Canada's Nuclear Regulator

Nuclear Substances and Radiation Devices

# Licence Application Guide: Nuclear Substances and Radiation Devices

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**Licence Application Guide: Nuclear Substances and Radiation Devices**
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## Document availability

This document can be viewed on the CNSC website at nuclearsafety.gc.ca. To request a copy of the document in English or French, please contact:

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# Preface

This regulatory document is part of the CNSC's Nuclear Substances and Devices series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

In accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under the NSCA, individuals wanting to possess, use, store, transfer, import, export, service and abandon nuclear substances and radiation devices require a licence issued by the Canadian Nuclear Safety Commission (CNSC). The NSCA prohibits the CNSC from issuing a licence unless the CNSC considers that the applicant is qualified, has made adequate provision for the protection of the environment and the health and safety of persons, and otherwise meets the requirements of the provisions of the NSCA and the Regulations.

Regulatory document REGDOC-1.6.1, *Licence Application Guide: Nuclear Substances and Radiation Devices*, sets out guidance for applicants in the preparation and submission of an application for a licence to carry out activities related to nuclear substances and radiation devices. REGDOC 1.6.1 will document and clarify the CNSC's current expectations. It is not expected to result in new or increased obligations for licensees.

REGDOC-1.6.1 supersedes RD/GD-371 *Licence Application Guide: Nuclear Substances and Radiation Devices* which was published in November 2011.

Guidance contained in this document exists to inform the applicant, to elaborate further on requirements or to provide direction to licensees and applicants on how to meet requirements. It also provides more information about how CNSC staff evaluate specific problems or data during their review of licence applications. Licensees are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements.

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# Licence Application Guide: Nuclear Substances and Radiation Devices

## 1. Introduction

### 1.1 Purpose

This document provides guidance to assist prospective/current licensees on how to complete and submit an application for a Canadian Nuclear Safety Commission (CNSC) licence for nuclear substances and radiation devices in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under the NSCA.

### 1.2 Scope

These licence requirements are based on the NSCA and its regulations, which are administered by the CNSC, the organization that has regulatory authority for all nuclear facilities and uses of radioactive materials in Canada. The NSCA authorizes the CNSC to issue licences to applicants who, in the opinion of the CNSC:

- are qualified to undertake the proposed licensed activity
- will make adequate provisions for the health and safety of persons, the protection of the environment and maintenance of national security
- will take measures necessary to implement international obligations to which Canada has agreed

Each application should demonstrate that the applicant is capable of and committed to complying with all requirements under the NSCA, including maintaining an effective radiation safety program as required by the *Radiation Protection Regulations*. This guide will assist an applicant to provide the information needed by the CNSC to make this determination.

For comprehensive information regarding nuclear regulatory matters, applicants and licensees are directed to consult the appropriate documentation on Canadian legislation, regulations, public policy, industry guidelines and information.

### 1.3 Relevant legislation

Legislation relevant to this guide is as follows:

1. *Nuclear Safety and Control Act*, Sections 24, 26 and 27
2. *General Nuclear Safety and Control Regulations*, Sections 3, 4, 5, 6, 7, 10, 12, 15, 17, 27, 28, 29, and 31
3. *Radiation Protection Regulations*, Sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 20, 21, 22 and 24.
4. *Nuclear Substances and Radiation Devices Regulations*, Sections 3, 4, 5, 6, 7, 8, 9, 11, 16, 17, 18, 20, 22, 23, 24, 30, 31, 32, 33, 34, 35, 36, 37, 38 and Schedule 1
5. *Packaging and Transport of Nuclear Substances Regulations, 2015*, Sections 19, 25, 26, 29, 37, 40, and 42
6. *Nuclear Security Regulations*, Sections 3, 4, and 5
7. *Nuclear Non-proliferation Import and Export Control Regulations*, Section 3
8. *CNSC Cost Recovery Fees Regulations*, Part 3

# 2. Process

## 2.1 Applying for a new licence or renewing an existing licence

### 2.1.1 General

An applicant must complete this licence application when:

- requesting a new licence
- renewing an existing CNSC licence

for nuclear substances and radiation devices for any use-type referenced in this licence application guide. See appendix B for a list of all use-types and their associated risk rankings.When preparing a licence application for a low-risk as identified in appendix B, see section 3 for a summary of the application submission requirements.

When renewing an existing CNSC licence, the applicant must complete in full all relevant sections of the application.

The application may incorporate, by reference, information previously submitted in the most recent Annual Compliance Report (ACR).

### 2.1.2 Submission

Before submitting an application to the CNSC for a new licence or any renewal of an existing CNSC licence, the applicant must ensure the following:

- the application is complete and signed in all required locations
- all supporting documents are attached, clearly identified and cross-referenced
- a copy of the applicant's most recent Radiation Safety Manual (RSM) is attached
- proof of the applicant's legal status is attached
- information for the applicant's financial contact person is included, as well as the designated payment, if the application is subject to the *Canadian Nuclear Safety Commission Cost Recovery Fees Regulations*

Provide one copy of the completed form, signed and dated, to the CNSC at:

Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
280 Slater Street
Ottawa ON, K1P 5S9

The completed form and supporting documentation can be emailed to forms-formulaires@cnsc-ccsn.gc.ca. Only uncompressed electronic files may be submitted to the CNSC.

**Documents submitted electronically must include all required signatures.**

Information sent over the Internet or by email without the use of encryption may not be secure. Therefore, please do not send personal information (for example, copies of a driver's licence or passport) by email.

A complete copy of the application should be kept by the applicant for their records. All information submitted is subject to the provisions of the *Access to Information Act* and the *Privacy Act* unless specifically exempted.

### 2.2 Amending a licence

An amendment is a modification to an existing licence in order to change information, equipment and licensed activities.

When requesting an amendment to an existing CNSC licence, provide detailed information about the following:

- changes to nuclear substances and/or radiation devices
- changes to the location of use and/or storage
- changes to personnel (licence or finance contact information, i.e. radiation safety officer (RSO), applicant authority (AA), alternate RSO, etc.)
- changes to policies and procedures

All requests for licence amendments must be made in writing by the designated signing authority. Please provide the above information by fax to 613-995-5086 or by contacting your Licensing Specialist at 1-888-229-2672.

### 2.3 Revoking a licence

When requesting the revocation of an existing CNSC licence the applicant must complete the form for revoking a licence entitled: Request for Revocation and Record of Disposition of Nuclear Substances and Radiation Devices. An electronic version of the form can be found on the CNSC website. The completed forms may be submitted to the CNSC email address forms-formulaires@cnsc-ccsn.gc.ca.

### 2.4 Transferring a licence

When requesting the transfer of an existing CNSC licence, the applicant must complete the appropriate licence transfer form. The completed form may be submitted to the CNSC by mail or by email at forms-formulaires@cnsc-ccsn.gc.ca.

## 3. Completing an Application for Low-risk Uses of Nuclear Substances and Radiation Devices

This section applies to applications for a CNSC licence for the following low-risk uses of nuclear substances and radiation devices:

- X-ray fluorescence (use-type 880)
- electron capture detection (use-type 881)
- bone mineral analysis (use-type 883)
- beta backscatter gauges (use-type 886)
- electronic component testing (use-type 888)
- research – maximum sealed nuclear substance activity of 50 MBq (use-type 889)
- industry – maximum sealed nuclear substance activity of 100 MBq (use-type 895)
- dew point detection (use-type 896)
- static elimination (use-type 897)

- static detection (use-type 898)
- radioluminescence (use-type 899)
- surge voltage protection (use-type 900)
- radioactive luminous compounds (use-type 901)
- remote blade inspection (use-type 902)
- teaching – maximum sealed nuclear substance activity of up to 50 MBq (use-type 907)
- radioactive check sources (use-type 919)
- liquid scintillation counters (use-type 940)

Please see appendix B for a list of all use-types and their associated risk-ranking.

### 3.1 Relevant parts of REGDOC-1.6.1

Only the following parts of REGDOC-1.6.1 and the application form apply to applications for low-risk use-types:

- Part A – Applicant information (page 5 of REGDOC-1.6.1)
- Part B – Purpose of the proposed licence (page 7 of REGDOC-1.6.1)
- Part E.6 – Low-risk use of nuclear substances and radiation devices (page 29 of REGDOC-1.6.1)

Only these three sections must be completed when submitting an application for a low-risk use-type.

### 3.2 Application submission

The submission for an application for a licence for a low-risk use-type must include:

- a complete application signed in all required locations (Part A, Part B and Part E.6)
- any supporting documents (including, but not limited to the appropriate Applicant Authority form and, if applicable, the Landlord/Owner Acknowledgement Form)
- proof of the applicant's legal status (i.e., certificate of incorporation or equivalent document)
- information for the applicant's financial contact person is included, as well as the designated payment, if the application is subject to the *Canadian Nuclear Safety Commission Cost Recovery Fees Regulations*

The applicant must ensure that the information provided on the form and in the attached supporting documents is clear, precise, accurate, and complete. Supporting documentation should clearly reference the part of the application form to which the information pertains. Provide the document titles, as well as any cross-references, which should be consistent with the numbered parts of the application.

CNSC staff can provide additional information upon request; applicants can contact a CNSC Licensing Specialist at:

- toll-free telephone number: 1-888-229-2672
- fax number: 613-995-5086
- email: licence-permis@cnsc-ccsn.gc.ca

## 4. Completing an Application for Medium and High-risk Uses of Nuclear Substances and Radiation Devices

The applicant must ensure that the information provided on the form and in the attached supporting documents is clear, precise, accurate, and complete. Supporting documentation should clearly reference the part of the application form to which the information pertains. Provide the document titles, as well as any cross-references, which should be consistent with the numbered parts of the application.

A copy of the most recent version of the Radiation Safety Manual must be included for all high and medium risk use-type applications. Please see appendix B for a list of all use-types and their associated risk-ranking.

CNSC staff can provide additional information upon request; applicants can contact a CNSC Licensing Specialist at:

- toll-free telephone number: 1-888-229-2672
- fax number: 613-995-5086
- email: licence-permis@cnsc-ccsn.gc.ca

## 5. Part A – Applicant information

In this part of the application, the CNSC requires specific information on the entity to be licensed, including complete contact information and proof of legal status.

### A.1 Type of request

Mark the relevant box and indicate if this application is to obtain:

- a new licence
- renewal of an existing licence

For renewals, indicate the current licence number.

### A.2 Language of licence

Identify the official language(s) preferred for the printed copy of the licence.

### A.3 Public access to information

Indicate whether or not any part of this application is subject to a request for exemption from the CNSC policy on public access to the information encompassing the licence. A request for exemption should be made in writing to the CNSC detailing the applicant's basis and reasons for such an exemption.

### A.4 Name of applicant

In this section, provide the legal name of the person, institution or corporation who will be referred to as the "licensee" on the issued licence.

Indicate the name as it appears on the proof of legal status documentation, such as the proof of incorporation or sole proprietorship.

An individual may be the Applicant only if they will be solely responsible for the licence and are not a corporation or institution.

The *General Nuclear Safety and Control Regulations* require notification to the CNSC in the event of a change in the applicant's name during the valid period of the licence.

### A.5 Eligibility of applicant

The *Nuclear Safety and Control Act* (NSCA) allows for a "person" to be authorized to conduct licensed activities. In order to ensure the necessary accountability and responsibility, the Applicant must be a "person", which is a natural person (an individual), a government or public institution incorporated through enabling legislation or a corporate person (a corporation). General or limited partnerships are not eligible to be an Applicant since the CNSC cannot license a partnership under the NSCA, as they do not specifically meet the legal definition of a "person".

The applicant must indicate whether the application is from a natural person (individual/sole proprietorship), a public institution or a corporation (incorporated company).

A sole proprietorship is where the business is owned and operated by one individual and where there is no legal distinction between the owner and the business.

A public institution is any non-incorporated government department or agency, any non-incorporated public institution or any other site which is set up under enabling legislation.

An incorporated company is any incorporated business, institution or company where incorporation is carried out under federal or provincial authorization.

Append information that establishes the applicant as a "person" for the purpose of this application.

### A.6 Proof of legal status

If the Applicant is a corporation it needs to submit proof of incorporation and an official corporation profile report which sets out various information about the corporation, including:

- corporation's legal name
- corporation number
- date of incorporation
- corporate status (showing it is still active)
- registered office address
- corporate history (providing details such as corporate amalgamations, corporate name changes)

An official corporation profile report can be obtained from Industry Canada for federally incorporated companies under the *Canada Business Corporations Act*, R.S.C., c. C-44 and is referred to as a "Strategis Report". For provincially incorporated corporations, similar corporation profile reports are available and for more information you should contact the provincial department where your corporation was registered.

The *General Nuclear Safety and Control Regulations* require notification to the CNSC in the event of a change in the applicant's legal status during the valid period of the licence.

For Public Institution, specify the name of the enabling legislation (act) under which the institution was created.

The Business Number (BN) identifier is assigned to each business or other entity by the Canada Revenue Agency (CRA).

### A.7 Financial contact person

Provide the name and contact information of the person to be contacted regarding payment of fees for the licence.

### A.8 Financial guarantees

The NSCA allows for the Commission or Designated Officers to request a financial guarantee. A financial guarantee assures there will be sufficient funds available for the safe completion of licensed activities, including decommissioning, clean-up and disposal of nuclear substances. Please contact CNSC staff for further information regarding financial guarantees, including how it may apply to the proposed licence.

### A.9 Description of the proposed licence

Indicate which use-types are the subject of this application. If using this application to apply for more than one use-type, please indicate all that apply. Appendix B: Use-types and Risk Rankings contains a list of use-types with risk rankings.

## 6. Part B – Purpose of the proposed licence

In this section, identify the proposed activities and the locations which will be associated with the licensed activities of the nuclear substances and radiation devices. Refer to the NSCA for all activities that require a licence. Also, provide details about the nuclear substances and radiation devices that are to be licensed. List the nuclear substances under the following categories: unsealed, sealed, and radiation devices. All quantities should be expressed in SI units. The base is Becquerels. See Appendix A: Measurement Conversion Table for a list of unit conversions.

### B.1 Head office (or agent for service in Canada)

Provide the legal, physical address of the applicant's head office, including the complete street name and number, and rural route number if appropriate, city, province or territory and postal code.

A post office box address is not acceptable for a head office address.

Non-Canadian applicants must have and maintain an agent for service in Canada. An agent for service must be either an individual of a minimum18 years of age that is a resident of Canada or a corporation having its head office or registered office in Canada.

An agent for service within Canada by non-Canadian applicants/licensees facilitates reliable access by the CNSC to a party qualified to receive information and legal process in Canada.

A confirmation letter from the agent for service is required.

Licensees must notify the CNSC within 15 days of any changes to this information.

### B.2 Mailing address

Provide the mailing address, if it is different than the head office address, including the complete street name and number, and rural route number if appropriate, city, province or territory, and postal code.

If no address is provided here, a licence issued in response to the application will be mailed to the head office address. A post office box is acceptable as a mailing address.

Licensees must notify the CNSC within 15 days of any changes to this information.

### B.3 Applicant authority

Complete and sign the appropriate Applicant Authority Form. There are separate forms for Public Institutions, Incorporated Companies and Sole Proprietorships. These forms are part of the application form package and can be found on the CNSC website.

A member of senior management must sign to certify that they have been designated as the Applicant Authority and to acknowledge that the designated person's signature binds the applicant. Provide the name, title, address, email address and telephone number of the individual who signed the application as the applicant authority.

The Applicant Authority understands that all statements and representations made in this application and on supplementary pages are binding on the applicant. The Applicant Authority also acknowledges that they have full legal and financial responsibility for the licence.

The appropriate Applicant Authority form must be completed in full and include a clear photocopy of a government issued identification bearing the image and signature of the person designated as the Applicant Authority.

Please note that a health card is not an acceptable form of government issued identification.

Regulations require that the licensee notify the CNSC within 15 days of a change in the Applicant Authority.

### B.4 Licence activities

Identify all activities that the Applicant intends to conduct, related to the standard use-types. These can include one or more of:

- possess
- use
- store
- produce
- transfer
- import
- export
- service
- abandon

Please consult the glossary for a definition of these activities.

Throughout the application, additional information is requested about these activities. This application provides the basis for the licence, which will consequently authorize only specified activities.

If import or export is requested additional justification for these activities will be required.

### B.5 Location

Provide the locations for the applicant's storage and/or use of nuclear substances and radiation devices.

Locations may be of three types:

- civic address (complete with street number and postal code)
- GPS coordinates (in the form XX.XXXXN, XXX.XXXXW)
- field locations (e.g., throughout Canada, throughout the province of Alberta, or within the city of Toronto)

A civic address should, as a minimum, consist of at least a street number, street name, municipality and postal code. A post office box is not acceptable as a civic address or a principal storage location.

GPS coordinates may be used for locations without a civic address. When referencing GPS coordinates, ensure that they are presented using four decimal places and that the negative symbol is not included; e.g., 12.3456N, 123.4567W.

A field location may be requested when the licensed activity will be conducted at one or more sites within a defined geographic region. Information must be provided on specific locations of use and/or storage of nuclear substances and radiation devices within field locations where use and/or storage occur for more than 90 days in a calendar year.

For all locations, if premises are rented or leased, include a completed and signed copy of the Landlord/Owner Acknowledgement Form. This form is designed to ensure the landlord or owner is aware of proposed activities at that site and that there are no objections to licensing that site for use or storage of nuclear substances and radiation devices. Failure by the landlord or owner to sign the form does not remove the landlord or owner from their responsibilities and obligations under the NSCA.

### B.6 Unsealed sources

If applying for more than one use-type, please include a separate table for each use-type.

***Nuclear substances:***

Provide the name or symbol and mass number of each nuclear substance in possession as an unsealed source; for example, P-32 and S-35.

***Maximum activity in possession:***

For each radionuclide, provide the maximum activity required at any one time. This activity is the total of each unsealed nuclear substance in use, storage and waste.

***Total activity to be acquired per year:***

Provide an estimate of the activity of the nuclear substances that will be acquired per year. This will give the CNSC an indication of the size and scope of the applicant's operations.

Please ensure that all activities are provided in SI units; the base is in becquerels. See Appendix A: Measurement Conversion Table for a list of unit conversions.

Append additional inventory list as required.

### B.7 Sealed sources

If applying for more than one use-type, please include a separate table for each use-type.

***Nuclear substances:***

Provide the name or symbol and mass number of each sealed nuclear substance in possession as a sealed source; for example, Co-57 and Cs-137.

***Maximum activity contained in any single sealed source*:**

Sealed nuclear substances are licensed according to the maximum individual activity rather than sums of total activity. For each radionuclide, provide the largest quantity contained in an individual sealed source. For example, if there are ten sealed sources of various quantities of Co-57 and the largest is 100 MBq, then the maximum quantity per source for Co-57 is 100 MBq.

***Number of sealed sources greater than 50 MBq to be acquired (estimate):***

Provide the number of sealed sources that have an activity of nuclear material greater than 50 MBq that is expected to be in the applicant's possession when conducting the licensed activities.

Append additional inventory list as required.

Please ensure that all activities are provided in SI units; the base is in becquerels. See Appendix A: Measurement Conversion Table for a list of unit conversions.

### B.8 Radiation devices

If applying for more than one use-type, please include a separate table for each use-type.

Provide information about sealed sources in radiation devices. Radiation devices are listed separately from other sealed sources. Append additional inventory list as required.

***Nuclear substances:***

Provide the name or symbol and mass number of each radionuclide in possession as a radiation device; for example, Cs-137 and Am-241.

***Maximum activity:***

Provide the maximum activity contained in the radiation device.

***Manufacturer of device:***

Provide the name of the manufacturer of the device.

***Name and model of radiation device:***

Provide the name and model number of the radiation device and the CNSC certification number.

***Number of Device:***

Provide the number/quantity of each type of radiation device listed.

Please ensure that all activities are provided in SI units; the base is in becquerels. See Appendix A: Measurement Conversion Table for a list of unit conversions.

## 7. Part C – Radiation protection program authority

**Please note that this part is not required to be completed for low-risk use-types. Refer to appendix B for risk ranking of use-types. For low risk use-types proceed to E.6**

In this part of the application, contact information is requested for each person who has authority and responsibility over each level of the radiation safety program. Information should clearly indicate who the person is, his/her job function/title and his/her responsibility and their authority to act as part of the radiation protection program.

### C.1 Management structure

Append detailed information about the applicant's management and organization structure that relates to radiation safety matters. The information provided includes:

- the names and position titles of everyone responsible for the management and control of the nuclear substances and radiation devices under any licensed activity encompassed by the CNSC licence
- a copy of the organization chart, which shows the applicant's lines of reporting for all radiation safety matters
- the management structure, which should clearly indicate the function, responsibility and authority of each level of the management structure, as well as management control over work practices. The expectation is that each level of worker is accountable to management and that management is ultimately responsible for the conduct of licensed activities

If the applicant has more than one location, the organization chart should name the workers at each location who report to the radiation safety officer on radiation safety matters.

### C.2 Applicant authority's designation of the radiation safety officer (RSO)

The designation of radiation safety officer (RSO) is given to the person responsible for the management and control of the licensed activity and the nuclear substances and radiation devices. The RSO is the person the CNSC will contact about radiation safety and compliance matters. The RSO must:

- have sufficient knowledge, experience and resources to effectively manage the radiation protection program
- have sufficient time to respond to day-to-day situations that may arise as well as ongoing program oversight
- understand the nature of the licensed activity and be fully knowledgeable of applicable regulations
- understand the information requirements of the licence application and the reporting requirements for notifying the CNSC of incidents and events

The CNSC requires the RSO's qualifications be included in a licence application and will determine if the RSO has sufficient knowledge and expertise with regards to the applicant's proposed activities. The RSO may be a consultant hired by the applicant to carry out this role, but must be clearly designated by the applicant authority to do so; this information must be communicated to the CNSC as part of the licence application process.

Applicants must provide the name, title, address, telephone number, fax number and email address of the RSO.

The RSO must be at the site of the licensed activity or reasonably be able to attend to the site of licensed activity as required. Alternate RSOs may be utilized where a licensee has multiple locations of licensed activity.

Applicants must provide the signature of the Applicant Authority designating the RSO.

Unless otherwise noted by the applicant authority, the RSO will be considered to have been designated the authority to act for the applicant and has signing authority for all matters encompassed by the CNSC licence.

Regulations require that the licensee notify the CNSC within 15 days of a change in RSO or in the RSO position.

A copy of the form "Request to appoint a new Radiation Safety Officer", which can be used to assist applicants in providing the required information to the CNSC can be found on the CNSC website.

### C.3 Radiation safety officer: job description and qualifications

Append the job description for the applicant's RSO, including roles and responsibilities, qualifications and authority. Applicants should also append a copy of the RSO's qualifications.

The job description should include the time and other resources allotted to the RSO to carry out relevant duties and make provisions for work to be performed according to all regulatory requirements. See Appendix C: Qualifications and Duties of the Radiation Safety Officer for additional information regarding the qualifications and duties of the RSO.

A copy of the RSO training course certificate should be submitted. For Industrial Radiography (use-type 812), a copy of the Source Retrieval Course Training Certificate is also required.

If the applicant's organization has many locations, it will be necessary to provide the names and copies of the job descriptions of any site-specific assistant RSOs.

### C.4 RSO acknowledgement

Once an individual has been designated as the RSO by the applicant authority, the individual identified as RSO must sign a consent form acknowledging his/her willingness to be designated as the applicant's RSO and acceptance of the responsibilities described in the submitted job description.

### C.5 Alternate RSO/site contacts

Please provide the name(s) of any alternate RSOs/site contacts, their contact information and their qualifications.

### C.6 Representative(s) of the Applicant

Representatives of an applicant can be delegated signing authority, specifically to request amendments to a licence. The CNSC must be aware of all persons, pursuant to the *General Nuclear Safety Control Regulations*, who have the authority to act for the licensee. The applicant must provide a list of all persons who have been designated as their representative and as such have signing authority.

In most cases, the RSO is also the primary signing authority and can act for the applicant for all matters encompassed by the CNSC licence.

If the RSO is not a signing authority or there are additional persons authorized to act for the applicant, provide the name and title of each person who has been designated the authority to act for the applicant and who has signing authority for all matters encompassed by a CNSC licence. The primary signing authority will receive all correspondence from the CNSC.

By signing this section of the application, this individual certifies his/her acceptance to be designated as the signing authority. Any limitations on authority, if applicable, for each designated person should be indicated in the application.

Licensees must notify the CNSC within 15 days of any change in a signing authority during the term of the licence.

Applicants must provide the signature of the Applicant Authority to designate any person as a signing authority.

## 8. Part D – Radiation safety program policies and procedures

**Please note that this part is not required to be completed for low-risk use-types. Refer to appendix B for risk ranking of use-types. For low risk use-types proceed to E.6.**

In this part of the application, the applicant must provide information regarding its radiation safety program.

All radiation safety programs should be documented and have detailed policies and procedures. Policies and procedures should be prepared under the supervision of the RSO and approved by senior management. Policies and procedures should be incorporated into a radiation safety manual that is readily available to all workers.

**A copy of the applicant's current radiation safety manual must be submitted as part of the completed application form.**

### D.1 As Low As Reasonably Achievable (ALARA) program

Append the policy and procedures that ensure that the radiation protection program meets regulatory obligations to maintain radiation exposures in accordance with the "As Low As Reasonably Achievable" (ALARA) principle, through:

- the management and control of work practices
- personnel training and qualification
- control of occupational and public exposure to radiation at all times (including dose rates around the licensee's storage area(s) of nuclear substances and radiation devices and all adjacent occupied areas)
- planning for unusual situations

The CNSC has prepared additional guidance regarding expectations for an ALARA policy. Contact the CNSC if additional information is required to meet the regulatory obligations.

### D.2 Classification of workers

Maintain an up to date list of the names of all workers who will use nuclear substances or operate radiation devices; however it need be submitted to the CNSC only upon request.

*D.2.1* Append a list of all job categories for workers using or working in the vicinity of nuclear substances and radiation devices.

*D.2.2* Provide a list of the names of all nuclear energy workers (NEWs) including their job category.

*D.2.3* The applicant must append its policy for informing in writing NEWs as well as the procedures used to provide specific instructions to them.

The *General Nuclear Safety and Control Regulations* and the *Radiation Protection Regulations* require that NEWs be notified in writing of their status as NEWs and all associated implications. These include the risks related to the radiation to which NEWs may be exposed, applicable effective dose limits, typical dose levels received and the NEWs' rights and obligations as specified by the *Radiation Protection Regulations*. Applicants must also include the information provided to NEWs regarding the rights and obligations of pregnant nuclear energy workers.

A licensee must obtain written acknowledgement from each NEW that this information has been received. A sample form that may be used to inform workers of their NEW status can be found in Appendix D: Notification of Nuclear Energy Worker Status (Example).

For the criteria to designate workers as NEWs, refer to the *Radiation Protection Regulations.*

### D.3 Worker training and authorization

Append a detailed description of the applicant's proposed/existing radiation safety training program for each job category.

Workers should not be authorized to work with nuclear substances or radiation devices until they have successfully completed appropriate training.

Retraining should be given following any significant change in their work. Periodic refresher training is also recommended.

It should not be assumed that radiation safety training obtained by workers in prior occupations or academic certification is adequate for an applicant's operations. As a minimum, training should be site-specific, task-specific and tailored to the education, background and practical needs of each trainee.

In addition, to promote a good safety culture, it is recommended that a licensee's basic radiation safety training be extended to auxiliary personnel (e.g., clerical, janitorial, maintenance, security).

An example of a training record can be found in Appendix E: Training Record (Example).

### D.4 Ascertaining and recording doses to workers

*D.4.1* Append a copy of the procedures for ascertaining and recording the radiation dose received by all workers as a result of licensed activities (i.e. alpha, beta, gamma and neutron).

The applicant must include information regarding external and internal radiation monitoring programs to be used for the proposed licensed activity. For external monitoring, this may include information for whole body, skin, extremity and lens of the eye monitoring. For internal monitoring, this may include information on urine bioassay, thyroid bioassay or other measurements of internal intakes.

If a dosimetry service is required to be used, identify the name of the CNSC licensed dosimetry service provider that will be used for any and all monitoring of workers.

*D.4.2* For new licences, provide dose estimates for all categories of workers.

*D.4.3* For renewals, append a summary of the annual radiation doses for all of the licensee's monitored workers. For groups of monitored workers who have significantly different exposure levels, the summaries should be grouped by similar job types, types of exposure, nuclear substances and radiation devices used and/or work location.

Do not include the dose result information obtained from the dosimetry service provider. This information contains dose results for specifically named persons and is considered personal medical information and must be kept private in accordance with the *Personal Information Protection and Electronic Documents Act*.

Please include the summary chart of doses to workers from the most recent Annual Compliance Report (ACR).

As specified in the *Radiation Protection Regulations*, identify the job positions whose recorded radiation dose is likely to exceed 5.0 mSv per year of whole body dose.

The CNSC has prepared guidance documents regarding ascertaining and recording of radiation doses to individuals. Workers must be either monitored directly or by estimation of doses based on workplace monitoring.

### D.5 Action levels

Action levels are designed to alert licensees before regulatory limits are reached. In section 6 of the *Radiation Protection Regulations*, an action level is defined as a "specific dose of radiation or other parameter that, if reached, may indicate a loss of control on the part of the licensee's radiation protection program and triggers a requirement for specific action to be taken."

Action levels are required to be established for industrial radiography and logging sealed sources licences (use-types 812 and 816); however, the CNSC strongly encourages all applicants to provide action levels in order to manage their radiation protection programs. Action levels should be based on the average in the industry.

If action levels are a component of the radiation protection program, they should be identified as part of the application. If appropriate, they may be referred to in a licence. When a licensee becomes aware that an action level referred to in a licence has been reached, the licensee is obligated to comply with the related licence conditions and the *Radiation Protection Regulations* by investigating, taking corrective action and notifying the CNSC.

### D.6 Control of radioactive contamination (where unsealed materials are used or stored)

*D.6.1* Append the policy and procedures for maintaining contamination control.

Conditions of a licence typically require that removable contamination does not exceed radionuclide-specific limits on accessible surfaces in occupational and public areas.

For control areas, removable surface-contamination limit criteria averaging over an area not exceeding 100 $cm^2$ are as follows:

- 3.0 $Bq/cm^2$ for Class A radionuclides, which are typically long-lived and emit alpha radiation
- 30 $Bq/cm^2$ for Class B radionuclides, which are typically long-lived and emit beta or gamma radiation
- 300 $Bq/cm^2$ for Class C radionuclides, which are typically short-lived and emit beta or gamma radiation

For supervised public areas and for decommissioning, removable surface-contamination limit criteria averaging over an area not exceeding 100 $cm^2$ are as follows:

- 0.3 $Bq/cm^2$ for Class A radionuclides
- 3.0 $Bq/cm^2$ for Class B radionuclides
- 30 $Bq/cm^2$ for Class C radionuclides

See Appendix BB: Radioisotope Safety – Monitoring for Radioactive Contamination for additional guidance for the creation of the procedures to be appended.

The applicant may request other contamination limits in accordance with the conditional clearance levels as provided in the *Nuclear Substances and Radiation Devices Regulations*.

*D.6.2* Append the procedures for monitoring contamination where unsealed nuclear substances are used or stored. Describe the measures to be taken if contamination limits are exceeded.

Information should be provided on the monitoring protocols to be used, including frequencies of monitoring, for all areas where unsealed nuclear substances are used or

stored. Applicants should classify areas to be monitored based on the potential risk for contamination and implement monitoring protocols that reflect this risk for each type of area.

Applicants should demonstrate that there is sufficient detection instrumentation to monitor contamination to the levels provided above for the nuclear substances to be used or stored under the proposed licence.

### D.7 Radiation detection instruments

*D.7.1* List all radiation detection and measuring instruments, including the type of instrument, its manufacturer, model, serial number and energy range and intended use. If the instrument is used for contamination monitoring, include the sensitivity of the instrument to detect nuclear substances typically used. In addition, include the last calibration date for all survey meters that will be used as part of the radiation safety program.

Contamination meters need to be provided wherever there are unsealed nuclear substances other than S-35, C-14 and H-3.

The CNSC strongly recommends licensees have a calibrated survey meter at all sites of licensed activity, including for every fixed or portable gauge location.

Under section 20 of the *Nuclear Substances and Radiation Devices Regulations*, no person shall use a survey meter unless it has been calibrated within the last 12 months.

The CNSC has prepared information regarding the regulatory expectations for the calibration of survey meters and the applicant will confirm that this calibration will be carried out in accordance with CNSC expectations, as included as Appendix Z: Regulatory Expectations for Calibration of Survey Meters.

*D.7.2* Append the policies and procedures for using the radiation detection and measuring instruments.

*D.7.3* Append the policy to be used for calibrating radiation detection and measuring instruments and the name of the calibration service provider.

### D.8 Leak testing of sealed sources

Append the policy and procedures for the leak testing of sealed sources and the name of the leak testing service provider (if applicable). These documents should include instructions for leak-test sampling and measurement as well as examples of the records used to document these activities.

Under section 18 of the *Nuclear Substances and Radiation Devices Regulations*, sealed sources containing 50 MBq or more of a nuclear substance or a nuclear substance as shielding (e.g. depleted uranium shields) shall be leak tested using instruments and procedures that enable the licensee to detect a leakage of 200 Bq or less. Section 18 of the *Nuclear Substances and Radiation Devices Regulations* also prescribes the frequency of the testing and the corrective actions to be taken if the leak detected exceeds this limit.

The CNSC has prepared information regarding the regulatory expectations for the leak testing of sealed sources and the applicant will confirm that this leak testing will be carried out in accordance with CNSC expectations, as included as Appendix AA: Regulatory Expectations for Leak Testing of Sealed Sources.

### D.9 Access control and security

*D.9.1* Append the policy and procedures that outline the process for restricting access to nuclear substances and radiation devices to authorized and trained persons.

Access is to be controlled from the time of acquisition until transfer or disposal. When not in use or not under the direct supervision and control of an authorized person, nuclear substances and radiation devices should be in a locked area, room, enclosure or vehicle.

*D.9.2* Append the policy and procedures for alerting the applicant to the loss, theft or unauthorized use of nuclear substances or radiation devices.

Applicants must include information on the methods used to secure nuclear substances and radiation devices and for the detection of unauthorized use, loss or theft of these materials.

**D.10 Transfer of nuclear substances and radiation devices**

Append the policy and procedures for the transfer of nuclear substances and radiation devices to another licensee. This should also include information regarding a transfer to another location. The applicant should show how the Sealed Source Tracking System (SSTS) requirements will be met for Category 1 and 2 sealed sources.

**D.11 Packaging and transport of nuclear substances and radiation devices**

*D.11.1* Append the policy and procedures for the packaging and transport of nuclear substances and radiation devices.

The applicant may have addressed some aspects discussed in this section (such as radiation protection and receipt of packages) in other sections of the application. Refer to the relevant sections and provide any required supplementary information.

The regulatory requirements for the packaging and transport of nuclear substances and radiation devices in Canada are specified in the *Packaging and Transport of Nuclear Substances Regulations, 2015* and Transport Canada's *Transportation of Dangerous Goods Regulations* (TDGR).

If these activities are the subject of the application, the licensee is required to demonstrate compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015,* and the TDGR by implementing and maintaining approved procedures. These procedures should be consistent with the type of packaging and transport activities undertaken. Consideration should address the hazards inherent in the transportation of the radioactive materials, the quantities of materials, the types of packages and the number of shipments.

Procedures for the transport and packaging of radioactive material must include:

- package preparation and shipment
- marking, labelling and placarding
- transport documents
- instructions for carriers
- measures to be employed in controlling radiation exposures during transport and packaging operations
- shipment notifications and confirmations
- carriage, stowage and segregation, and storage in transit
- receipt of packages
- opening of packages, if applicable
- undeliverable consignments
- packaging inspection and maintenance
- training and certification of workers

The licensee is required to maintain current records of the following, for all radioactive material prepared in a Type A, IP-2 or IP-3 package:

- package design specifications
- package design compliance information (e.g., test reports, calculations, quality assurance program)
- instructions for packing
- transporting
- receiving
- maintaining
- unpacking the packages

If a licensee packages radioactive material in a package of a certified design (e.g., Type B package or package for fissile material), the licensee must register and receive confirmation of this registration from the CNSC before using the package.

An example of an application for registration of use of packages has been provided in Appendix Q: Application for Registration of Use of Packages (Example).

All records and procedures must be available for inspection upon the request of the CNSC.

*D.11.2* Append the policies and procedures for receiving shipments of nuclear substances and radiation devices and identify workers who are authorized to carry out this activity.

When preparing the policy and procedures, the applicant should remember the following:

- only trained and authorized workers should open packages containing nuclear substances and radiation devices
- upon receipt, workers should inspect packages for evidence of damage, leaking and/or contamination
- workers should be trained in the methods of limiting the spread of radiation contamination in case of a leaking package containing unsealed nuclear substances
- prescribed reports to the consignor and to the CNSC are mandatory upon discovering any damage to or tampering with a package containing nuclear substances
- to ensure the security of the material and the safety of workers and the public, only trained and authorized workers should receive all deliveries of nuclear substances
- the licensee should transfer deliveries during normal working hours, without delay, to a location where packages may be checked for removable contamination
- during off-duty hours, deliveries should be stored in a specified location that is secure and prevents unnecessary exposure

For additional information, refer to the CNSC document INFO-0744 *Guidelines for Handling Packages Containing Nuclear Substances* and the *Nuclear Substances and Radiation Devices Regulations*. Also, refer to the TDGR for other obligations.

See Appendix X: Package Receipt and Monitoring Log (Example) for an example of a package receipt and monitor log.

### D.12 Controlling possession of nuclear substances

This information is different from that regarding access control and security.

*D.12.1* Append the policy and procedures to account for nuclear substances and radiation devices from the time they are acquired to the time they are transferred or disposed.

*D.12.2* Provide the procedures to be used to ensure that the inventory of nuclear substances and radiation devices does not exceed the licence limit for each.

All acquisitions should be reviewed and authorized by the RSO.

Inventories of nuclear substances and radiation devices include any material in use or storage and material awaiting disposal. Current records must be maintained in the areas where the nuclear substances and radiation devices are used and/or stored. These records include the:

- name, quantity, form and location of the nuclear substance
- date received
- name, address and licence number of the supplier
- radiation device model and serial number

Complete records must also be maintained for all transfers or disposals of nuclear substances and radiation devices from a licensee's possession. Transfer records include the:

- name, quantity and form of the nuclear substance
- model and serial number of each sealed source
- radiation device model and serial number
- activity associated with the radiation device
- date of transfer or disposal
- recipient's name, address and CNSC licence number
- name and address of the destination
- verification of safe arrival

A sample nuclear substance and radiation device transfer log has been provided in Appendix F: Nuclear Substance Transfers Log (Example).

To transport radioactive sources, licensees must comply with the *Packaging and Transport of Nuclear Substances Regulations, 2015* and the TDGR. Nuclear substances and radiation devices may only be delivered to locations specified by the applicant. A list of these sites, including building name, complete physical street address and directions, must be provided to the supplier of nuclear substances and radiation devices.

### D.13 Management of waste nuclear substances and radiation devices

Append the policy and procedures for handling and disposing of waste containing nuclear substances and/or waste radiation devices.

Indicate proposed methods for the management of transfers of nuclear substances and radiation devices when they are no longer required by the applicant.

For all applicants, all nuclear substances and radiation devices that are no longer required must be used and disposed of in a way that prevents unreasonable risk to the public or the environment. The acceptable characteristics and limits for each method of disposal are specified as conditions of the licence.

Typically, the licence will authorize radionuclide-specific methods of disposal, including:

- release through the municipal garbage system of nuclear substances in solid form and uniformly distributed in the waste with a concentration by weight less than the limit; this method is limited to disposal of less than three tonnes per year per building
- release through the municipal sewage system of nuclear substances in water-soluble liquid form with a total annual quantity less than the limit for each building

- release into the atmosphere of nuclear substances in gaseous form that are incidental to normal operations based on a weekly average concentration
- transfer to a CNSC licensee authorized to accept waste
- transfer to the supplier

The applicant may request other methods of waste disposal in accordance with the conditional clearance levels as provided in the *Nuclear Substances and Radiation Devices Regulations*.

The following information is provided for each method of disposal:

- name of nuclear substance
- quantity
- form
- origin
- volume of any waste
- proposed method for disposing the waste

### D.14 Emergency procedures

Append the policy and procedures that will be used in incidents, accidents and other events (such as, but not limited to, fire, loss, theft, damage, transportation mishap or accident) that involve nuclear substances and radiation devices.

Procedures should be current and include plans for dealing with various types of possible incidents and accidents. A licensee's emergency plan should include:

- evacuating the immediate area of the incident
- identifying and isolating all workers and others who may be affected
- ascertaining doses to workers and members of the public who may have been affected by the event
- securing the entry to the accident site
- getting assistance from the RSO, manufacturers or radiation safety consultants
- recording all event details chronologically
- activating authorized follow-up procedures
- having comprehensive emergency equipment at hand
- maintaining a current emergency contact list
- reporting to the CNSC as required by licence conditions and/or regulations

The applicant must have trained personnel available to respond in a reasonable time to the site of licensed activity in the event of an emergency.

For transportation mishaps or accidents, the applicant must comply with the requirements of the *Packaging and Transport of Nuclear Substances Regulations, 2015* and the TDGR. The applicant may want to consider these requirements when developing the emergency policy and procedures described above.

### D.15 Decommissioning

Append the policy and procedures related to decommissioning or remediation of licensed locations.

Once a location has been licensed, it cannot be released from the CNSC's regulatory control until it has been decommissioned and the location has been authorized for release by the CNSC. When operations cease at any of the licensed locations, the CNSC must be advised, a

written report must be submitted and, after CNSC authorization, these locations will be removed from the licence.

A final decommissioning report should be attached to any request to change a location listed on a licence. This document should include:

- the decommissioning plan
- a complete accounting of the disposition of all nuclear substances and radiation devices
- a statement confirming that all radiation warning signs have been removed from the premises
- the final radiological survey results at the site where unsealed nuclear substances were stored

Rooms within a location can be decommissioned and released if permitted by licence conditions without forwarding the results to the CNSC. However, records of the decommissioning must be kept and be made available for inspection by the CNSC.

The following should be considered when preparing a decommissioning plan:

- characterizing the operations
- examining historical information such as the:
  - length of time that nuclear substances and radiation devices were in use
  - location where they were used
  - specific types and quantities of nuclear substances that were used
  - information available by consulting previous licences
- planning the processes of monitoring radiation contamination and decontamination
- preparing for the monitoring, dismantling and removal of associated equipment
- planning for the removal, transfer or shipment and disposal of nuclear substances and radiation devices
- removing or defacing all signs, labels and nuclear substances packaging
- conducting a final radiological survey and submitting a complete report to the CNSC so that verification of the decommissioning can be completed
- planning for a possible final inspection by the CNSC

### D.16 Records and reporting system

*D.16.1* Append the policy and procedures for reporting of incidents and events, as required by the NSCA, the Regulations and any applicable licence conditions. This will include the immediate reporting of events and the detailed written report required within 21 days of an event.

*D.16.2* Append the policy and procedures that outline the process for retention of records.

All records should be available for inspection. The *General Nuclear Safety and Control Regulations* prescribe specific records and reports, as well as the conditions for their retention and disposal. Records to be maintained include the following:

- names of persons involved in the handling of nuclear substances and radiation devices
- names and job categories of NEWs
- training for workers handling nuclear substances and radiation devices
- list of locations of nuclear substances in possession
- dosimetry results
- inventory of unsealed sources in possession
- inventory of sealed sources and radiation devices
- details of incidents involving nuclear substances and radiation devices

- acquisitions and transfers of nuclear substances and radiation devices
- wipe-test monitoring results for unsealed substances
- fixed-contamination monitoring results
- decommissioning results
- list of radiation-detection equipment
- radioactive waste disposal
- transport documents

The policy and procedures should include written notification to the CNSC for authorization of the intended date of disposal and the nature of the records at least 90 days before the intended date of disposal.

*D.16.3* Append a list of documents that will be retained at each location of licensed activity including field locations.

Documents that should be maintained at the main office of operation include:

- inventory of all devices and sources
- leak test analysis certificates
- NEW acknowledgement forms
- local usage logs for each device (if applicable)
- a copy of TDG training certificates
- reports of incidents, malfunctions, security breaches, etc.
- special form certificates
- transfer records
- a list of authorized users and their training
- radiation dose results for authorized users
- counts for all shots, practice and real, for portable gauges
- copies of shipping documents
- current licence and emergency procedures
- type A packaging certifications

Documents that should be maintained at field locations and temporary job locations include:

- shipping documents
- operating and emergency procedures
- TDG training certificates
- complete copy of current CNSC licence

### D.17 Posting of radiation warning signs

*D.17.1* Append the policy and procedures that limit the storage of nuclear substances and radiation devices to rooms designated as locations for use and/or storage. Also append information regarding the posting of radiation warning signs for these locations.

Regulations require the posting of a durable and legible radiation warning sign at the boundary of and every point of access to an area, room, enclosure or vehicle where there is a quantity of nuclear substance greater than 100 times its regulated exemption quantity, or where there is a reasonable probability that a person will be exposed to a radiation dose rate greater than 25 μSv/h.

Licensees are required to post the name, job title and telephone number of an individual with the appropriate authority who can be contacted 24 hours a day in case of an emergency.

*D.17.2* Append the policy and procedures for verifying dose rates around any and all storage locations.

**D.18 Classification of rooms (for unsealed nuclear substances only)**

The licensee's use and storage of nuclear substances will be limited to the locations authorized on the CNSC licence.

*D.18.1* Append the policy and procedures for classifying areas, rooms and enclosures.

*D.18.2* Append a Design Assessment Form (DAF) or equivalent for each room, area or enclosure not previously authorized by the CNSC, including all storage areas. Include a list of all previously authorized rooms, areas and enclosures used for the proposed licensed activity and indicate the purpose of each.

The DAF should be supplemented by diagrams, drawings or sketches, which include information on:

- room dimensions
- construction materials used for the walls
- use of adjacent areas
- nuclear materials stored or used within each area
- shielding materials used
- the source sizes to be used

These diagrams, drawings or sketches should also show the relationship of areas where nuclear substances are used or stored to any adjoining unrestricted areas. Unrestricted areas may be offices, restrooms, exterior areas, cafeterias and other areas not under the licensee's control.

To minimize the possibility of inadvertent exposure, radioactive materials and waste should only be stored in unoccupied areas that are accessible only to authorized workers. A sample list of designated nuclear substances locations has been provided as Appendix V: List of Designated Nuclear Substance Locations (Example).

Applicants are referred to GD-52, *Design Guide for Nuclear Substance Laboratories and Nuclear Medicine Rooms*, available from the CNSC.

D.18.3 Append the policy and procedures used to administer nuclear substances to animals.

**D.19 Internal review**

Append the policy and procedures for conducting internal compliance, monitoring, enforcement and verification of all licensed activities.

Incidences of non-compliance should be documented and corrected and the resulting compliance subsequently verified. The results of monitoring and corrective actions should be regularly reported and reviewed internally.

Enforcement actions should be taken by the applicant to encourage compliance and prevent ongoing non-compliance.

A graduated scale of enforcement action should be used, reflecting the severity and repetition of the incidents of non-compliance.

## 9. Part E – Specific requirements based on proposed licence activity

In this part of the application (which is to be completed as applicable), provide the information specific to the use-type being applied for.

### E.1 Nuclear medicine and human research studies (use-types 862, 872 and 875)

*E.1.1* ***Medical practitioner:***

A physician acting as the medical practitioner must be qualified under provincial law to provide the medical supervision encompassed by the activities of the licence for which the application is made. When submitting an application for any activities involving nuclear medicine or human research, the person who will be acting as the medical practitioner must supply their name and contact details, provincial registration number and sign the declaration that they are qualified pursuant to s.16 of the *Nuclear Substances and Radiation Devices Regulations*.

If there is more than one medical practitioner, provide a separate form for each.

### E.2 Therapeutic nuclear medicine (use-type 872)

*E.2.1* ***Administration of nuclear medicine therapy doses:***

Append the policy and procedures for delivering radiation doses to patients for therapeutic reasons during the activities to be licensed, including:

- the preparations to be undertaken prior to administering nuclear substances
- the proposed manner of administering nuclear substances
- the precautions to be followed after administering the nuclear substance
- method for controlling radiation exposures of patients and non-patients
- whether doses are administered on in-patient or out-patient basis

A specific procedure must be submitted for each nuclear substance authorized by the therapeutic licence.

All policies and procedures should demonstrate that the effective dose limits set out in the *Radiation Protection Regulations* will be met during the proposed activity. These procedures should also recognize the challenges associated with the discharge of materials and fluids from the treated patient.

For patients treated with nuclear substances other than Iodine-131, the associated safety requirements will depend upon the characteristics (e.g., type of emissions, biological half-life) of the nuclear substances used and other factors such as the routes of excretion.

The licensee must have procedures for the care and management of patients who are deceased following internal administration or implantation of therapeutic nuclear substances, including policies for cremation or other disposition of the body.

*E.2.2* ***Instructions to caregivers:***

Append the precautionary instructions that are to be given to persons who will care for a patient who has undergone nuclear medicine therapy. Provide instructions for all potential caregivers such as medical professionals, hospital workers and persons who may provide extended-care and home-care services.

Good hygiene practices, infection control measures and universal precautions are typically sufficient to address most hazards associated with caring for a person who has undergone

nuclear medicine therapy. However, special precautions are usually necessary to control the spread of radioactive contamination due to the excretions of nuclear medicine patients.

*E.2.3* ***Instructions to patients of nuclear medicine therapy and their families:***

Append the precautionary instructions that are to be given to patients and their family members who have recently received nuclear medicine therapy in order to control radioactive contamination effects and radiation exposures to others. The proposed precautionary measures should take into account the radiation exposure limit that, typically, is set as a condition for the patient's release from the hospital or treatment facility.

The precautionary instructions must include information on any requirements, restrictions or prohibitions for the management of the patient if they become deceased after internal administration or implantation of the therapeutic nuclear substance. This should include information on possible retrieval of implants or restrictions for cremation of remains.

*E.2.4* ***Release of patients:***

Append the policy and procedures for determining when patients that have received nuclear medicine therapy must be isolated and when they may be released from isolation. Propose the patient's radiation activity level, that is to be used to determine when the patient must be isolated from other patients, as well as the limit below which no further precautions for radiation protection purposes will be required.

Recommendations concerning isolation or release of patients treated with Iodine-131 are:

- if the activity remaining in the patient after treatment is less than 300 MBq and the approximate radiation dose rate at 2 m is less than 4 µSv/h, no hospitalization and only minimal precautions are required
- if the activity remaining in the patient after treatment is less than 1,100 MBq and the approximate radiation dose rate at 2 m is less than 16 µSv/h, precautions should be taken whether the patient is hospitalized or released
- if the activity remaining in the patient after treatment is greater than 1,100 MBq and the approximate radiation dose rate at 2 m exceeds 16 µSv/h, the patient should be isolated in the hospital and strict precautions implemented to limit the exposure of other persons

*E.2.5* ***Assignment of nuclear medicine therapy rooms:***

Append the procedures used to assure that patients undergoing nuclear therapy with Iodine-131 will be assigned to a specifically designated private room with a private washroom. Typically, access to such rooms should be restricted, the flooring should be sealed against contamination and easy to decontaminate, and radiation warning signs and the name of an emergency contact person should be clearly posted.

The radiation dose rate in an occupied area adjacent to a room occupied by a patient who is undergoing or who has undergone radiation therapy must not exceed regulatory limits and a patient who has not received nuclear therapy should not receive a radiation dose in excess of 500 µSv during a hospital stay.

*E.2.6* ***Decontamination and reuse of treatment rooms:***

Append the procedures for returning rooms that have been used for nuclear medicine therapy to a condition where they can be safely released for other purposes.

Any licence issued by the CNSC in response to an application for a licence to conduct nuclear medicine therapy will include decontamination limits that must be met before nuclear medicine therapy treatment rooms can be released. Accordingly, the applicant's proposed procedures and criteria for decontaminating rooms used for nuclear medicine

therapy should assure compliance with the anticipated licence limits. For Class A, B and C nuclear substances (referred to in Appendix Y: Classes of Nuclear Substances), the relevant surface contamination limits, expressed in terms of removable surface contamination averaged over an area not exceeding 100 $cm^2$, are as follows:

- 0.3 $Bq/cm^2$ for all Class A nuclear substances, which are typically relatively long-lived and emit alpha radiation
- 3 $Bq/cm^2$ for all Class B nuclear substances, which are typically relatively long-lived and emit beta or gamma radiation
- 30 $Bq/cm^2$ for all Class C nuclear substances, which are typically short-lived and emit beta or gamma radiation

See Appendix BB: Radioisotope Safety – Monitoring for Radioactive Contamination for additional guidance for the creation of the procedures to be appended.

*E.2.7* ***Medical emergencies:***

Provide a copy of the proposed policy and procedures for dealing with medical emergencies that involve patients treated with nuclear substances during the activities to be licensed. Include basic procedures that address requirements for emergency surgery, the death of a therapy patient, the availability of emergency supplies and the role of the RSO or RSO's delegate.

As noted in E.2.1, the licensee must have procedures for the care and management of patients who are deceased following internal administration or implantation of therapeutic nuclear substances, including policies for cremation or other disposition of the body.

The CNSC recommends that the above procedures include a "first response" provision to make emergency care workers aware of the nature of the emergency and the associated radiation hazards, without restricting them from performing their health care duties. Applicants should provide for the availability of basic cleaning and decontamination supplies to use for radioactive spills, including bodily fluids, and for the availability of radiation safety experts to provide advice during the emergency.

## E.3 Human research studies (use-type 875)

*E.3.1* ***Human research review committee:***

Append a description of the authority, composition and duties of the proposed Human Research Review Committee (HRRC).

An HRRC (or equivalent body) should have the authority and resources to ensure adequate provision of radiological protection to participants in research studies involving nuclear substances in or on human volunteers.

*E.3.2* ***Authorization of research studies:***

Append a description of the proposed process and criteria by which the HRRC or its equivalent will assess and authorize human research studies.

The feasibility, applicability and scientific merits of each planned research study should be reviewed by the HRRC before the study proceeds. Only studies that meet the committee's criteria and approval should be allowed to proceed. Each proposed human research study should receive an independent scientific review in advance of implementation of the study. In addition, before nuclear substances are used in a human research study, the study should be subjected to a credible ethical review which records that the study and proposed use of nuclear substances respect current moral and ethical standards.

*E.3.3* ***Classification of research studies:***

Append a statement of the proposed research studies and the proposed radiation dose constraints for each study.

For radiation protection purposes, the proposed research studies should receive a depth of scrutiny that is proportional to their potential radiological consequences as reflected in the probable annual effective radiation doses to the volunteer participants in the study.

*E.3.4* ***Selection of volunteer participants:***

Append a description of the proposed policy and criteria for selecting or excluding human volunteers from participation in human research studies.

*E.3.5* ***Consent form:***

Append the policy and procedures for obtaining and assuring the informed consent of human research volunteers. Include a copy of a blank consent form. Typically, a comprehensive consent form should state the:

- aims of the study to be engaged in
- procedures that the subject will undergo
- risks inherent in these procedures
- areas of uncertainty in the research study, including explicit declarations that acknowledge any experimental procedures and that the participant may not benefit from the research
- participant's ability to decline to participate in or withdraw from the study at any time, without prejudice
- duration of the study
- name and letterhead of the institution conducting the study
- name and telephone number of the contact person for the study
- procedures that will be implemented to preserve the confidentiality of the participants identity

*E.3.6* ***Records of studies:***

Specify where the records of all studies using nuclear substances in or on human research volunteers are to be maintained and made available for the CNSC's inspection.

Typically, the records of a study should include the:

- composition, including names, of the HRRC that reviewed the study
- nature of the study
- number of similar studies conducted by the licensee
- number of participating volunteers
- total quantity of nuclear substance administered to each study participant

**E.4 Consolidated uses of nuclear substances (use-type 815)**

Please note: licence use-type 815 is restricted to licensees who issue internal authorizations (permits).

*E.4.1* ***Internal authorization/permits:***

Append the policies regarding internal permits. Also append the procedures that ensure that, under a consolidated uses for nuclear substances licence from the CNSC, the possession and use of any nuclear substances or radiation devices will be controlled within the licensee's operations through a documented internal permit system.

Describe the entire process, from the starting point when an application is made by an employee through the approval process to the issuance of a permit. Include a sample of a permit application form and an example of a permit.

The licensee should effectively coordinate and authorize all uses, quantities and locations of nuclear substances, as well as devices containing nuclear substances and/or radiation devices through a controlled internal permit system.

A permit should include:

- the name of the authorized person internal to the licensee
- the issue and expiry date
- authorized activities
- nuclear substances and possession limits
- devices containing nuclear substances and maximum source limits
- rooms, areas and enclosures where the nuclear substance is used or stored
- the names of workers authorized to use nuclear substances

Internal authorization permits should be posted in or near each room, area or enclosure where nuclear substances and radiation devices are used or stored.

These permits may only be issued for nuclear substances and radiation devices that are under the licensee's care and control. Evidence of this care and control includes the licensee:

- issuing a permit only to a worker who is an employee of the licensee
- having that employee working in a location owned, leased or rented by the licensee

An example of an internal authorization form or permit is provided in Appendix S: Internal Authorization Form or Permit (Example).

*E.4.2* ***CNSC approval for special projects:***

Written authorization must be obtained from the CNSC prior to issuing any internal authorization permit for any work requiring the use of more than 10,000 exemption quantities of a nuclear substance at a single time.

Append the policy and procedures for obtaining written authorization from the CNSC prior to issuing an internal authorization permit for special projects.

## E.5 Industrial radiography (use-type 812)

*E.5.1* ***Emergency and operating procedures manual:***

An Emergency and operating procedures (EOP) manual must be submitted with an application for a nuclear substance and radiation devices licence for industrial radiography. Instructions for the preparation of the EOP manual can be found in Appendix I: Instructions for the Preparation of
an Emergency and Operating Procedures Manual.

*E.5.2* ***Application for registration of use of packages (one per certificate number):***

The *Packaging and Transport of Nuclear Substances Regulations, 2015*, requires that a person must apply to register their use of a certified package design before he/she may start transporting the package. The information listed in the *Packaging and Transport of Nuclear Substances Regulations, 2015*, must be submitted to the CNSC prior to receiving confirmation that the applicant has been registered for the use of the package. An example of this type of application can be found in Appendix Q: Application for Registration of Use of Packages (Example).

A separate application form has to be submitted for each valid package design approval certificate issued by the CNSC.

### *E.5.3 Maintenance and use of exposure devices*

Append sample copies of records of the quarterly and annual maintenance of exposure devices and associated equipment and of camera use records.

### *E.5.4 Safety and emergency equipment*

Append a list of all safety and emergency equipment which is used as part of the daily radiography operations. List any additional shielding materials.

### *E.5.5 Specialized training and personnel*

Append a list of all persons, along with their training, which are qualified to respond to the following incidents:

- the exposure device or the sealed source assembly is damaged to an extent that could impair its normal use
- the exposure device has a radiation dose rate of more than 2 mSv per hour on any part of its surface when the sealed source assembly is in the shielded position
- the sealed source assembly is separated from the exposure device when the latter is not being serviced
- the sealed source assembly fails to return to the shielded position inside the exposure device

## E.6 Low-risk use of nuclear substances and radiation devices (use-types 880, 881, 883, 886, 888, 889, 895, 896, 897, 898, 899, 900, 901, 902, 907, 919, 940)

This section is to be completed instead of Part C and Part D of the application for low-risk use-types.

Radiation safety program:

In this part of the application, information is requested about various aspects of the applicant's radiation safety program. This includes the organization management structure and details about the workers who implement and supervise the program, as well as workers who handle packages containing nuclear substances, the radiation dose monitoring program and nuclear substance inventory.

The radiation safety program components described in this guide do not prevent alternative proposals being made by the applicants to the CNSC but any proposed radiation safety program should appropriately reflect the complexities and hazards of the activities described in a licensee's application. In addition, as the licensee is ultimately responsible for radiation safety related to all activities authorized by the licence, an effective radiation safety program must have the support, commitment and participation of management and staff.

### *E.6.1 Radiation safety officer:*

The RSO is the person responsible for the management and control of the licensed activity and of the nuclear substances. The RSO is the person the CNSC will contact about radiation safety and compliance matters. The RSO must be familiar with the routine uses of the nuclear substances described in the application, and must know who is using them and where they are being used. The RSO must be designated by the Applicant Authority.

Regulations require that the licensee notify the CNSC within 15 days of a change in RSO or in the RSO position.

*E.6.2* ***RSO acknowledgement:***

Once an individual has been designated as the RSO by the Applicant Authority, the individual identified as RSO must sign a consent form acknowledging his/her willingness to be designated as the applicant's RSO and accepting the responsibilities described in the job description submitted.

*E.6.3* ***Sealed source or radiation device incidents (for renewal):***

Append a brief description of any occurrence or incident in the previous licensing period that required investigation, as well as any remedial action that was needed to prevent recurrence. Please note that incidents must be reported immediately to the CNSC and not just in the renewal application.

Briefly summarize the nature and significance of each. If an incident has been previously reported to the CNSC (as required by the NSCA and its regulations), simply reference the correspondence for the original submission.

*E.6.4* ***Access control and security*:**

Mark the relevant box indicating how access to the radiation device or sealed source is to be controlled. More than one box can be marked.

Access can be controlled by a lock, security guard or alarm system. If something other than these methods is used, indicate on the application that another method will be used and append a brief description of the method.

*E.6.5* ***Leak testing:***

All sealed sources (alone or in radiation devices) that contain nuclear material in a quantity greater than 50 MBq must be leak tested.

Indicate whether or not leak testing is required and describe how the leak testing will be conducted in accordance with the CNSC's expectations included as Appendix AA: Regulatory Expectations for Leak Testing of Sealed Sources of this document.

Leak tests are not required where the sealed source contains a gaseous nuclear substance; where the sealed source is contained in a static eliminator in possession of the licensee for less than 15 months or are otherwise exempted by the *Nuclear Substances and Radiation Devices Regulations*. Therefore, if the proposed sealed sources do not require leak testing, indicate this on the application form.

*E.6.6* ***Emergency procedures:***

Indicate if whether or not the emergency procedures outlined on the application form will be adopted or other emergency procedures will be developed.

If other emergency procedures will be developed, append a brief description of these procedures.

*E.6.7* ***Record retentions and reporting requirements:***

Indicate if the record retention and reporting requirement procedures outlined on the application form will be adopted or if other record retention and reporting requirement procedures will be developed.

If other record retention and reporting requirement procedures will be developed, append the policy and procedures for reporting as well as procedures that outline the process for the retention of records.

## E.7 Veterinary nuclear medicine (use-type 915)

### *E.7.1* ***Veterinary procedures:***

Append the procedures used to administer nuclear substances to animals for diagnosis or treatment.

For each procedure, include the quantity and type of radiopharmaceutical that is to be administered as well as the number of administrations you are able to handle simultaneously.

### *E.7.2* ***Animal housing****:*

Append the policy and procedures regarding the housing controls imposed on animals undergoing veterinary nuclear medicine.

An animal treated with radiopharmaceuticals must be quarantined appropriately in a room specifically designated for treated animals. In addition:

- cages housing animals treated with radionuclides must be posted with a radiation warning sign
- the dose rate in occupied or public access areas adjacent to the animal housing must not exceed the regulatory limits and the licensee should be able to demonstrate that it will not increase a person's effective dose by 500 µSv or more per year in excess of background radiation.

### *E.7.3* ***Disposal of animal waste:***

Append the policy and procedures regarding the management of waste arising from veterinary nuclear medicine.

For animal waste or emesis, report any method of release and indicate the quantities released to municipal garbage systems, municipal sewers, the atmosphere and other destinations. If a nuclear substance has been transferred to another licensee, submit that licensee's name, complete address and licence number. For short-lived radionuclides, it is advisable to store the waste for decay and then dispose of the material.

The management of animal waste must include policy and procedures for disposition of any carcasses containing nuclear substances. Particular attention should be paid to the management of recently deceased pets and the information provided to owners regarding care and control of the animal, including restrictions on burial or cremation.

### *E.7.4* ***Animals treated with Iodine-131:***

Cages occupied by animals treated with Iodine-131 should be lined with plastic and the bedding should be changed daily. Waste contaminated with Iodine-131 should be stored in a well-shielded and ventilated area until its disposal.

Append the policy and procedures for housing and waste disposal for animals treated with Iodine-131.

### *E.7.5* ***Animals injected with Technetium-99m:***

Technetium-99m has a half-life of six hours. The *General Nuclear Safety and Control Regulations* prescribe that measures to reduce the level of contamination in a place may be taken by a licensee in a manner appropriate for the circumstances and in accordance with the NSCA. In this case, it may be more reasonable from an ALARA perspective to secure the area and let the radioisotope decay to minimal levels. Therefore, before the decontamination process is started, a licensee may secure an area contaminated with Technetium-99m for 48 hours; this should allow this radiopharmaceutical to decay to background radiation (depending on what level of activity the radiopharmaceutical started out with).

Append the policy and procedures used when dealing with animals that have been injected with Technetium-99m.

*E.7.6* ***Monitoring and release of animal housing:***

Append the policy and procedures that confirm that the housing for animals treated with veterinary nuclear medicine will not be used for any other purpose until the level of radioactive contamination meets criteria for release or re-use.

All areas of animal housing should be monitored, cleaned, decontaminated and decommissioned, if necessary, before being reoccupied. Access to the area is restricted until the area has been decommissioned.

If the subsequent animal occupying the housing is undergoing treatment with radiopharmaceuticals, the housing should meet the contamination monitoring limits for work surfaces. If the housing is released for non-radioactive use or if the housing is to be subsequently occupied by an animal not subject to related diagnosis or receiving radioactive therapy, the housing must meet the decommissioning requirements specified in the licence.

The radioactive contamination level must be reduced sufficiently so that it will not increase a person's effective dose by 500 μSv or more per year in excess of background radiation.

*E.7.7* ***Release of animals:***

Append the criteria used by the applicant to decide when animals treated with radiopharmaceuticals will be released to their owners.

In the case of cats treated for hyperthyroidism with Iodine-131, the cat should remain quarantined until the dose rate does not exceed 10 μSv/h, when measured at 30 cm from the cat’s thyroid gland.

Every animal treated with diagnostic amounts of Technetium-99m should remain in the veterinarian facilities until the dose rate from the animal does not exceed 5.0 μSv/h on contact.

For any animal treatment, please provide calculations, including all assumptions, which verify that the highest accumulated radiation dose to a member of the public will not exceed 50 μSv as a result of the nuclear substance remaining in the animal at the time of release.

*E.7.8* ***Treatment consent form:***

Append a copy of the consent form that will be signed by the owner before the animal is treated with radionuclides. Prior to treating an animal with a radionuclide, the animal owner must be informed of the study or treatment and sign a form consenting to the study or treatment.

For animals treated with Iodine-131, include a copy of the instruction sheet that will be given to the owner before the animal is released. The owner must also be informed of the radiation risks associated with the treatment and be given instructions on minimizing the risks to persons caring or coming into contact with the treated animal after its release from the facility.

Information should be provided regarding the potential for the death of a treated animal and specific information provided to owners regarding care and control of the animal, including restrictions on burial or cremation.

## E.8 Fixed gauges (use-type 814)

### *E.8.1* ***Procedures:***

Append the policy and procedures that detail the handling of fixed gauges. Procedures must include the proposed inspection program for the equipment and systems that will be used to carry on the activity to be licensed.

### *E.8.2* ***Rules for entry into vessels or hoppers:***

Append the policy and procedures to enter vessels or hoppers fitted with fixed gauges.

If the applicant does not have vessels or hoppers equipped with fixed gauges, provide a statement to that effect.

To minimize the possibility of inadvertent exposure, procedures for entry into a vessel or hopper fitted with a radiation device must be documented and provided to workers and any other person(s) who may be required to enter the space.

Vessel entry procedures must include the following:

- prior to any entry, every radiation device on or in the vessel or hopper :
  - must be identified
  - have its source shielded or otherwise made safe
  - have been verified to be safe for a person to enter
- a radiation survey meter must be used to verify that it is safe to enter the vessel or hopper, and to measure the radiation dose values where any person will be located inside the vessel or hopper, and these values must be recorded
- a specific written authorization for entry into the vessel or hopper must be issued for the proposed activity including the date and estimated duration of entry
- any person entering the vessel or hopper:
  - must be appropriately trained
  - be aware of the presence of the radiation devices
  - has been made aware of the specific written authorization
  - made aware of the recorded radiation dose values inside the vessel or hopper where a person may be located
- a record must be maintained of the entry authorized including the name of the person(s) entering the vessel or hopper and the dose received by that person (s) as well as the results of any other radiation survey

### *E.8.3* ***Installation and dismounting of fixed gauges:***

Append the policy and procedures for installing and/or dismounting fixed gauges. If the applicant does not intend to install or dismount gauges, provide a statement to that effect.

Documented procedures are required. Specific controls include the following:

- installation is to be conducted only by workers who have successfully completed appropriate training (a licence application should include details on training in radiation detection instruments and fixed gauge installation)
- workers must be properly authorized to perform this function
- when installing a fixed gauge, the shutter of the device is to be closed and padlocked before any work begins; the closed status of the shutter is to be verified by noting the appropriate decrease in the gamma survey meter reading
- a safe work permit is to be obtained as authorization to install or dismount fixed gauges
- a calibrated survey meter is to be available at all times during the operation

- the source holder is to be locked in the off position during mounting/dismounting operations
- radiation intensities around the gauge are to be measured and recorded with the shutter in both the open and closed position, using at least four compass points on two perpendicular planes at the external surfaces and at 30 cm from the external surface
- occupancy evaluation is to be conducted to decide whether additional shielding and/or personnel monitoring is required
- permanent radiation warning signs are to be posted immediately upon completion of the gauge installation

*E.8.4* ***Operation of insertion-type fixed gauges:***

Append the policy and procedures to handle insertion-type fixed gauges. If the applicant does not have insertion-type fixed gauges, provide a statement to that effect.

To minimize the possibility of inadvertent and unnecessary exposure, procedures must be documented and provided to maintenance workers and others of the gauge's isolation requirements. Specific controls are required.

For the protection of workers, most nuclear gauging devices are designed with built-in safety features. However, there is a type of fixed gauge that is typically mounted on the outside of a vessel and is connected through a well in that vessel. This type of fixed gauge does not provide the same degree of safety as a standard fixed gauge.

The operation of this type of fixed gauge requires that the source be taken out of its source holder and positioned at a specific location in the well. At this point, the amount of shielding between the source holder and the inside of the vessel is minimal. Therefore, insertion of the source into the well is to be done as rapidly as possible to minimize exposure to workers. There may also be a radiation hazard if the source is extended into the well and the vessel is not full. Personnel monitoring of radiation dose rates may be required during this type of installation.

*E.8.5* ***Emergency procedures for fixed gauges:***

In addition to the information provided in section D.14, append procedures specific to dealing with fire including appropriate actions to be taken and process to be followed for handling the situation and reporting requirements.

As part of meeting the requirements under paragraph 4(*a*) of the *Radiation Protection Regulations*, applicants must have available at the site of the licensed activity a survey meter to be used for emergency events involving the fixed gauges, particularly fires involving the nuclear gauges. Where the applicant has not purchased a survey meter to remain on-site, the applicant may satisfy the requirements by having a calibrated survey meter at the site of licensed activity within four hours of notification. The applicant may have a contract with a service provider who can provide a calibrated survey meter at the site of licensed activity within four hours of notification. The applicant must supply a copy of such a contract showing this capability and the contract must be valid for the proposed period of the licence under consideration.

## E.9 Petroleum exploration (use-types 816, 844, 846, 858)

*E.9.1* ***Releases of nuclear substances to the environment:***

Append the policy for monitoring releases of nuclear substances into the environment.

During assessment of the licence application, if it is determined that the proposed/potential releases are substantial the licensing specialist may contact the applicant to discuss the potential requirement for an Environmental Assessment (EA).

Emissions of nuclear substances into the environment may be subject to specific requirements of the *Canadian Environmental Assessment Act* (CEAA) and its regulations. Considerations include:

- the potential for negative environmental effects
- the impacts of the adverse environmental effects
- remedial measures

Some activities that may be exempt from requirements for assessments under the CEAA may still be subject to review by other federal and provincial authorities having jurisdiction over this work.

Please contact the CNSC for more information on environmental assessments.

### *E.9.2 **Fishing for stuck tools/sources:***

Append the policy and procedures that will be used during an emergency that involves fishing for stuck tools/sources.

Procedures should be current and include plans for dealing with various types of possible incidents and accidents. A licensee's emergency plan should include:

- recovering borehole logging tools and sources by fishing them out
- monitoring releases of nuclear substances from the site
- maintaining a list of the licensee's emergency equipment and an emergency contact list
- notifying the CNSC

### *E.9.3 **Abandonment of sealed sources:***

In certain cases, the best option is to abandon a logging tool with a nuclear sealed source. If so, the licensee is required to abandon a nuclear substance or radiation devices in accordance with section 4 of the *General Nuclear Safety and Control Regulations*. Each notification of proposed abandonment must include the:

- name of components and/or equipment that are to be abandoned
- proposed time and location of the abandonment
- proposed method of and procedure for abandonment
- effects on the environment and the health and safety of persons that may result from the abandonment, and the measures that will be taken to prevent or mitigate those effects

The notification of proposed abandonment should also include the actions to be taken to:

- immobilize the tool and sources
- prevent inadvertent drilling of the sources
- permanently label the surface of the well
- report the actions completed

### *E.9.4 **Abandonment of unsealed sources:***

Append the policy and procedures for the proposed abandonment of unsealed nuclear substances following subsurface zone location or subsurface tracer studies.

## E.10 Portable Gauges (use-type 811)

*E.10.1* ***Emergency procedures:***

In addition to the information provided in section D.14, append the procedures specific to responding to and managing situations involving crushed or damaged portable gauges.

As part of meeting the requirements under paragraph 4(*a*)of the *Radiation Protection Regulations*, applicants must have available at any site of the licensed activity a survey meter to be used for emergency events involving the portable gauges, including crushing or other physical damage. Where the applicant has not purchased a survey meter to remain on-site, the applicant may satisfy the requirements by having a calibrated survey meter at the site of licensed activity within two hours of notification. The applicant may have a contract with a service provider who can provide a calibrated survey meter at the site of licensed activity within two hours of notification. Provide a copy of the contract with the service provider which is valid for the proposed period of the licence under consideration.

# Appendix A: Measurement Conversion Table

International System of Units (SI): 1 becquerel (Bq) = 1 disintegration/second

| | | |
|---|---|---|
| **The rad is replaced by the gray (Gy)** | | |
| 1 kilorad (krad) | = | 10 grays (Gy) |
| 1 rad (rad) | = | 10 milligrays (mGy) |
| 1 millirad (mrad) | = | 10 micrograys (μGy) |
| 1 microrad (μrad) | = | 10 nanograys (nGy) |
| | | |
| **The gray (Gy) replaces the rad** | | |
| 1 gray (Gy) | = | 100 rad (rad) |
| 1 milligray (mGy) | = | 100 millirad (mrad) |
| 1 microgray (μGy) | = | 100 microrad (μrad) |
| 1 nanogray (nGy) | = | 100 nanorad (nrad) |
| | | |
| **The rem is replaced by the sievert (Sv)** | | |
| 1 kilorem (krem) | = | 10 sieverts (Sv) |
| 1 rem (rem) | = | 10 millisieverts (mSv) |
| 1 millirem (mrem) | = | 10 microsieverts (μSv) |
| 1 microrem (μrem) | = | 10 nanosieverts (nSv) |
| | | |
| **The sievert (Sv) replaces the rem** | | |
| 1 sievert (Sv) | = | 100 rem (rem) |
| 1 millisievert (mSv) | = | 100 millirem (mrem) |
| 1 microsievert (μSv) | = | 100 microrem (μrem) |
| 1 nanosievert (nSv) | = | 100 nanorem (nrem) |
| | | |
| **The curie (Ci) is replaced by the becquerel (Bq)** | | |
| 1 kilocurie (kCi) | = | 37 terabecquerels (TBq) |
| 1 curie (Ci) | = | 37 gigabecquerels (GBq) |
| 1 millicurie (mCi) | = | 37 megabecquerels (MBq) |
| 1 microcurie (μCi) | = | 37 kilobecquerels (kBq) |
| 1 nanocurie (nCi) | = | 37 becquerels (Bq) |
| | | |
| **The becquerel (Bq) replaces the curie (Ci)** | | |
| 1 terabecquerel (TBq) | = | 27 curies (Ci) |
| 1 gigabecquerel (GBq) | = | 27 millicuries (mCi) |
| 1 megabecquerel . (MBq) | = | 27 microcuries (μCi) |
| 1 kilobecquerel (kBq) | = | 27 nanocuries (nCi) |
| 1 becquerel (Bq) | = | 27 picocuries (pCi) |

# Appendix B: Use-types and Risk Rankings

| Use-type Number | Use-type Name | Description | Risk Ranking |
|---|---|---|---|
| 811 | Portable gauges | Use of portable radiation devices to measure density, level, thickness or moisture content. | Medium |
| 812 | Industrial radiography | Use of sealed sources in exposure devices for non-destructive testing. | High |
| 813 | Laboratory studies | Use of unsealed and sealed nuclear substances and radiation devices in approved laboratories for research. | Medium |
| 814 | Fixed gauges | Use of a radiation device in a fixed configuration to measure density, level, thickness or flow. | Medium |
| 815 | Consolidated uses of nuclear substances | A single licence issued to an institution to encompass a number of use-types where the use is conducted in multiple areas, rooms or enclosures. | High |
| 816 | Logging sealed sources | Use of sealed sources to obtain geological information. | High |
| 817 | Development and testing of radiation devices | Development and testing of uncertified radiation devices that contain sealed sources. This is an approved use and is intended for development and testing of radiation devices and radiography cameras prior to certification. | High |
| 822 | Basic servicing of radiation devices | Servicing of radiation devices, including installation or dismantling of devices containing radioisotopes of either fixed or portable gauges (not both) | High |
| 823 | Complex servicing of radiation devices | Servicing of radiation devices, including installation or dismantling of devices containing radioisotopes of both fixed and portable gauges as well as exposure devices. | High |
| 824 | Distribution – drop shipment | Direct shipment from manufacturer to licensed end user, no possession, for import/export only. | Medium |
| 825 | Distribution – activity less than 740 MBq | The possession limit for each unsealed nuclear substance or the maximum activity for each sealed source is less than 740 MBq. | Medium |
| 826 | Distribution – activity equal to or greater than 740 MBq | The possession limit for each unsealed nuclear substance or the maximum activity for each sealed source is greater than 740 MBq. | Medium |
| 844 | Subsurface zone location | Use of sand, gel, cement or other material labelled with unsealed nuclear substances into a well during a fracturing or cementing operation to determine the depth and the extent of a fractured or cemented zone. | High |
| 846 | Subsurface tracer studies | Release of unsealed nuclear substances into a well to trace movement in the well or adjacent formations. | High |
| 847 | Processing more than 10 GBq of an unsealed nuclear substance | Preparation or treatment of unsealed nuclear substances for distribution where the possession limit is greater than 10 GBq but less than 1,000 | High |

| Use-type Number | Use-type Name | Description | Risk Ranking |
|---|---|---|---|
| | | TBq per calendar year for each unsealed nuclear substance. | |
| 851 | Manufacturing of sealed nuclear substances | Manufacturing of sealed sources other than uranium, thorium and plutonium in a quantity less than 1,000 TBq per calendar year. | High |
| 858 | Tracer studies | Field use of unsealed nuclear substances for individual, environmental or research purposes other than use-type subsurface tracer studies. | High |
| 862 | Diagnostic nuclear medicine | Administration of unsealed nuclear substances to humans for diagnostic purposes related to the health care. This includes processing of radiopharmaceuticals for in-house use and laboratory studies that are part of the diagnostic studies. | Medium |
| 863 | Processing – maximum unsealed nuclear substance activity of 10 GBq | Preparation or treatment of unsealed nuclear substances for commercial applications of which the possession limit is less than 10 GBq for each unsealed nuclear substance. | High |
| 864 | Radiation device manufacturing | Production of radiation devices that contain sealed sources. This includes servicing, demonstration and distribution. | High |
| 867 | Neutron activation | Use of neutron emitting nuclear substances to activate materials for analysis. | Medium |
| 868 | Borehole tube tagging | Use of nuclear substances placed subsurface or in equipment intended for subsurface use for the purpose of borehole depth or direction determination | High |
| 872 | Therapeutic nuclear medicine | Administration of unsealed nuclear substances to humans for therapeutic purposes related to their health care; processing of radiopharmaceuticals for in-house use and laboratory studies that are part of the therapy are included. | Medium |
| 873 | Research – sealed nuclear substance activity greater than 50 MBq | Use of sealed sources for research purposes; the maximum activity for each sealed source is greater than 50 MBq. | Medium |
| 875 | Human research studies | Administration of unsealed nuclear substances to or external irradiation of humans for purposes not related to their personal health care; processing of radiopharmaceuticals for in-house use and laboratory studies that are part of the human research study are included. | Medium |
| 878 | Self-shielded irradiators | Use of a radiation device to irradiate materials, but where the source remains shielded at all times during use. | Medium |
| 879 | Calibration | Use of nuclear substances and radiation devices to determine the response of radiation detection instruments. | Medium |
| 880 | X-ray fluorescence | Use of x-ray emitting nuclear substance in radiation devices for analysis purposes. | Low |

| Use-type Number | Use-type Name | Description | Risk Ranking |
|---|---|---|---|
| 881 | Electron capture detection | Use of sealed sources in gas chromatography; if the device contains less than 10 x EQ (e.g., for Ni-63 this means less than 1 GBq) it is exempt from licensing. H-3 is also used. | Low |
| 883 | Bone mineral analysis | Use of a radiation device to analyze bone in humans. | Low |
| 885 | Repair of components containing radioactive luminous compounds | Possession of instruments containing nuclear substances solely for the purpose of servicing. | Medium |
| 886 | Beta backscatter gauges | Use of a beta-emitting nuclear substance incorporated in radiation devices to measure thickness of materials and coatings. | Low |
| 888 | Electronic component testing | Use of Kr-85 to test the integrity of electronic components. | Low |
| 889 | Research – maximum sealed nuclear substance activity of 50 MBq | Use of sealed sources for research purposes. The maximum activity for each sealed source is less than 50 MBq. | Low |
| 894 | Teaching – sealed nuclear substance activity greater than 50 MBq | Use of sealed sources for teaching purposes. The maximum activity for each sealed source is greater than 50 MBq. | Medium |
| 895 | Industry - maximum sealed nuclear substance activity of 100 MBq | Industrial applications of radiation devices and sealed sources not otherwise covered by another use-type. Uses may include, but are not limited to, fuel gauges in aircraft, aircraft components and spark gap igniters. | Low |
| 896 | Dew point detection | Use of sealed nuclear substances in dew pointers. | Low |
| 897 | Static elimination | Possession and use of radiation devices containing sealed sources for static elimination. | Low |
| 898 | Static detection | Possession and use of radiation devices for static detection. | Low |
| 899 | Radioluminescence | Use of tritium-activated, self-luminous radiation devices. | Low |
| 900 | Surge voltage protection | Use of radiation devices to limit power surges in electronic components. | Low |
| 901 | Radioactive luminous compounds | Possession of instruments containing radioactive luminous nuclear substances for display or use. | Low |
| 902 | Remote blade inspection | Use of radiation devices to monitor helicopter-blade integrity. | Low |
| 906 | Storage | Possession of nuclear substances and radiation devices for storage only; no use. This use-type does not include the storage of waste nuclear substances from third parties | Medium |
| 907 | Teaching – maximum sealed nuclear substance activity of up to 50 MBq | Use of sealed sources for teaching purposes. | Low |
| 908 | Demonstration | Possession of nuclear substances or radiation devices for demonstration purposes. | Medium |

| Use-type Number | Use-type Name | Description | Risk Ranking |
|---|---|---|---|
| 915 | Veterinary nuclear medicine | Administration of unsealed nuclear substances to animals for diagnosis or therapy; processing of radiopharmaceuticals and laboratory studies that are part of the study or treatment are included. Veterinary medicine schools that perform research and teaching involving nuclear medicine procedures will require this license even in situations where they have another NSRD license. | Medium |
| 916 | Possession of deuterium | Possession of more than 10 kg of deuterium per year. | Medium |
| 918 | Temporary possession – no use | Possession of nuclear substances and radiation devices for storage only; no use, typically for trustees and others with limited understanding of radiation protection. Temporary possession less than one year. | Medium |
| 919 | Radioactive check sources | Possession of small sealed sources for the purpose of checking the function of radioactive detection instruments where the check source is not exempt under NSRD section 8.1. | Low |
| 940 | Liquid scintillation counters | Many now exempt under the NSRD, liquid scintillation counters are often found in laboratories and associated with 815 and other operations or standalone in laboratory situations to measure low-activity beta emitters. | Low |

# Appendix C: Qualifications and Duties of the Radiation Safety Officer

Radiation Safety Officers (RSOs) are specialists who, typically, provide day-to-day administration and control of radiation safety programs on behalf of their employers. Thus, the necessary competence in terms of educational training and practical experience that is required of an RSO in a particular situation will vary according to the responsibilities assigned to the RSO and the magnitude, complexity or diversity of the employer's use of nuclear substances. Competence in radiation safety matters may be gained by completion of classroom instruction in radiation safety, relevant work experience or any appropriate combination of formal training and practical experience.

Typically, RSOs who are assigned lead responsibility to ensure radiation safety should have relevant, practical work experience. RSOs that handle packages containing open-source radioisotopes should understand methods and technology to control, use, handle, store and transfer the nuclear substances, and to monitor and control radioactive contamination, radiation fields and radiation exposures. They should also understand pertinent regulatory processes and legislation. These may include the licensing process; conditions of the licences issued to the licensee by the CNSC, the *Nuclear Safety and Control Act* and its regulations; and pertinent CNSC regulatory guidance documents.

Licensees are reminded that pursuant to section 15 of the *General Nuclear Safety and Control Regulations* that the CNSC must be notified within 15 days of any change of RSO or the RSO's contact information.

To ensure radiation safety and compliance with regulatory requirements on behalf of management, the RSO may need to:

1. monitor, advise and consult regarding issues related to the handling of nuclear substances and radiation devices in accordance with regulations and licence conditions. Communicate with all workers and management
2. review requests for authorization to purchase or use nuclear substances and radiation devices in order to ensure that the radioactive material, the proposed handling and location of storage are acceptable and comply with the regulations and licence requirements
3. assess the qualifications and competence of workers who will use nuclear substances and radiation devices to determine whether they can do so safely and in compliance with regulations and the licence
4. ensure that workers who are required to use nuclear substances and radiation devices are adequately trained in radiation safety and radiation protection procedures. Authorize qualified workers to use nuclear substances or operate radiation devices. Ensure that workers whose duties may occasionally expose them to nuclear substances and radiation devices, such as cleaners, administration or other support staff, receive appropriate training in radiation safety
5. designate workers as Nuclear Energy Workers in accordance with the regulations
6. develop and implement programs to inspect and review licensed activities; locations of nuclear substance and radiation device storage; and the adequacy of worker training, safety procedures or the work environment. Implement remedial actions to correct any deficiencies identified
7. initiate any revisions to procedures, changes to equipment/facilities and licence amendments required to ensure on an ongoing basis that the licensee's operations, equipment and facilities comply with regulatory requirements
8. design and implement, in accordance with regulatory requirements, appropriate personnel monitoring programs

9. administer or control the distribution, use, and maintenance of personnel radiation monitoring devices and equipment, and the recording of results
10. monitor the occupational radiation exposures received by workers by reviewing the records of exposures. Recommend measures to management to reduce these exposures in accordance with the ALARA principle of dose limitation
11. investigate all reports of overexposures to ionizing radiation and of accidents and losses involving nuclear substances and radiation devices, determine pertinent facts or confirm events, and recommend appropriate actions to mitigate the consequences or to prevent recurrences. Ensure that the incidents and the results of related investigations are reported to the CNSC and other relevant authorities in accordance with the regulations and licence conditions
12. assess the adequacy of survey programs that measure or control radiation fields and radioactive contamination during licensed activities
13. ensure that sealed sources are leak tested and radiation-monitoring instruments are calibrated in accordance with the regulatory requirements
14. coordinate or participate in emergency responses to accidents and incidents involving nuclear substances and radiation devices
15. ensure that all records and reports that are required by the conditions of the licence and the regulations are prepared, maintained and submitted as required

# Appendix D: Notification of Nuclear Energy Worker Status (Example)

Worker: _____ Sex: ☐ M ☐ F

In accordance with the *Nuclear Safety and Control Act* (NSCA) and its regulations, this is to inform you that you are a Nuclear Energy Worker (NEW). As defined in the NSCA, a NEW is a person who is required, in the course of the person's business or occupation in connection with a nuclear substance or nuclear facility, to perform duties in such circumstances that there is a reasonable probability that the person may receive a dose of radiation that is greater than the prescribed limit for the general public.

Acknowledgement by NEW:

As required by the *Radiation Protection Regulations*, I have been informed in writing of:

- the risks associated with radiation to which I may be exposed during the course of my work, including the risk associated with the exposure of an embryo and fetus
- the applicable dose limits as specified in the regulations
- my expected radiation dose levels
- for females, my rights and obligations should I become pregnant

I understand the risks, my obligations and the radiation dose limits and levels that are associated with being designated a NEW.

Signature of worker: _____

Signature of radiation safety officer: _____

# Appendix E: Training Record (Example)

| Employee name: | | |
|---|---|---|
| Job classification: | | |
| Licensee: | | |
| **Topic** | **Training Coordinator's Name** | **Pass (P) / Fail (F)** |
| Module 1: Orientation lecture | | |
| Module 2: Structure of matter | | |
| Module 3: Radiation and radioactivity | | |
| Module 4: Radiation units | | |
| Module 5: Radiation detection and measurement | | |
| Module 6: Control of radiation exposure | | |
| Module 7: Biological effects | | |
| Module 8: Regulatory requirements | | |
| Module 9: Operating and emergency procedures | | |
| Module 10: Transportation requirements | | |
| Other training (specific): | | |

# Appendix F: Nuclear Substance Transfers Log (Example)

Transfer from the inventory of licence number: _____

| Date | Recipient Licence No. | Ship to Name | Ship to Address | Radionuclide | Quantity | Form/ Source |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# Appendix G: Principles for Applying ALARA to Industrial Radiography

1. Ensure radiography locations are posted with radiation warning signs or barriers to ensure compliance with dose-rate restrictions in your licence and the CNSC regulations.

2. Post signs at boundaries to inform others of radiography in progress. Ensure that all unauthorized personnel are out of the radiography area prior to commencing and maintain careful surveillance of the restricted area to ensure no other unauthorized personnel enter the area.

3. Utilize tungsten collimators wherever possible or where applicable. Collimators should be positioned in such a manner so that the beam of radiation is directed away from personnel.

4. Source guide tubes should be positioned when possible to take advantage of any shielding offered by surrounding components.

5. Radiography personnel shall position themselves as far as possible from the exposed source. The distance shall be governed by the radiographer's ability to maintain surveillance over the high radiation area.

6. Radiography personnel shall make use of any available shielding offered by the surrounding work environment. Maintain surveillance over the high radiation area.

7. The source should be exposed and retracted as quickly possible without exerting excessive force on the exposure device.

8. Radiographers shall always approach the exposure device from the rear with the radiation survey instrument in front of them. Survey shall be made 360 degrees around the device and 100 percent of the guide tube.

9. Report all deviations from good ALARA practices to the RSO or other management immediately.

10. RSO or supervisor performs periodic in-field observations to ensure ALARA practices are being implemented. These surveillances should be documented.

11. Radiography operation staffing should include two operators, if possible. More than two may be needed to control the boundaries to achieve ALARA commitments.

12. Radiography personnel shall understand their responsibilities and actions following a radiation incident to receive minimum exposure and prevent overexposures during emergency situations.

# Appendix H: Trainee Supervisor Request and Consent Form (Example)

In accordance with the *Nuclear Safety and Control Act* and its regulations, (*insert licensee name*) requests the certified exposure device operator (CEDO) whose name appears below to supervise the trainee(s) listed below in the operation of an exposure device containing Cobalt-60/Iridium-192/Selenium-75 as described.

Make of exposure device: _____ Model: _____

Make of exposure device: _____ Model: _____

I hereby consent to comply with the above request and am familiar with the sections of the *Nuclear Safety and Control Act* and its regulations and the requirements of the nuclear substance and radiation devices licence issued to (*insert licensee name*) with respect to the exposure devices listed above.

I submit that I will not allow any trainee to operate an exposure device unless I am satisfied that there is no danger to the health and safety of any person as a result of such operation and that each operation will be under my continual personal observation.

As a trainee supervisor, I will report any occurrence of any emergency situation such as is described in the *Nuclear Safety and Control Act* and its regulations and any occurrence when a direct-ready display dosimeter (DRD) records a reading greater than 2.0 mSv and when any malfunction of the equipment is observed.

Name of CEDO: _____ Signature: _____

Name of trainee: _____ Date: _____

# Appendix I: Instructions for the Preparation of an Emergency and Operating Procedures Manual

This appendix is meant to assist new applicants in preparing their emergency and operating procedures (EOP) manual. An EOP manual must be submitted with an application for a nuclear substance and radiation devices licence for industrial radiography. Appendices G, H and J through P of this guide, inclusive, are intended as operational guidance and may be included in your EOP. The recommendations, suggestions and comments presented here are the results of the CNSC's review of various manuals and do not necessarily represent all the material required in an EOP manual. The information requested is considered as the minimum information required for an EOP manual. As an applicant or licensee, you are encouraged to include any additional information that you deem necessary for the safe use of nuclear substances in your operations.

The EOP manual should note the date it was prepared (or revised), who prepared it and what equipment it covers. It should include in its introduction a list of supporting documentation to be included in its appendices (e.g., checklists, manufacturer's manuals).

Material covered in the EOP should be divided into two sections: daily (or routine) operations and emergency procedures, both of which are required by the *Nuclear Safety and Control Act* and its regulations.

## I.1 Daily (routine) operations

This section should be supported by the manufacturer's operating instructions and the various checklists that would be used for day-to-day operations. These operations should be described in the chronological order in which they would occur, beginning with the collection of equipment at the shop and ending with the return of the equipment and submission of the required reports.

The procedures should cover any operations required for a radiography job that lasts one day or longer, and must take into consideration the different operating processes of the types of exposure devices to be covered by this manual.

These procedures would include equipment and document checks, preparation for shipment and daily inspection of equipment.

An example of a daily checklist can be found in Appendix J: Daily Checklist (Example).

Subsections of the daily operations manual should include:

### I.1.1 Exposure devices:

These must be labelled as required by regulations. The operator would have to ensure he/she has the corresponding operations manual. These items should be included in the daily operations checklist.

### I.1.2 Radiation survey meters:

For purposes of this manual, operators should be instructed to check batteries and calibration (calibration sticker). Survey meter function can be checked while performing the surface dose-rate survey of the exposure device. These items should be included in the daily operations checklist.

### I.1.3 Dose control:

A dose-control program must be documented and must be designed to prevent exposures that exceed the permissible limits. The program must therefore address dose and time factors and must also take into consideration the delays associated with TLD analysis.

Action levels must be established, implemented and enforced by the licensee.

### I.1.4 Safety equipment:

All required safety equipment should be listed in the daily operations checklist.

### I.1.5 Transportation of sources:

Preparation of the exposure device (i.e., the transport package) and documents for transport must be described. These steps apply to all shipment/transport of nuclear substances, whether it is by private vehicle, company vehicle or commercial shipper. A checklist for packaging and transportation should be prepared.

In addition, an appropriate package of documents must be prepared as described in the *Transportation of Dangerous Goods Regulations* or as directed by the equivalent level of safety permit. These documents must accompany the device while it is being transported.

### I.1.6 Source-changing procedures:

This part of operations requires that a source-change request and consent form (see Appendix K: Source Change Request and Consent Form (Example)) be completed and the work carried out only by authorized personnel. Manufacturer's procedures must be followed. After the new source has been inserted, a survey of the exposure device must be completed and the results recorded. Inventory sheets must be updated.

### I.1.7 Leak tests:

Instruction on how to perform a leak test should be included in this section. Leak tests must include analysis for the depleted uranium incorporated in the shielding body, if any, as well as for the nuclear substance source assembly.

### I.1.8 Source storage enclosures:

Permanent storage locations should not be a part of this manual; they are assessed as part of your initial licence application. The preparation and use of temporary locations should be described here. Instruction must be given on what to do should the storage site be used for more than 90 days in any calendar year (i.e., the CNSC must be notified to formalize the location as a long-term place of storage and records must be maintained at that storage location in accordance with the licence conditions).

### I.1.9 Records:

This section should include instruction as to what forms and records are to be completed and submitted by the operator. Samples of records must be included in your manual and referenced in the appropriate procedures. Following is a list of the various records that must be kept. Each item in the list has been designated [EOP] or [ADMIN] depending on whether they need to be kept in the EOP manual or on file for administrative purposes.

- inventory, make, model number, serial number, the activity of the nuclear substance, date of procurement and disposal of both the sources and the exposure devices [ADMIN]. It is recommended that a sheet be prepared for each exposure device. The header should list device model number, serial number, location of storage and dates of procurement and disposal. The columns on the sheet should record the source information under headings for date of insertion, model number, serial number, isotope, activity, date

activity was measured, date of removal, to whom the source was transferred and who performed the transfer.
- dates and places of use [EOP]
- persons permitted to operate [ADMIN]
- list of nuclear energy workers [ADMIN]
- trainee request and consent form [EOP]
- maintenance records [ADMIN]
- leak-test records [ADMIN]
- DRD and TLD records, [ADMIN]
- daily DRD records [EOP]
- occurrence, malfunction, loss or theft reports [EOP]
- source-change request and consent form [EOP]
- surface dose rates and doses received during source change [EOP]
- daily operational checklist [EOP]
- transportation occurrence [EOP]
- survey meter calibration record [EOP]
- leak-test sampling form [EOP]

### I.1.10 Dosimeters:

#### I.1.10.1 Direct reading dosimeters:

These are commonly referred to as DRDs. For purposes of this manual, the operator should be instructed on:

- the purpose of the DRD
- when it must be worn
- where on the body it must be worn
- when readings are to be recorded and submitted
- what must be done when a reading exceeds 2.0 mSv
- any other limit specified by the applicant

#### I.1.10.2 Thermoluminescent dosimetry:

These are commonly referred to as TLDs. For purposes of this manual, the operator should be instructed on:

- the purpose of the TLD
- when it must be worn
- where on the body it must be worn
- when the TLD must be returned for reading
- the fact that the TLD is to be worn by only one person
- the fact that the TLD is only to be worn for the assigned period
- storing the TLD away from sources of radiation
- reporting requirements for lost TLD
- reporting requirements if TLD is accidentally exposed to radiation while not being worn

### I.1.11 Radiation survey meter:

For purposes of this manual, the operator should be instructed on:

- steps to take before use (battery and calibration checks)
- the ‘function check’ (this can be done while surveying the exposure device and observing that the survey meter is displaying the expected radiation reading)
- when the survey meter is to be used
- what to do when the survey meter malfunctions or fails the battery, calibration or function checks

### I.1.12 Radiation audible alarms:

For purposes of this manual, the operator should be instructed on:

- who must wear an audible alarm
- when to wear the dosimeter
- where on the body to wear the dosimeter
- any battery and function checks to be performed
- that it is not be used as a substitute for the survey meter
- calibration requirements

### I.1.13 Operations:

The operations subsection of this manual should include the following:

- a description of the procedures for securing and barricading of the work area. It is recommended that a chart be prepared to be used by the operator which would show the distances for the 0.1 mSv/h barrier, based on the activity of the source and collimator to be used. Barrier placement must be confirmed with a survey meter with the source in the exposure position
- a description of the formula and procedure to be used to ensure the doses described in the barrier area are not exceeded. To properly determine dose, the survey meter must be carried to the exposure device and the exposure device must be surveyed on all sides.
  - the formula is

    DOSE = DOSE RATE X TIME (OCCUPANCY)

- steps to be taken to minimize exposure if the movement of personnel cannot be controlled.
- use of a radiation survey meter to establish barriers and controlled areas to ensure the return of the source to the fully shielded position after each retraction of the source and to prepare the device for shipment

### I.1.14 Radiographer training:

Training of the operator by the licensee on the exposure device to be used should be reviewed.

Transportation of dangerous goods training requirements should be reviewed.

Training of the operator by the licensee on the specific emergency procedures should be reviewed.

All certified exposure device operators who transport nuclear substances, whether by company or private vehicle or a commercial shipper, are required by the *Packaging and Transport of Nuclear Substances Regulations, 2015,* and Transport Canada's *Transportation of Dangerous Goods Regulations* (TDGR) to hold a Training Certificate.

Sub-Section 6.1(1) of the TDGR requires that no person shall handle, offer for transport or transport dangerous goods unless the person is a trained person or performing those activities under the direct supervision of a trained person. A trained person is defined in section 6.2 as someone who has received adequate training related to that person's assigned duties in the aspects of handling, offering for transport or transporting dangerous goods, and has been issued a Training Certificate for Class 7, Radioactive Materials.

The training requirements for Class 7, Radioactive Materials should include all elements listed in section 6.2 of the TDGR and emergency response procedures for transportation incidents and reporting of dangerous occurrences.

A certified exposure device operator (CEDO) is a person who has successfully completed the CNSC's certification program and is recognized by the CNSC as a CEDO by the issuance of a certified exposure device operator card. A CEDO may operate any type of radiographic exposure device in Canada. Certified exposure device operator cards, however, do not cover handling, offering for transport or transporting a radiographic exposure device, and therefore cannot be used as a training certificate for TDGR purposes.

To complete the training requirements, a certificate of training must be issued by the employer. The certificate of training is valid for the period specified in the TDGR.

The following list summarizes the requirements of the TDGR that relate to the offering for transport (and the transport itself) of radioactive materials.

| Section | Subject |
|---|---|
| 1.4 | Definitions |
| 3.1 | Consignor responsibilities |
| 3.5 | Information on a shipping document |
| 3.6 | Additional information on a shipping document |
| 3.6.1 | Consignor's Certification |
| 3.7 | Location of a Shipping Document: Road |
| 3.8 | Location of a Shipping Document and Consist: Rail |
| 3.9 | Location of a Shipping Document: Marine |
| 3.11 | Keeping Shipping Document Information |
| 4.10 | Labels on a Small Means of Containment |
| 4.10.1 | Safety Marks on an Overpack |
| 4.11 | Shipping Name and Technical Name on a Small Means of Containment or on a Tag |
| 4.12 | UN Numbers on a Small Means of Containment of on a Tag |
| 4.15 | Placards on a Large Means of Containment |
| 4.15.3 | Placards and UN Numbers on a Large Means of Containment |
| 5.17 | Means of containment for Class 7, Radioactive Materials |
| 5.4 | Loading and Securing |
| 6.1 | Training Certificate Requirements |
| Schedule I | Proper shipping names and UN numbers – Classes 1 to 9 |

### I.1.15 Emergency procedures:

There are two types of emergencies that must be addressed in this part of the manual. They are:

- situations that occur during radiographic operations ("operational emergencies")
- those which occur during other phases (e.g., during transport, fire, theft, leaking source)

Source retrievals may only be undertaken by those persons specifically trained.

#### I.1.15.1 Operational Emergencies

Responses to operational emergencies should be divided into three parts:

**Pre-retrieval steps:**

These include:

- removal of all personnel from radiation area
- resurvey area and move barriers (0.1 mSv/h) and establish control areas
- contact appropriate authorities

- ensure proper dosimetry worn
- description of how to locate source position using a survey meter

**Specific retrieval steps:**

Once the source position is known a specific emergency procedure may be followed. Specific emergency procedures should not repeat the common pre-retrieval procedures. Some examples of emergency situations are:

- loss or theft of source
- fire
- leaking source
- transport (accident)

The following emergency situations require specialized training:

- cable drive exposure device emergencies
- source disconnect
- source misconnect
- source jammed in guide tube
- source jammed in collimator
- source not fully retracted
- source outside the exposure device
- pneumatically operated exposure device emergencies

**Post-retrieval steps:**

These should include:

- reporting requirements for all agencies involved (CNSC, Transport Canada, provincial authorities, etc.)
- removal from service of all involved equipment
- required equipment checks, leak tests, surveys, etc.
- recording and reporting of all doses associated with the retrieval
- preparation of an incident report (a standard form should be prepared)

### I.1.15.2 Non-operational emergencies

**Leaking sources:**

Dealing with sources leaking nuclear substance and/or contamination problems is beyond the scope and training of a certified exposure device operator.

If contamination is suspected the operator should contact the RSO immediately.

Survey meters should not be used for contamination checks.

**Transport incidents:**

For exposure devices involved in transport accidents, procedures must include directions on who to call (i.e. RSO, CNSC Duty Officer, CANUTEC, etc.) and in what order in accordance with the *Transportation of Dangerous Goods Regulations*.

The first instruction should be to attend to any injuries. If possible, remove injured persons from radiation areas.

If the exposure device transport compartment is not damaged, it is safe to assume the exposure device has not been damaged. A survey should be performed as soon as possible to confirm this; radiation barriers and control areas should then be established.

If the transport compartment is damaged and a survey cannot be performed, barriers should be set using the worse-case scenario of the source being fully exposed.

**Sources involved in a fire:**

Firefighting personnel should be informed of the possible hazard and its location and, when it is possible, monitor the radiation dose rates.

After the fire, barricade the area, perform a detailed survey of the exposure device and take the appropriate actions. Equipment involved in the fire must not be used until it is leak tested and proper operation is confirmed by persons authorized to do so.

**Lost source:**

The loss of a source must be immediately reported to the CNSC in accordance with the *Nuclear Safety and Control Act* and its regulations.

# Appendix J: Daily Checklist (Example)

Date: _____ Name of operator: _____

1. Dosimetry
   a. Thermoluminescent dosimeter (TLD)
   b. Direct-reading dosimeter (DRD) [zeroed if possible]
   c. Alarming dosimeter
2. Radiation survey meter
   a. Calibrated (sticker in place)
   b. Battery check
   c. Function (responding correctly)
3. Exposure device Model: Serial number:
   a. Radiation warning symbol
   b. Emergency contact details
   c. Source tag
   d. Surface dose rate (< 2.0 mSv/h)
   e. Operator properly trained in use of exposure device
4. Safety equipment
   a. Cutters
   b. Shielding tunnel
   c. Tongs
   d. Radiation warning signs
   e. Rope or ribbon (materials for barricades)
5. Documentation
   a. Completion of location of use (sign-out) sheet
   b. Copy of licence
   c. Copy of emergency and operation procedures
   d. Daily DRD record
   e. Trainee supervisor and consent (if required)
6. Packaging and Transportation (required before every shipment)
   a. Package surface dose rate (< 2 mSv/h)
   b. Package transport index (< 100 μSv/h at 1 m)
   c. Type B package for Type B quantity
   d. Source properly secured in device
   e. Compliance with Type B certificate
   f. Security during transport
   g. Type B certificate available
   h. Vehicle is placarded (four sides)
   i. Driver and/or operator has a certificate of training
   j. Transportation safety markings of container
   k. Shipping document prepared and available
   l. Secure stowage during transport
   m. Copy of Special Arrangement Certificate (if applicable)
   n. Copy of licence

All checks as listed have been performed by (signature): _____

Any problems or comments are to be recorded.

# Appendix K: Source Change Request and Consent Form (Example)

In accordance with the *Nuclear Safety and Control Act* and its regulations, *(name of licensee)* requests *(name of qualified operator)* to remove from and insert into *(type(s) of exposure device(s))* the following sources *(type(s) of source assembly(ies))*.

For the licensee: _____

Position: _____

Date: _____

I,_____, hereby consent to comply with the above request and am familiar with the *Nuclear Safety and Control Act* and its regulations.

Signature: _____

# Appendix L: Safety Audit Checklist (Example)

Job Site: _____

Project Manager: _____ Date: _____

Are the emergency procedures and safe operator manual for gamma-ray exposure devices available on the job site? ☐ Yes ☐ No

Is the CNSC licence for the exposure device and source posted on the job site?

☐ Yes ☐ No

Are radiation safety meetings held at this location?

☐ Yes ☐ No

Are emergency telephone numbers posted?

☐ Yes ☐ No

Are radiation areas properly controlled? Describe.

_____
_____
_____

Are signal or warning devices operable?

☐ Yes ☐ No ☐ N/A

Are storage areas acceptably located and shielded?

☐ Yes ☐ No

Are the following records available and being maintained?

| | | |
|---|---|---|
| Exposure devices in inventory | ☐ Yes | ☐ No |
| Leak wipe test results | ☐ Yes | ☐ No |
| Record of operators | ☐ Yes | ☐ No |
| Survey meter calibration | ☐ Yes | ☐ No |
| Record of location of use | ☐ Yes | ☐ No |
| Daily dose | ☐ Yes | ☐ No |
| TLD reports | ☐ Yes | ☐ No |
| Daily checklists | ☐ Yes | ☐ No |

Are the monitoring devices functioning properly?

| | | |
|---|---|---|
| Dosimeters | ☐ Yes | ☐ No |
| Survey Meters | ☐ Yes | ☐ No |

Dosimeter chargers ☐ Yes ☐ No

Survey meter calibration ☐ Yes ☐ No

Performance:

Is the exposure device properly cabled and functional?

☐ Yes ☐ No

Are workers using equipment certified and qualified?

☐ Yes ☐ No

Are surveys made after each exposure?

☐ Yes ☐ No

Is the exposure device placed in storage when not in use?

☐ Yes ☐ No

Remarks:

☐ No items of non-compliance, no unsafe conditions found.

☐ Areas of non-compliance found as follows:

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

Audit conducted by: _____

Radiographer: _____

Copies to: Radiation Safety Officer

# Appendix M: Exposure Device Inspection (Example)

Inspection Date: _____ Next inspection due date: _____

Exposure device manufacturer: _____ Model number: _____

| **SHIELD ASSEMBLY** | **ACCEPT** | **REPAIR** | **REPLACE** |
|---|---|---|---|
| Inspect for damage to the case or shielding. | | | |
| Check radiation levels on the surface and one meter from the shield assembly and record on the applicable sketch. | | | |
| Inspect safety plug proper condition. | | | |
| Check locking mechanism for proper operation and for firm attachment to the shield assembly. | | | |
| Inspect for proper alignment for "S" tube with entrance and exit ports. | | | |
| Inspect carrying and hold-down components for proper condition. | | | |
| Inspect for proper labelling:<br>1. Radiation warning symbol<br>2. Source tag<br>3. Name plate<br>4. Yellow III radiation sticker<br>5. Model and serial number | | | |
| Complete a leak wipe test in accordance with section 8.1 | | | |
| **SOURCE PIGTAIL ASSEMBLY** | **ACCEPT** | **REPAIR** | **REPLACE** |
| Inspect connector for proper condition using gauge when applicable. | | | |
| **SOURCE TUBES AND CABLE HOUSINGS** | **ACCEPT** | **REPAIR** | **REPLACE** |
| Inspect for rust, dirt and sludge build-up. | | | |
| Inspect tube connectors for proper condition. | | | |
| Inspect for kinks, crushed sections or other damage that could prevent operation. | | | |
| **CRANK ASSEMBLY** | **ACCEPT** | **REPAIR** | **REPLACE** |
| Check for operating characteristics. | | | |
| Inspect for excessive wear or damage. | | | |
| **CABLE** | **ACCEPT** | **REPAIR** | **REPLACE** |
| Inspect connector for proper condition using gauge when applicable. | | | |
| Remove and inspect entire cable for flexibility, wear, rust, broken wires and length. | | | |
| **MECHANICAL COMPATIBILITY OF COMPONENTS** | **ACCEPT** | **REPAIR** | **REPLACE** |
| Check connectors on source pigtail assembly and cable for proper fit and the possibility of accidental disconnection. | | | |
| Check connectors on shield assembly and tubes for proper fit. | | | |

# Appendix N: Exposure Device Occurrence Report (Example)

**LOCATION:**

Client name: _____

Address: _____

**CONTACTS:**

Radiation safety officer: _____

Local office manager: _____

Canadian Nuclear Safety Commission: _____

CNSC inspector: _____

TDG authority: _____

Police: _____

**TYPE OF SITUATION:** _____

_____

**EMERGENCY PROCEDURE FOLLOWED:** _____

_____

**NAMES OF RADIOGRAPHERS: (include TLD numbers and DRD readings)**

_____

_____

_____

**EQUIPMENT INVOLVED:**

Exposure device identity: _____ Serial no.:_____

Isotope: _____ Serial no.: _____

Source activity _____ GBq _____ curies

Controls serial no.:_____

**NAMES OF PERSONS EXPOSED: (include estimated dose or distance, time and shielding factors)**

_____

_____

_____

_____

**OTHER FACTORS:**

_____

_____

_____

_____

# Appendix O: Exposure Device Utilization and/or Inventory Form (Example)

Description: Nuclear Substance, Special Form N.O.S.

Source serial no.: _____ Camera no.: _____

Supplier: _____ Camera serial no.:_____

Date of installation: _____ Model no.:_____

Activity: _____ Ci (_____ GBq) Date of disposal:_____

Disposal agency: _____

| Issue Date | Surface Reading | NEW Responsible | Job Location | Return Date | Returned By | Comments |
|---|---|---|---|---|---|---|
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# Appendix P: Source Inventory Form (Example)

| Date Received | Source | Quantity | Serial # | Date Installed | Surface Dose Reading | Disposal Date |
|---|---|---|---|---|---|---|
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# Appendix Q: Application for Registration of Use of Packages (Example)

**Certificate details**

CNSC file no: _____

Canadian certificate no: _____

Foreign certificate no: _____

Package identification (make/model): _____

Canadian certificate issue date: _____

Canadian certificate expiry date: _____

**Registered user details:**

Contact name: _____

Name and address of organization: _____

Telephone no: _____

Fax no: _____

CNSC Licence no. (If applicable): _____

Serial numbers of packages (if purchased): _____

We confirm that we possess the instructions necessary to prepare the package for shipment as set out in the applicable certificate for the package design.

Signature: _____ Date: _____

Title: _____ RSO: _____

Send copy to:

Canadian Nuclear Safety Commission
P.O. Box 1046
Ottawa, ON, Canada
K1P 5S9
Phone: 613- 995-5894
Fax: 613-995-5086

# Appendix R:Regulatory Quantities for Typical Radionuclides

| Radionuclide | Classification | EQ /Exemption Quantity | ALI Estimate (Inhalation) | ALI Estimate (Ingestion) | Basic Level </=5 ALI | Intermediate Level </=50 ALI | High Level </=500 ALI | Wipes (Controlled Area) Bq/cm$^2$ | Wipes (Public Area) Bq/cm$^2$ | