe or swab and measured at a different location. Section 10.9.7 offers guidance for selecting and programming an instrument to meet the monitoring requirement for your area. Contact the RSO for assistance with contamination monitoring as needed.

The following instructions have been designed to assist laboratory personnel in the correct procedure for monitoring their laboratory(s) for contamination. It may be necessary to adapt some of the procedure to the equipment being used for monitoring.

1. Draw a map of the floor plan of each laboratory designated as a radioactive work area. On your map identify areas that are potential locations for contamination. Add a couple of less likely or random sample areas.
2. Create a 52 week log book to record the monitoring results in. A hard copy shall be readily available in the laboratory. (Contact Safety Resources for a sample copy.)
3. If no nuclear substance has been used that week, a simple notation of this fact should be documented in the log book. Otherwise, there must be monitoring results recorded.
4. A background wipe shall always be taken for comparison.
5. Number the holding container for the wipe (liquid scintillation vials or test tubes) to correspond to the numbered location on the map of the laboratory where the wipe shall be taken.
6. If monitoring for beta emitters, select filter paper for the wipe. If monitoring for gamma emitters select cotton tipped application swabs.
7. Wearing gloves, wipe each of the locations shown on the map. Try to avoid touching the surface with your fingers.
8. Wipe an area of approximately 100 cm^2. This is equivalent to the area of a square, 10 centimeters on each side. However, the preferred method is to perform the wipe in an S-shaped pattern over a distance of 30-35 centimeters or a straight line 70 cm long.
9. Most wipe surveys are performed with dry wipes. However, if you wet the wipe with water or alcohol, allow for the wipe to thoroughly dry before counting. Otherwise, water or alcohol will shield the beta particles especially those of low energy.
10. Place the wipe in the holding container. Proceed to count the wipes. For liquid scintillation wipes the filter paper should dissolve prior to counting to prevent erroneous results. (This might take several hours.)
11. Record the results.
12. If contamination is detected, clean the area, and re-monitor. Repeat cleaning until the removable contamination is removed to at least the applicable limit. Refer to the spill response poster (Section 13) for cleaning procedures.
13. Record results after decontamination.

10.9.6 Direct Monitoring Method

Direct monitoring means surveying an area for contamination using a portable meter at the site of the potential contamination. Direct monitoring will measure removable and non-removable contamination. Section 10.9.7 offers guidance for selecting and programming an instrument to meet the monitoring requirement for your area. Contact the RSO for assistance with contamination monitoring as needed, and before purchasing any direct monitoring equipment.

1. Read the instrument's operating manual to gain familiarity with the controls and operating characteristics.
2. Before each use, check for proper instrument function:
    a. Check the function test sticker, ensure test date is within the last 12 months.
    b. Check that the battery level and high voltage (if applicable) are within the specified range.
    c. Confirm a response to background radiation or a known source.

    If any of the above test conditions are not met, do not use the meter. Contact the RSO for support and a temporary replacement meter if needed.
3. Adjust the meter range selector to the lowest range multiplier (some meters are auto ranging). It is recommended to also use the audible response (clicks) if available.
4. Determine the average background reading at a surface that is known to be uncontaminated. Record this result.
5. To monitor a surface for contamination, bring the detector to within one centimeter of the surface, being careful not to damage or contaminate the detector.
6. Move the detector slowly over the surface. Move at no more than 1 detector width per second.
7. Stop at any areas of increased response and allow the reading to settle. Record the maximum steady reading for each area.
8. Any monitoring result greater than triple the background level or the established limit from 0 will be considered contamination.
9. If contamination is detected, clean the area, and re-monitor. Repeat cleaning until all contamination has been removed or only fixed contamination remains. Refer to the spill response poster (Section 13) for cleaning procedures.
10. Record results after decontamination.

10.9.7 Relating Contamination Measurement Readings to Regulatory Criteria

This section is courtesy of the CNSC, REGDOC-1.6.1

The readings from contamination meters can be related to regulatory criteria if the efficiency of the instrument for a specific nuclear substance is known. Instrument efficiencies for specific nuclear substances can be obtained from the manufacturer or determined using an appropriate standard of known activity.

For mixtures of nuclear substances, identify the isotope for which the detector has the lowest response at the applicable contamination limit.

Using the following equation, calculate the measurement results in Bq/cm^2

$$\text{Removable Activity} = \frac{\text{N-NB}}{\text{E x 60 x A x F}}$$

Where:

- N = the total count rate in counts per minute (cpm) measured directly or on the wipe.
- NB = the normal background count rate (in cpm) from the portable survey instrument or the count rate (in cpm) from a blank sample using a benchtop instrument
- E = the instrument efficiency factor (expressed as a decimal, i.e. for 5 percent efficiency, E=0.05) 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.
- 60 = sec/min
- A = area wiped (not to exceed 100 cm^2) or area of the detector in cm^2 (for direct measurement)
- F = the collection factor for the wipe (used only when calculating indirect wipe monitoring results). If F is not determined experimentally, a value of F=0.1 (i.e. 10%) shall be used.

Minimum detectable activity

The minimum detectable activity (MDA) is defined as the minimum amount of activity in a sample that can be detected with a 5-percent probability of erroneously detecting radioactivity when none is present, and a 5- percent probability of not detecting radioactivity when it is present. For any given system designed to count and quantify radioactivity, the MDA should be calculated for the most restrictive scenario (i.e., for the nuclide with the lowest detection efficiency and the most restrictive regulatory criterion). The units of the MDA (Bq, Bq/gr, Bq/cm^2) should be the same as those expressed in the licence or regulatory criterion, as applicable. The MDA in Bq/cm2, can be calculated as follows:

$$\text{MDA } (Bq/cm^2) = \frac{2.71+4.66\sqrt{NB\times[T/60]}}{E\times T\times A\times F}$$

Where the terms NB, E, A and F have the same meanings as the section above and

T = the counting time, in seconds, for indirect wipe monitoring, and is the instrument response time for direct measurements (or the actual time if performing scalar counting). The instrument response time will vary between instruments and is a parameter which can be selected by the user on some devices; e.g., via either software selection of the actual time or “fast/slow” switch set to predefined times specified in the user manual. Other instruments may auto-select the response time based on the count rate. Longer response times will improve the MDA, but the instrument shall stay stationary over each area for a period that is at least as long as the response time.

