1 PURPOSE

1.1 The Canadian Nuclear Safety Commission (CNSC) issues licences issued to McMaster University establish possession limits for radioactive material. Under the McMaster University Radiation Safety Program, individual Project Supervisors are granted radioisotope permits that convey permission to possess and use radioactive materials, with specific limits on the quantities to be purchased, used and stored. The acquisition, use storage and transfer of radioactive materials must be carefully managed to ensure compliance with CNSC licences and internal radioisotope permits. Each permit holder is required to maintain an up to date inventory of all radioactive sources (sealed and unsealed) in their possession. This procedure provides specific guidance on fulfilling these requirements.

1.2 Implementation of these requirements provides assurance that radioactive materials will remain within the controls of the Radiation Safety Program and thereby protects staff and members of the public from the potential hazards of radioactive material. In addition, the University and individuals using radioactive material are protected from statutory liabilities which may arise from enforcement action by the CNSC and from civil liabilities which may arise from exposure to members of the public.

2 SCOPE

2.1 This procedure applies to all University activities involving the acquisition, use, storage, transfer and disposal of radioactive materials, except where specifically excluded below.

2.2 Activities within the scope of the licences for the McMaster Nuclear Reactor and the McMaster Accelerator Laboratory are managed under separate Radiation Safety Programs and are excluded from this procedure.

3 RELATED DOCUMENTS

3.1 RMM 700 Radiation Safety Program for Campus Laboratories

3.2 Radiation Safety Procedure: Authorization of Work with Radioactive Materials

3.3 Radiation Safety Procedure: Disposal of Radioactive Waste

3.4 Radiation Safety Procedure: Posting and Labelling
4  DEFINITIONS

4.1 Permit  A Permit to use nuclear substances or radiation devices issued by the McMaster University Health Physics Advisory Committee

4.2 HPAC  The McMaster University Health Physics Advisory Committee

4.3 CNSC  The Canadian Nuclear Safety Commission

4.4 Radiation Device  (a) a device that contains more than the exemption quantity of a nuclear substance and that enables the nuclear substance to be used for its radiation properties; and;

(b) a device that contains a radium luminous compound

4.5 Exemption Quantity  Generally, the quantity of nuclear substance above which activities must be licensed. Exemption Quantities are listed in Appendix A.

5  RESPONSIBILITIES

5.1 Project Supervisors are responsible for:

- implementing this procedure in all activities related to their project
- ensuring and verifying that inventory limits specified on the Permit are adhered to
- assigning trained personnel to carry out this procedure
- providing all equipment required to carry out this procedure
- maintaining records as specified

5.2 Authorized Radionuclide Users are responsible for:

6  complying with the requirements of this procedure

6.1 Health Physics, under the direction of the Senior Health Physicist, is responsible for:

A. approving acquisitions of radioactive material
B. maintaining a database of all acquisitions of radioactive material
C. auditing laboratories to verify implementation of this procedure.
D. training receiving personnel in the safe receipt of shipments of radioactive materials
Purchasing Resources personnel are responsible for:

E. placing all orders for nuclear substances and radiation devices according to the restrictions in Section 6.

Physical Plant Receiving Dock personnel are responsible for:

F. safe receipt and delivery of radioactive material delivered to the University

6.2 Hamilton Health Sciences receiving personnel are responsible for

G. safe receipt and delivery of radioactive material delivered to University permit holders in the McMaster University Medical Centre.

7 PROCEDURES

Prepare to Possess Radioactive Material

7.1.1 Radioactive material (nuclear substances and radiation devices) can only be acquired by individuals holding a valid Permit issued by the HPAC. See Radiation Safety Procedure: Authorization of Work with Radioactive Materials.

7.1.2 Prepare a binder or file to keep inventory information. The binder should contain the following, appropriately organized into sections:

- A copy of the current HPAC Permit.
- A section to hold the Unsealed Radioisotope Inventory Control Forms for current inventory. (See Attachment A).
- One copy of the Sealed Source Inventory Form (see Attachment B).
- A section with several copies of blank forms used in the lab, kept stocked to ensure they are available when needed.

Prepare a separate binder or file to contain the following:

- A section to hold the Unsealed Radioisotope Inventory Control Forms for inventory that has been used and disposed of over the previous three years.
- A section to hold all Radioactive Material Acquisition Approval forms used within the previous three years (see Attachment C), if any.

NOTE: Maintaining inventory records is a requirement of the Regulations, the licence and the University Radiation Safety Program. Maintaining a well organized, clear and legible set of inventory records is an important indicator of safety and compliance attitudes within the laboratory and will have a significant impact on internal and external compliance audits.

7.2 Purchase of Radioactive Material

7.2.1 Determine the quantity of radioactive material that is required. Refer to suppliers catalogues to determine the quantity that will be ordered.
Note: Purchases should be planned to minimize the quantity of material stored in a laboratory to the extent practical. For example, if two uses of 1mCi of $^3\text{H}$ are required but they are expected to be several months apart, purchase the material in two lots, close to the time that they will be used.

7.2.2 Review the current inventory of the laboratory (including material in storage and in use) and the expected usage between the time of placing the order and the time of delivery. Ensure that adding the intended purchase to your inventory will not cause you to exceed the inventory limits on the permit.

7.2.3 For unbound radioiodine purchases, review the current bioassay status of all personnel involved in the project and complete a Request to Acquire Unbound Radioiodine form (see Attachment D).

7.2.4 Submit a purchase order for the material for approval of Health Physics. Note the quantity, activity, radionuclide and the Permit Number on the purchase order. Purchase orders must be signed by the Permit Holder or a person designated in writing as having authority to order on behalf of the Permit Holder.

7.2.5 Health Physics will:

- Review the purchase to verify activity and radionuclide are within the limits specified on the permit.
- For unbound radioiodine, verify the bioassay status of the personnel involved in the project.
- Add the purchase to the database maintained to track annual purchases for compliance reporting.
- Verify that the purchase order is signed by an authorized person.
- Sign the Purchase Order, indicating approval.
- Forward the Purchase Order to the designated Purchasing Officer.

On receipt of a Purchase Order for radioactive material, the Purchasing Officer will:

- Verify that the RSO has approved it.
- Place the order.
- Ensure that any changes to the order are first approved by the RSO.

7.2.6 Standing orders for radionuclides are discouraged and will only be approved by Health Physics under exceptional circumstances where staff can demonstrate undue hardship and have satisfactorily demonstrated that adequate procedures are in place to control inventories and ensure safe receipt during holiday periods. The maximum period for a standing order is one year or to the expiry date of the permit, whichever is less. Standing orders for unbound radioiodine will not be approved under any circumstances.

7.2.7 Orders may not be placed directly with suppliers. All orders for radioactive materials must be placed through purchasing resources.

7.3 **Purchase of Radiation Devices**
7.3.1 The process for ordering radioactive materials in Section 6.2 shall be followed.
7.3.2 All radiation devices purchased or obtained must be certified by the CNSC.
7.3.3 For devices that have not been pre-certified, purchasers must be prepared to obtain certification prior to use of the device. Health Physics will assist in obtaining required certifications.

7.4 Other Acquisition of Radioactive Material

- Occasionally, radioactive material may be obtained by other than purchase from a radioisotope supplier. Examples may include sealed sources installed in a radiation device by a service contractor or samples provided a collaborative researcher.
- Any acquisition must be approved in advance by Health Physics and is subject to the requirements of this procedure.
- The Project Supervisor receiving the material shall follow the process outlined in this procedure, replacing the purchase order with a Radioactive Material Acquisition Approval form shown in Attachment C.

7.5 Receipt of Radioactive Material

7.5.1 Purchases are delivered to Receiving in MUMC or Campus Services Building.
7.5.2 Staff in receiving will visually inspect the package to verify that there is no indication of damage or material leaking from within.
7.5.3 Deliver the package without delay to the laboratory. The package must be delivered to a member of the staff in the lab.
7.5.4 On receiving the package, an Authorized User who is part of the lab personnel will:

- Always open and inspect packages immediately upon receipt.
- Wear a lab coat and disposable gloves while handling the package.
- Place package in the fume hood if possible, or in a designated radioisotope handling area.
- If an appropriate survey monitor is available, monitor the radiation fields around the package and compare with the units stated on the package. Note any discrepancies.
- Inspect the package for evidence of damage or leakage. Wipe test the package if damage or leakage is suspected.
- Remove packing slip.
- Open the outer package and check for possible damage to the contents, broken seals or discoloration of packing materials. If the contents appear to be damaged, isolate the package to prevent further contamination and notify Health Physics.
- If no damage is evident, remove the inner package or primary container and wipe test the container. If contamination is detected, monitor all packaging and if appropriate, all areas coming into contact with the package for contamination.
Contain the contamination, decontaminate and dispose in accordance with established practices for the lab.
Verify the radioisotope, the activity and other details with the information on the packing slip and with the purchase order. Log the radioisotope, activity, date received and any anomalies in the inventory control sheets.
Place radioisotope in appropriate storage container for effective shielding to avoid unnecessary direct contact.
Remove or deface radioactive labels on empty uncontaminated containers before disposing of them.
Report any anomalies (radiation levels in excess of the package labelling, incorrect transport index, contamination, leakage, short or wrong shipment) to the Project Supervisor and Health Physics.

7.5.5 Add the material to the laboratory inventory, as specified in Section 6.5 and Section 6.6.

7.6 **Maintaining an Inventory of Radioactive Material – Unsealed Sources**

- For each vial, kit, sample, or item received containing in excess on one EQ of radioactive material, initiate an Unsealed Radioisotope Inventory Control Form as shown in Attachment A.
- Assign a unique identifier to the sample, generally the lot number.
  
  NOTE: Review the lot numbers of other items in the lab inventory. Lot numbers are not unique to each vial. For long lived radionuclides and in cases where samples are ordered at high frequency, more than one vial may be in possession with the same lot number. If this occurs, make the sample identifier unique by adding “-A”, “-B” etceteras to the end of the lot number.
- If the material is aliquotted into separate vials, on receipt, prepare an Unsealed Radioisotope Inventory Control Form for each. Assign a unique inventory to each aliquot, as above.
- If the vial is to be kept in a container (such as a shielded “pig”) label the outside of the container with the radionuclide, the original activity, the date of receipt, and the unique identifier number assigned in 6.5.2.
- As material is used from each stock vial, update the inventory sheet. Normally, this should be done just before you remove the material from the vial for use. Record the amount of material being removed and the balance of material remaining, with appropriate units on a new line of the inventory form... Initial the line.
  
  Note: It is generally preferable to track material inventory in units of activity. Units of volume may be used, provided the original activity and volume of the solution or sample is recorded on the inventory control sheet. Lab personnel must be able to estimate the current activity at any time from the information recorded on the sheet. Transfers to waste must be recorded in units of activity in every case.
Once work is complete, indicate the disposition of the material (solid and/or liquid waste) on the same line of the form.

Normally, samples prepared from stock radioactive material do not need to be inventoried separately. The exception is when individual samples are prepared that will be retained in the lab for longer than one week and which contain more than ten Scheduled Quantities of activity per sample.

Note: Regardless of inventory requirements, samples must be appropriately labeled. See Radiation Safety Procedure: Safe Use of Radioisotopes.

When work with a stock solution is complete, dispose of the remaining material, record the disposal on the Unsealed Radioisotope Inventory Control Form, and transfer the form to the binder or file for disposed sources. See Radiation Safety Procedure: Disposal of Radioactive Waste.

**Sealed Sources**

7.6.1 For each sealed source or item received containing in excess on one scheduled quantity of radioactive material, update the laboratories Sealed Source Inventory Form as shown in Attachment B.

**Storage of Radioactive Material**

7.6.2 All radioactive material must be kept securely stored such that it is only accessible to authorized users.

7.6.3 The radioactive material must be kept locked when not attended. This may be achieved by:

- ensuring that the laboratory is always locked when unattended
- keeping material within a locked refrigerator, freezer or cabinet.
- keeping the material within a locked box

All areas, fridges, freezers, cabinets etcetera in which radioactive material is stored must be posted with a radiation warning sign.

7.7 **Transfer of Radioactive Materials Within the University**

7.7.1 Transfer of radioactive material between Permit Holders is allowed, subject to prior approval by Health Physics.

7.7.2 The Permit Holder receiving the material shall follow the process outlined in this procedure, replacing the purchase order with a Radioactive Material Acquisition Approval form shown in Attachment C.

7.7.3 The supplying laboratory must record the transfer in their inventory records. If an aliquot has been provided, show the usage as normal on the inventory sheet and write in “transferred to project XXX” on the appropriate line in the column labeled “Disposal”. If the entire remaining stock has been transferred, close out the form and write in bold letters “Transferred to project XXX” across the unused
portion at the bottom of the form. Note XXX is the number of the permit for the receiving lab. Retain a copy of the completed Radioactive Material Acquisition Approval form in the inventory records.

7.8 **External Transfer of Radioactive Material**

- Any transfer of radioactive material outside of the University must be approved in advance by Health Physics.
- The Health Physics will make all packaging, monitoring and shipping arrangements to ensure compliance with the Transport of Dangerous Goods Regulations, the Transport and Packaging of Nuclear Substances Regulations and export restrictions on the applicable licence.
- Receiving agencies will be required to provide their licence and a letter from their RSO approving the acceptance of the material prior to shipment.

8 **RECORDS**

8.1 The following records are to be retained by the Project Supervisor until disposal is authorized by Health Physics.

All inventory control forms

8.2 One year after the expiry of each licence, Health Physics shall notify the CNSC in writing of its intention to dispose of records created during the period of the licence. After a period of at least 90 days, Health Physics will advise project supervisors in writing of records which may be disposed.

9 **EXCEPTIONS**

9.1 All exceptions to this procedure require the approval of the Senior Health Physicist.

Attachments:

- Unsealed Radioisotope Inventory Control Form
- Sealed Source Inventory Form
- Radioactive Material Acquisition Approval Form
## UNSEALED RADIOISOTOPE INVENTORY CONTROL FORM

### LOCATION

- Permit Number: ____________________
- Permit Holder: ____________________
- Lab room number: ____________________
- Radioisotope location: ____________________

1 Vial/Kit or sample set per control sheet

### RADIOISOTOPE

- Isotope: ____________________
- Product: ____________________
- Supplier: ____________________
- Total activity: ____________________
- Volume: ____________________
- I.D. #: ____________________

### SHIPMENT

- Date received: ____________________
- Received by: ____________________
- Package information verified on receipt: ________ (initials)
- Package checked for Contamination: ________ (initials)
- Record and report any anomalies to the Project Supervisor and Health Physics.

<table>
<thead>
<tr>
<th>Date</th>
<th>Quantity used Units</th>
<th>Quantity remaining Units</th>
<th>Disposal Solid (μCi or KBq)</th>
<th>Disposal Liquid (μCi or KBq)</th>
<th>User’s Initials</th>
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Product holder (i.e. lead/plastic) checked for radioactive contamination and provided to Health Physics.

Final date of disposal: ____________________
Initials: ____________________
# SEALED SOURCE INVENTORY

<table>
<thead>
<tr>
<th>Radioisotope</th>
<th>Manufacturer / Lot Number</th>
<th>Reference Date</th>
<th>Activity</th>
<th>Physical Form of Source</th>
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- No Sealed sources are in the possession of this laboratory

# Radiation Devices

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<tr>
<th>Isotope</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Serial Number</th>
<th>Activity</th>
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</table>

- No radiation devices are incorporated in devices in possession of this laboratory
# Radioactive Material Acquisition Approval Form

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Activity</th>
<th>Receiving Labs Possession Limit</th>
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**From:**

Institution:  

Permit Number:  

Approval of Permit Holder:  

Signature of Permit Holder:  

Contact Information for RSO:\footnote{1}

**To:**

Permit Number:  

Permit Holder:  

Signature of Permit Holder:  

Date Of Transfer:  

HP Approval:  

Signature:  

Date:  

Conditions:  

---

\footnote{1} If Source of material is another Institution, provide contact information for the RSO at that location
Request to Acquire Unbound Radioiodine

The CNSC licence conditions are stated below and apply to any workers using more than 2 MBq (0.05 mCi) of radioiodine. Failure to undergo screening and bioassay as required by licence conditions can lead to suspension of radioiodine use.

<table>
<thead>
<tr>
<th>Confirmation of Compliance</th>
<th>CNSC Licence Conditions</th>
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<tbody>
<tr>
<td>I certify that I am in compliance with the licence conditions stated here, and that I will not knowingly provide unbound radioiodine to another user.</td>
<td>(a) Every person who in any 24-hour period uses a total quantity of Iodine 124, Iodine-125 or Iodine-131 exceeding:</td>
</tr>
<tr>
<td></td>
<td>i) 2 MBq in an open room;</td>
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<td></td>
<td>ii) 200 MBq in a fume hood;</td>
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<td></td>
<td>iii) 20 000 MBq in a glove box; or</td>
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<td>iv) any approved quantity in any room, area or enclosure authorized in writing by the CNSC</td>
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<td>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.</td>
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<td>(b) Every person who in any 24-hour period uses a total quantity of Iodine 123 exceeding:</td>
</tr>
<tr>
<td></td>
<td>i) 200 MBq in an open room;</td>
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<tr>
<td></td>
<td>ii) 20 000 MBq in a fume hood;</td>
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<tr>
<td></td>
<td>iii) 2 000 000 MBq in a glove box; or</td>
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<td></td>
<td>iv) any approved quantity in any room, area or enclosure authorized in writing by the CNSC</td>
</tr>
<tr>
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<td>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.</td>
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<td></td>
<td>(c) Every person who is involved in a spill of 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.</td>
</tr>
<tr>
<td></td>
<td>(d) 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.</td>
</tr>
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(2046-17)

Thyroid Screening
Screening for internal Iodine 123, Iodine 124, Iodine 125 and Iodine 131 shall be performed using:

a) a direct measurement of the thyroid with an instrument that can detect 1 kBq of Iodine 124, Iodine-125 or Iodine-131, or 10 kBq of Iodine 123; or

b) a bioassay procedure approved by the Commission or a person authorized by the Commission.

(2600-4)