Note: the efficiency, and hence the MDA of the instrument is highly dependent on the distance between the source and the detector. The MDA should be calculated for the distance at which the detector will be when monitoring.

Selection of contamination monitoring instruments

The MDA for a nuclear substance will depend on both the types and energies of radiation emitted by that nuclear substance and on the type of detector used. In general, there are three basic detector design considerations that will impact instrument sensitivity, and each of these parameters will have a different impact, depending upon the type and energy of radiation being detected:

- Window thickness and composition

  Consideration should be given to whether the window density is small enough to allow the radiation emitted by source to enter the detector. This is critical for low-energy beta radiation and alpha radiation, which can be completely absorbed even by materials as thin as a sheet of paper. Note that some isotopes, such as H-3 or Ni-63, cannot be detected by most instruments, because the beta radiation they emit gets completely absorbed within the window. For such isotopes, indirect monitoring using liquid scintillation is generally the best choice.

- Detector density

  Every radiation detector functions by detecting interactions between the radiation and a material within the detector. There are two broad classes of detectors: gas-filled detectors, and solid or liquid scintillators. Gas- filled detectors, such as Geiger detectors and proportional counters, will generally work well for detecting alpha or beta radiation, since these types of radiation will cause interactions even in low-density materials. Conversely, gamma rays may readily pass through a low-density gas without interaction, especially at high energies. Solid scintillators, such as NaI detectors, are generally much better suited to detecting gamma radiation. Thin crystal detectors are suitable for low-energy gamma emitters such as Tc-99m, while thicker detectors will enhance sensitivity for high-energy gammas such as those from Cs-137 or Co-60.

- Detector output

  Every time radiation interacts with a detector, a tiny amount of energy is released within the detector. This energy is then converted into an electronic signal that can be measured. Some detectors, such as Geiger counters, produce uniform pulses which can be counted. Other systems, such as scintillators or proportional counters, may produce a signal that is proportional to the amount of energy released in the initial radiation interaction. This can be used to distinguish between different types of radiation or different energies of radiation of the same type. Such detectors are useful in applications where distinguishing between multiple different isotopes may be necessary.

Hand-held contamination monitoring instrument*	Recommended applications**
Thin-window G-M detector	Beta emitters, alpha emitters
Gas-filled proportional detector	Variable, refer to manufacturers specifications
Thin-crystal sodium iodide scintillation detector	Low-energy gamma emitters (<200 keV)
Thick-crystal sodium iodide scintillation detector	High-energy gamma emitters (>200 keV)
Organic/plastic scintillation detector	Generally specifically designed for alpha and beta detection with low background. Gamma detection is variable; refer to manufacturers specifications.
Zinc sulphide scintillation detector	Alpha emitters
Thick zinc sulphide scintillator with proprietary discrimination	Beta emitters, alpha emitters, gamma emitters
Non-portable monitoring instruments (wipe counters)	**Recommended applications****
Liquid scintillation counter	Alpha and beta wipe samples, especially for very low-energy beta emitters such as H-3, Ni-63, and C-14
Sodium iodide well counter	Gamma wipe samples, allows for spectroscopic analysis of different isotopes if multiple isotopes are being used
Gas-flow proportional counter	Alpha and beta wipe samples
Semiconductor gamma spectrometer (High Purity Germanium)	Gamma wipe samples, allows for high-resolution spectroscopic analysis of different isotopes if multiple isotopes are being used

* Ion chambers are another major type of portable detector. These devices are intended for measurement of radiation dose rates rather than contamination. In general, they are poorly suited to contamination monitoring and should not be used for this purpose.

** Nuclear substances that decay via emission of alpha or beta particles often also emit gamma rays. Many isotopes, especially high atomic number materials such as uranium and radium, may exist in equilibrium with the other isotopes in their “decay chain”, which in turn emit many different types and energies of radiation. When choosing a contamination monitor, it is important to consider exactly what types of radiation will be present. For example, positron emission tomography (PET) isotopes decay by the emission of a positron (beta+) which in turn produces two high-energy (511 keV) gamma rays. It is the gamma rays that are of primary importance in the use of these isotopes, and a thick crystal NaI scintillator will detect these gammas very efficiently. However, a thin window Geiger detector will detect the beta+ emissions even more efficiently, and will generally have a much lower background (NB) count-rate.

Note: For further information on nuclide specific instrument selection, please see the CNSC’s Radionuclide Information Booklet:
http://nuclearsafety.gc.ca/eng/resources/radiation/radionuclide-information.cfm

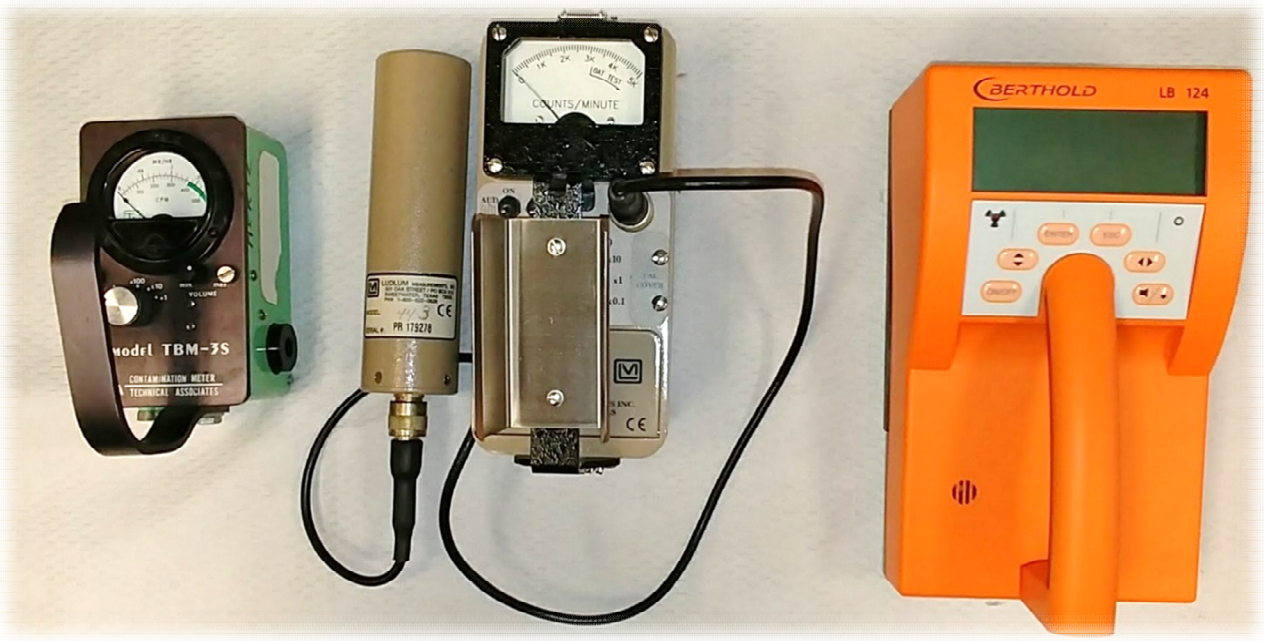


Figure 2 Contamination Meters
From left to right: thin window GM detector, thin crystal sodium iodide scintillation detector, and a Zinc-sulphide scintillation detector.

10.9.8 Leak Testing of Sealed Sources

The regulatory requirement to conduct regular leak testing of sealed sources, including their frequency and detection level, is specified in Section 18 of the Nuclear Substances and Radiation Devices Regulations.

"(1) Every licensee who possesses, uses or produces either a sealed source containing 50 MBq or more of a nuclear substance or a nuclear substance as shielding shall, at the following times, conduct leak tests on the sealed source or shielding using instruments and procedures that enable the licensee to detect a leakage of 200 Bq or less of the nuclear substance:

(a) where the sealed source or shielding is used after being stored for 12 or more consecutive months, immediately before using it;
(b) where the sealed source or shielding is being stored, every 24 months;
(c) where an event that may have damaged the sealed source or shielding has occurred, immediately after the event; and
(d) in all other cases,
    (i) where the sealed source or shielding is located in a radiation device, every 12 months, and
    (ii) where the sealed source or shielding is not located in a radiation device, every six months.

(2) Subsection (1) does not apply in respect of a sealed source that is

(a) gaseous;

(b) contained in a static eliminator that has been retained by the licensee for less than 15 months;

(c) exempted under section 5, 6, 8 or 8.1; or

(d) used or stored underwater in a nuclear facility that is equipped with a device capable of detecting waterborne contamination of 200 Bq or less of a nuclear substance.

(3) Where a licensee, in the course of conducting a leak test on a sealed source or on shielding, detects the leakage of 200 Bq or more of a nuclear substance, the licensee shall

(a) discontinue using the sealed source or shielding;

(b) discontinue using the radiation device in which the sealed source or shielding is located or may have been located;

(c) take measures to limit the spread of radioactive contamination from the sealed source or shielding; and

(d) immediately after complying with paragraphs (a) to (c), notify the Commission that the leakage has been detected."

Safety Resources will perform leak testing consistent with the regulatory requirements. Copies of the leak test certificates can be obtained from Safety Resources. In the event that leakage greater than 200 Bq is detected, Safety Resources will respond as per the regulations listed above.

11 Radiation Exposure

11.1 Exposure Assessment

In cooperation with the permit holder, Safety Resources will perform an exposure assessment for all workers who possess, use or store nuclear substances and radiation devices listed under the university's licences with the CNSC. The assessment may complex or simple and is incorporated into the permit application and amendment process.

Exposure assessments are performed in order to:

- Estimate individual or group radiation doses received from working with nuclear substances and/or radiation devices;
- Classify users based on anticipated radiation exposures;
- Determine and/or confirm appropriate control measures to protect users;
- Determine radiation dosimetry requirements.

Individuals whose effective occupational radiation dose is anticipated to exceed 1 mSv/year shall be designated as a Nuclear Energy Worker (NEW). All individuals determined to be a NEW will be informed, in writing, of their designation and rights and responsibilities in accordance with the CNSC *Radiation Protection Regulations*. All NEWs must acknowledge their acceptance of the NEW designation by completing a NEW designation form that is kept on file by the RSO.

11.1.1 Regulatory limits

The Canadian Radiation Protection Regulations set limits (Table 2) on the amount of radiation to which the public and nuclear energy workers (NEWs) can be exposed. These restrictions are referred to as “dose limits” and are set below the threshold that would be expected to result in adverse health effects.

Authorized Radiation Workers at the U of S are considered members of the general public with respect the dose limits unless they have been designated as NEWs. A NEW designation is only issued if there is a reasonable likelihood of exposure above the public limits during the course of their work. These limits are in excess of the normal background radiation and any non-employment exposures (medical x-rays, flights) the worker may receive.

Table 2 Regulatory Dose Limits

Person	***Period***	***Effective Dose***	***Equivalent Dose***
Nuclear Energy Worker	One-year dosimetry	50 mSv	
	Five-year dosimetry	100 mSv	
Lens of an eye	One-year dosimetry		50 mSv
Skin	One-year dosimetry		500 mSv
Hands and feet	One-year dosimetry		500 mSv
Pregnant NEW	Balance of pregnancy	4 mSv	
General Public	One calendar year	1 mSv	
Lens of an eye	One calendar year		15 mSv
Skin	One calendar year		50 mSv
Hands and feet	One calendar year		50 mSv

11.1.2 Administrative limits

In alignment with the ALARA (as low as reasonably achievable) philosophy, the CNSC regulatory limits are maximums and not the expected exposure for most workers. Internally, the RSO will investigate doses greater those listed in Table 3.

Due to the diverse nature of work at the U of S, the expected doses will vary greatly between working groups. Each worker should evaluate their exposure in the context of their duties and historical readings.

Table 3 Administrative Dose Limits

Person	*Period*	*Effective Dose*	*Equivalent Dose*
Nuclear Energy Worker	Quarterly	2.5 mSv	
Lens of an eye	Quarterly		5 mSv
Skin	Quarterly		25 mSv
Hands and feet	Quarterly		25 mSv
Pregnant NEW	Quarterly	1 mSv	
General Public	Quarterly	0.25 mSv	
Lens of an eye	Quarterly		1 mSv
Skin	Quarterly		2.5 mSv
Hands and feet	Quarterly		2.5 mSv

11.1.3 Pregnant or breastfeeding workers

The University of Saskatchewan is committed to keeping occupational radiation exposures As Low As Reasonably Achievable (ALARA). Fetuses are particularly sensitive to radiation during their development and certain nuclear substances, when taken into the body, are more likely to become concentrated in breast milk. Due to this, pregnant or breastfeeding workers may choose to take additional precautions or request changes to their duties.

Pregnant NEWs (Nuclear Energy Workers) are encouraged to declare their pregnancy or breastfeeding status in writing to the Radiation Safety Officer (RSO). Upon notification, the RSO, the supervisor, and the NEW will evaluate the anticipated exposure during the remainder of the pregnancy and make accommodations as needed to ensure the pregnant NEW dose limits are not exceeded and/or that the potential for intake of radionuclides is minimized during the breastfeeding period. Pregnant NEWs may be issued additional monthly dosimeters or calibrated electronic dosimeters to monitor exposure to the fetus at an increased frequency. Pregnant non-NEW Authorized Radiation Workers may also choose to report their pregnancy to the RSO.

The duty to make accommodations for pregnant and breastfeeding workers is not meant to prevent the worker from entering or working in a designated radiation and/or contamination zone. Accommodations should, however, ensure that under normal operating conditions the dose is kept ALARA and that the dose limits are respected. The revised working conditions should also ensure that in the event of an accident or other event, any radiological exposure (internal or external) that could result in a dose above the dose limit is avoided.

11.2 Committed Dose and Dose Rate Monitoring

11.2.1 Dose rate meters

Unlike contamination meters which give readouts in cps, cpm, or Bq/cm^2, dose rate meters display uSv/h or mSv/h. These measurements can be related to the exposure limits described in Section 11.

Dose rate meters are not effective tools to monitor for contamination as they are generally only sensitive to gamma and x-ray radiation and have a hard plastic or metal shell that reduces their sensitivity. Specialized instruments can also be used to measure the dose rate from neutron radiation or the shallow dose rate from beta radiation.

Dose rate meters must have their calibration verified annually by a licensed provider. Safety Resources will coordinate the calibration of dose rate meters and bill permit holders for the incurred expense.

11.2.2 Generalized dose rate meter operating instructions:

1. Read the instrument's operating manual to gain familiarity with the controls and operating characteristics.
2. Before each use, check for proper instrument function:
    a. Check the function test sticker, ensure test date is within the last 12 months.
    b. Check that the battery level and high voltage (if applicable) are within the specified range.
    c. Confirm a response to background radiation or a known source

    If any of the above test conditions are not met, do not use the meter. Contact the RSO for support and a temporary replacement meter if needed.
3. Hold the meter with the direction of response facing the radiation source as specified by the manufacturer.
4. Allow the reading to settle before recording the measurement, lower level measurements will take longer to stabilize.
5. If reading are significantly higher than expected and the cause is not immediately apparent, move away from the area until the cause is determined. Contact the RSO for support as needed.

Figure 3 Dose Rate Meters

11.2.3 Personal Dosimeters

Passive Dosimeters

External dosimetry services are administered by Safety Resources through a CNSC licenced dosimetry service provider. Effective whole-body doses and equivalent doses to extremities are measured using Optically Stimulated Luminescence (OSL) or thermoluminescent dosimeters (TLD) provided by the dosimetry service provider.

Passive dosimeters are only sensitive to high-energy beta, gamma, or x-ray sources. Specialized dosimeters can be issued for neutron radiation. Dosimeters are not effective in for monitoring exposure to low energy beta emitters such as emitters H-3 or C-14.

Figure 4 Dosimeter Badge and Ring

Based on the results from the exposure assessment, whole body dosimetry (OSL badges) are indicated when the worker is:

- Likely to receive, in one year, from sources external to the body, an effective dose in excess of 0.50 mSv (50% of 1 mSv, the effective dose limit for a member of the public); or
- For other reasons at the discretion of the Radiation Safety Officer

Based on the results from the exposure assessment, extremity dosimetry (TLD rings) are indicated when the worker is:

- Handling more than 50 MBq of P-32, Sr-89, Y-90, Sm-153, or Re-186; or
- For other reasons at the discretion of the Radiation Safety Officer

Proper Care and Use of dosimeters

- Do not expose the dosimeter to high temperature, water, direct sunlight or fluorescent light.
- Wear the dosimeter at all times while in a radioactive work area.
- Clip your whole body OSL firmly to your clothing between your chest pocket and collar. Ensure the side with the name printed is facing outward.
- Extremity TLDs (rings) should be worn facing the source of radiation.
- If you lose or damage your dosimeter you should stop working with radiation until you receive a replacement. Spare dosimeters are available from the RSO.
- Store dosimeters in a designated holder or rack when not in use. The designated area should be in a low radiation background area away from direct light and heat.

Electronic Dosimeters

A limitation of passive dosimeters is that the result is typically issued quarterly and may take several weeks to process after the badges are returned to the supplier. Safety Resources has a limited supply of electronic dosimeters, sensitive to gamma and x-ray radiation, which can be issued when a real time measurement of equivalent dose is desired.

Possible uses of an electronic dosimeter include:

- Monitoring the exposure of pregnant workers;
- Evaluating the radioprotection of a new procedure;
- Monitoring exposure of visitors who have not been issued a passive dosimeter.

Figure 5 Electronic Personal Dosimeter (EPD)

11.2.4 Thyroid Monitoring

Workers may be exposed to radionuclides in a variety of chemical forms that can be inhaled, ingested, or absorbed through intact skin or open wounds. The purpose of a thyroid screening program is to monitor the intake of volatile radioiodine. Information produced by the program is used to assess any intake of volatile radioiodine, provide assurance that the radiation protection program is working, and demonstrate compliance with regulatory dose limits.

Every person who in any 24-hour period uses a total quantity of Iodine 124, Iodine-125 or Iodine-131 exceeding:
(i) 2 MBq in an open room;
(ii) 200 MBq in a fume hood;
(iii) 20 000 MBq in a glove box; or
(iv) any approved quantity in any room, area or enclosure authorized
in writing by the CNSC shall undergo thyroid screening within a period more than 24 hours after the last use that resulted in any of the above limits being exceeded and less than 5 days after the limit was exceeded.

Every person who in any 24-hour period uses a total quantity of Iodine-123 exceeding:
(i) 200 MBq in an open room;
(ii) 20,000 MBq in a fume hood;
(iii) 2,000,000 MBq in a glove box; or
(iv) any approved quantity in any room, area or enclosure authorized in writing by the CNSC shall undergo thyroid screening within a period more than 8 hours after the last use that resulted in any of the above limits being exceeded and less than 48 hours after the limit was exceeded.

Every person who is involved in a spill greater than 2 MBq of Iodine-124, Iodine-125 or Iodine 131 or on whom external contamination is detected, shall undergo thyroid screening within a period more than 24 hours after the spill and less than 5 days after the spill or contamination.

Every person who is involved in a spill of greater than 200 MBq of Iodine-123 or on whom external contamination is detected, shall undergo thyroid screening within a period more than 8 hours after the spill and less than 48 hours after the spill or contamination.

Safety Resources maintains detectors and techniques that can detect less than 1 kBq of I-125 or I-131 in-vivo, and participates in the Radiation Protection Bureau's Thyroid Performance Test to ensure the accuracy of the counting technique. Similar methods for I-124 or I-123 will be validated as needed. The thyroid screening techniques were developed with guidance form the CNSC document *RD-58: Thyroid Screening for Radioiodine.*

The response to detected radioiodine uptake greater than 1 kBq will be as follows:

Investigation Level - Measurement Results ≥ 1 kBq and < 10 kBq

1. Verify that the method of screening measurement procedure has been followed; If necessary, make any corrections and repeat the measurement;
2. If the measurement result is still equal to or greater than 1 kBq, verify clothes or skin for contamination; If clothes or skin are contaminated, remove the clothes or decontaminate the skin and repeat the measurement;
3. If the measurement result is still equal to or greater than 1 kBq, then the RSO will conduct an investigation which will include screening all persons who worked in proximity to the person whose results are equal to or greater than 1 kBq.
4. The RSO will report the event in the annual report to the CNSC.

Reporting Level - Measurement Results ≥ 10 kBq

1. Verify that the method of screening measurement procedure has been followed; If necessary, make any corrections and repeat the measurement;
2. If the measurement result is still equal to or greater than 10 kBq, verify clothes or skin for contamination; If clothes or skin are contaminated, remove the clothes or decontaminate the skin and repeat the measurement;
3. If the measurement result is still equal to or greater than 10 kBq, then the RSO will notify the CNSC immediately and make arrangements for a bioassay at a site approved by the CNSC.
4. The RSO will investigate the event and implement corrective actions as required.

12 Emergency Procedures

12.1 Theft or Loss of Nuclear Substances

Theft or loss of nuclear substances is a serious offense and shall immediately be reported to the Radiation Safety Officer. It is important to know the amount of nuclear substance that is missing. An investigation will follow. If a significant quantity of substance is involved, the Radiation Safety Officer may have to notify the CNSC.

12.2 Fire or Explosion Involving Nuclear Substances

In the event of a fire or explosion, follow the procedures detailed in the facilities Emergency Response Plan. When nuclear substances are known to be present, the Radiation Safety Officer must be notified as soon as possible. Emergency personnel responding to the scene should be advised that nuclear substances are present. If chemicals are involved, the concern with their toxicity should also be addressed.

NOTE: Seriously injured persons should not be delayed medical attention because of concerns relating to radioactive contamination. Universal precautions used by healthcare professionals will greatly reduce the risk of exposure to responding personnel. Simple steps such as bagging contaminated clothing will reduce the risk of significant contamination spreading beyond the incident site.

12.3 Radioactive Spill

After immediate actions to contain the spill, classify the spill as major or minor. A major spill involves more than 100 exemption quantities, contamination of personnel, or the release of a volatile material. Major spills require that the RSO is contacted immediately. Section 13 contains the spill response procedures and Section 14 contains a list of relevant exemption quantities.

12.4 Treatment of Personal Contamination

When contamination of the skin is known or suspected, the steps listed below should be followed. It is very important that skin contamination be cleaned immediately. Early, effective removal of the contamination can help to reduce radiation exposure.

During skin decontamination, it is important to proceed from mild treatments to harsher ones only if necessary. Abrasion or any other breaks of the skin must be avoided, as these will allow increased absorption of the nuclear substances.

12.4.1 Treatment of Skin or Hair Contamination

1. Contact the Radiation Safety Officer.
2. Remove any contaminated clothing or personal protective equipment.
3. Flush contaminated area with copious amounts of warm water.
4. Apply mild soap or detergent. Lather well with plenty of water.
5. Work lather into contaminated area by rubbing gently for two to three minutes.
6. Exercise caution to prevent contamination from spreading to other areas of the body.
7. Pay special attention to a variety of areas where contamination might settle, such as fingernails, folds, creases, inner-finger spaces and jewelry.
8. Rinse thoroughly with tepid water.
9. Monitor contaminated area. (direct or indirect)
10. Repeat wash/rinse procedure several times using a soft brush, if necessary.
11. Discontinue before skin becomes abraded or sensitive.

Only after several attempts with soap and water should harsher decontamination methods and cleaning agents be considered. These methods should be under the direction of the Radiation Safety Officer.

12.4.2 Treatment of Contaminated Wounds or Eye Exposure

1. Remove any contaminated clothing and personal protective equipment.
2. If eyes are exposed, immediately flush eyes for 15 minutes using an emergency eyewash station.
3. If there is an open wound to the skin (cuts, punctures), encourage bleeding, flush area with water taking care to direct any skin contamination away from the wound, apply first aid.
4. Contact the Radiation Safety Officer.
5. As required, seek professional medical attention.

In the case of serious injuries:

1. Call 9-911 and Protective Services at 306-966-5555.
2. Call Safety Resources to report the nature of the hazard, the amount of nuclear substance, the chemical form of the substance and any other pertinent information such as location.
3. Direct someone to meet the emergency medical personnel.
4. Ensure that nuclear substances cannot further contaminate the injured person.

NOTE: Seriously injured persons should not be delayed medical attention because of concerns relating to radioactive contamination. Universal precautions used by healthcare professionals will greatly reduce the risk of exposure to responding personnel. Simple steps such as bagging contaminated clothing will reduce the risk of significant contamination spreading beyond the incident site.

12.4.3 Internal Contamination

If internal contamination is suspected, the Radiation Safety Officer shall immediately be notified.

- Personnel working with nuclear substances should understand its chemical and radioactive properties such that a prompt response to a suspected intake of substance can be carried out.
- If the material is chemically toxic as well as radioactive, treat for chemical toxicity first. It is important for a quick response to internal contamination to prevent or reduce the nuclear substance uptake into the bloodstream and tissues. The contaminated person should be taken to the hospital for proper medical attention.

12.4.4 Contaminated Clothing

In the event that nuclear substances contaminate personal clothing or lab coat, it is important that it be removed quickly to reduce your exposure to the radiation. Collect the clothing in a plastic bag labelled with the estimated amount of activity and radioisotope. Monitor the skin to ensure the substance did not transfer through the clothing. The clothing can likely be returned after a

suitable period for decay or controlled laundering. Contact the Radiation Safety Officer for further information.

Figure 6 Contaminated Clothing

13 Spill Procedure Poster

RADIOACTIVE SPILL PROCEDURES

Radiation safety officer	Telephone number
Matt Hutcheson	306-966-8494
24-hour emergency contact	**Telephone number**
Protective Services	306-966-5555

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)

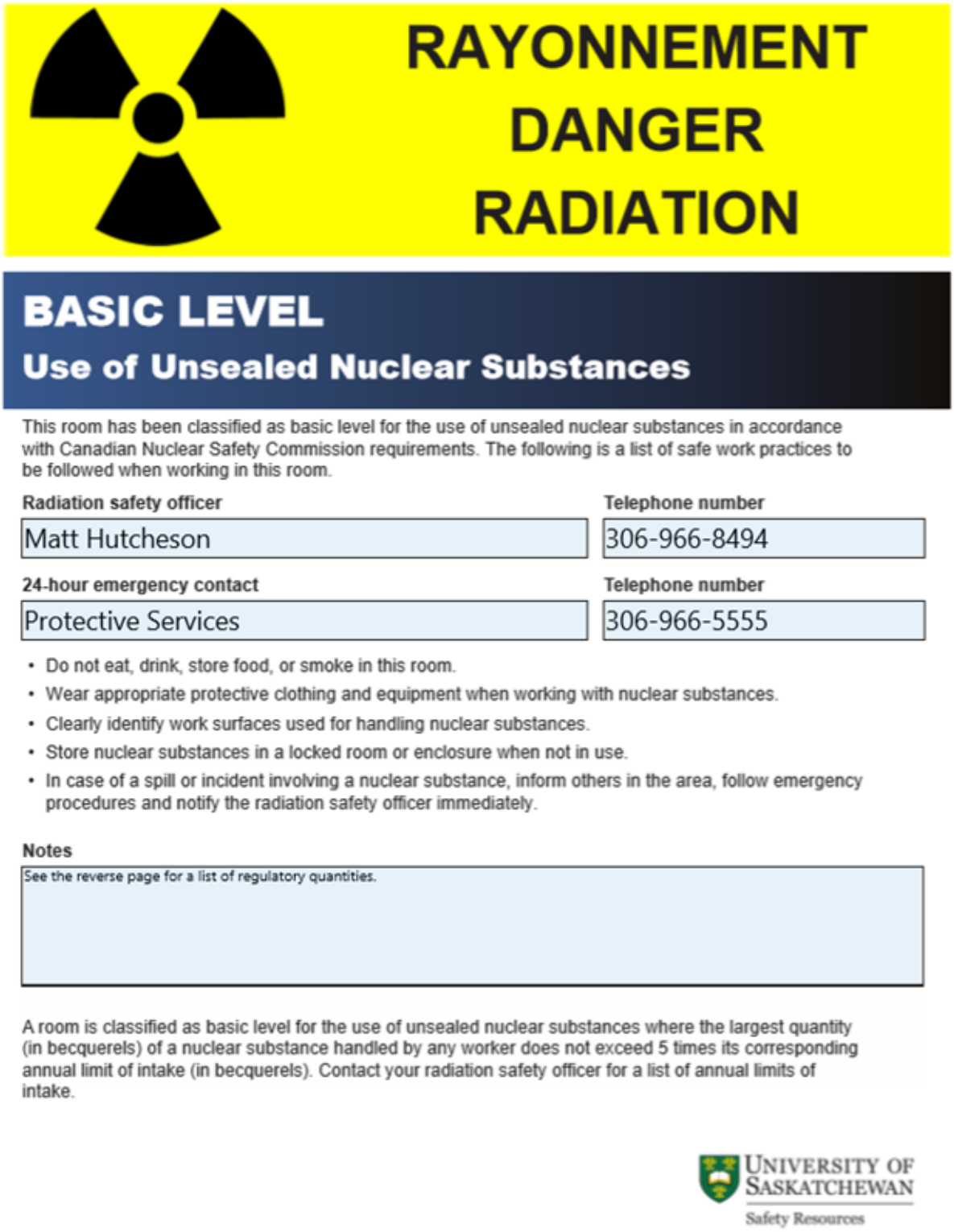
1. Clear the area. Persons not involved in the spill should leave the immediate area. Limit the movement of all personnel who may be contaminated until they are monitored.
2. If the spill occurs in a laboratory, leave the fume hood running to minimize the release of volatile nuclear substances to adjacent 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 RSO shall notify the CNSC as required by section 16 of the *Radiation Protection Regulations*.

14 Regulatory Quantities for Typical Radionuclides

Radionuclide	Class	Exemption Quantity	ALI Estimate (Inhalation)	ALI Estimate (Ingestion)	Basic Level Lab	Intermediate Level Lab	High Level Lab	Wipes Controlled Area (Bq/cm2)	Wipes Public Area (Bq/cm2)
Ac-225	A	1 kBq		830 kBq	4.15 MBq	41.5 MBq	415 MBq	3	0.3
Bi-213	A	1 kBq		100 MBq	500 MBq	5 GBq	50 GBq	3	0.3
C-11	C	1 MBq	9.1 GBq	830 MBq	4.2 GBq	41.7 GBq	417 GBq	300	30
C-14	C	10 MBq	3.1 GBq	34 MBq	170 MBq	1.7 GBq	17 GBq	300	30
Ca-45	C	10 MBq	8.7 MBq	26 MBq	43.5 MBq	435 MBq	4.35 GBq	300	30
Cd-109	C	1 MBq	2.1 MBq	10 MBq	10.5 MBq	105 MBq	1.05 GBq	300	30
Cl-36	C	1 MBq	3.9 MBq	22 MBq	19.5 MBq	195 MBq	1.95 GBq	300	30
Co-57	C	1 MBq	33 MBq	95 MBq	165 MBq	1.65 GBq	16.5 GBq	300	30
Co-58	B	1 MBq	12 MBq	27 MBq	60 MBq	600 MBq	6 GBq	30	3
Co-60	A	100 kBq	1.2 MBq	5.9 MBq	6 MBq	60 MBq	600 MBq	3	0.3
Cr-51	C	10 MBq	560 MBq	530 MBq	2.65 GBq	26.5 GBq	265 GBq	300	30
Cs-137	A	10 kBq	3 MBq	1.5 MBq	15 MBq	150 MBq	1.5 GBq	3	0.3
Cu-64	C	1 MBq	130 MBq	170 MBq	650 MBq	6.5 GBq	65 GBq	300	30
Cu-67	B	1 MBq	34 MBq	59 MBq	170 MBq	1.7 GBq	17 GBq	30	3
F-18	C	1 MBq	220 MBq	410 MBq	1.1 GBq	11 GBq	110 GBq	300	30
Fe-55	C	1 MBq	22 MBq	61 MBq	110 MBq	1.1 GBq	11 GBq	300	30
Ga-67	C	1 MBq	71 MBq	110 MBq	355 MBq	3.55 GBq	35.5 GBq	300	30
Ga-68	C	10 kBq	250 MBq	200 MBq	1 GBq	10 GBq	100 GBq	300	30
Ge-68	C	100 kBq	2.5 MBq	15 MBq	75 MBq	750 MBq	7.5 GBq	300	30
H-3	C	1 GBq	1 GBq	1 GBq	5 GBq	50 GBq	500 GBq	300	30
I-123	C	10 MBq	182 MBq	95 MBq	475 MBq	4.75 GBq	47.5 GBq	300	30
I-124	A	10 kBq	3.2 MBq	1.5 MBq	7.5 MBq	75 MBq	750 MBq	3	0.3
I-125	C	1 MBq	2.7 MBq	1.3 MBq	6.5 MBq	65 MBq	650 MBq	300	30
I-131	C	1 MBq	1.8 MBq	910 kBq	4.55 MBq	45.5 MBq	455 MBq	300	30
In-111	C	1 MBq	65 MBq	69 MBq	325 MBq	3.25 GBq	32.5 GBq	300	30
Lu-177	C	10 MBq	18 MBq	38 MBq	90 MBq	900 MBq	9 GBq	300	30
Mo-99	B	1 MBq	18 MBq	17 MBq	85 MBq	850 MBq	8.5 GBq	30	3
Na-22	A	1 MBq	10 MBq	6.3 MBq	31.5 MBq	315 MBq	3.15 GBq	3	0.3
Ni-63	C	100 MBq	38 MBq	130 MBq	190 MBq	1.9 GBq	19 GBq	300	30
O-15	C	1 GBq	41 GBq	3.7 GBq	18.5 GBq	185 GBq	1850 GBq	300	30
P-32	C	100 kBq	6.9 MBq	8.3 MBq	34.5 MBq	345 MBq	3.45 GBq	300	30
P-33	C	100 MBq	15 MBq	83 MBq	75 MBq	750 MBq	7.5 GBq	300	30
Pb-210	A	0.01 MBq	18 kBq	29 kBq	90 kBq	900 kBq	9 MBq	3	0.3
Po-210	A	0.01 MBq	9.1 kBq	83 kBq	45.5 kBq	455 kBq	4.55 GBq	3	0.3
Ra-223	B	0.1 MBq	3.5 kBq	200 kBq	17.5 kBq	175 kBq	1.75 MBq	30	3
Ra-226	A	10 kBq	1.7 kBq	71 kBq	8.5 kBq	85 kBq	850 kBq	3	0.3
Rb-86	B	0.1 MBq	15 MBq	7.1 MBq	75 MBq	750 MBq	7.5 GBq	30	3
Re-188	B	0.1 MBq	27 MBq	14 MBq	135 MBq	1.35 GBq	13.5 GBq	30	3
S-35	C	100 MBq	18 MBq	105 MBq	90 MBq	900 MBq	9 GBq	300	30
Se-75	B	1 MBq	12 MBq	7.7 MBq	60 MBq	600 MBq	6 GBq	30	3
Sm-153	B	1 MBq	29 MBq	27 MBq	145 MBq	1.45 GBq	14.5 GBq	30	3
Sr-90	B	10 kBq	260 kBq	710 kBq	1.3 MBq	13 MBq	130 MBq	30	3
Tc-99m	C	10 MBq	690 MBq	910 MBq	3.45 GBq	34.5 GBq	345 GBq	300	30
Th-232	A	10 kBq	690 Bq	91 kBq	3.45 kBq	34.5 kBq	345 kBq	3	0.3
U Natural	A	1 kBq	3.2 kBq	410 kBq	16 kBq	160 kBq	1600 kBq	3	0.3
U-234	A	10 kBq	2.9 kBq	410 kBq	14.5 kBq	145 kBq	1450 kBq	3	0.3
U-235	A	10 kBq	3.3 kBq	430 kBq	16.5 kBq	165 kBq	1650 kBq	3	0.3
U-238	A	10 kBq	3.5 kBq	450 kBq	17.5 kBq	175 kBq	1750 kBq	3	0.3
Y-90	B	100 kBq	12 MBq	7.4 MBq	60 MBq	600 MBq	6 GBq	3	3
Zr-89	B	10 kBq	27 MBq	25 MBq	135 MBq	1.35 GBq	13.5 GBq	3	0.3

15 Basic Level Lab Poster



RAYONNEMENT
DANGER
RADIATION

BASIC LEVEL

Use of Unsealed Nuclear Substances

This room has been classified as basic 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.

Radiation safety officer	Telephone number
Matt Hutcheson	306-966-8494
24-hour emergency contact	**Telephone number**
Protective Services	306-966-5555

- Do not eat, drink, store food, or smoke in this room.
- Wear appropriate protective clothing and equipment when working with nuclear substances.
- Clearly identify work surfaces used for handling nuclear substances.
- 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

See the reverse page for a list of regulatory quantities.

A room is classified as basic 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 5 times its corresponding annual limit of intake (in becquerels). Contact your radiation safety officer for a list of annual limits of intake.

University of Saskatchewan
Safety Resources

16 Intermediate Level Lab Poster

INTERMEDIATE LEVEL

Use of Unsealed Nuclear Substances

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.

Radiation safety officer	Telephone number
Matt Hutcheson	306-966-8494

24-hour emergency contact	Telephone number
Protective Services	306-966-5555

- 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.

17 High Level Lab Poster

HIGH LEVEL

Use of Unsealed Nuclear Substances

This room has been classified as high 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.

Radiation safety officer	Telephone number
Matt Hutcheson	306-966-8494

24-hour emergency contact	Telephone number
Protective Services	306-966-5555

- Restrict access to authorized workers only.
- 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 at all times.
- Clearly identify work surfaces used for handling nuclear substances.
- Work in a ventilated enclosure when required by the radiation safety officer or by your radiation protection program.
- 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 high 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 500 times its corresponding annual limit of intake (in becquerels). Contact your radiation safety officer for a list of annual limits of intake.

18 Containment Level Lab Poster

CONTAINMENT LEVEL

Use of Unsealed Nuclear Substances

This room has been classified as containment 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.

Radiation safety officer	**Telephone number**
Matt Hutcheson	306-966-8494
24-hour emergency contact	**Telephone number**
Protective Services	306-966-5555

- Restrict access to authorized workers only.
- Do not eat, drink, store food, or smoke in this room.
- Wear appropriate dosimetry at all times.
- Wear appropriate protective clothing and equipment at all times.
- Ensure a contamination meter capable of detecting the nuclear substances present in the lab is available and in working order.
- Avoid using non-essential or personal items in the room.
- Perform work only in the designated area or enclosure.
- Clearly identify work surfaces used for handling nuclear substances.
- Monitor hands for contamination frequently.
- Clearly identify areas where nuclear substances are handled.
- Monitor all items leaving the containment lab for contamination, in accordance with authorized procedures.
- 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.
- In case of ventilation failure exit the area until ventilation is restored.

Notes

A room is classified as containment 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 500 times its corresponding annual limit of intake (in becquerels). Contact your radiation safety officer for a list of annual limits of intake.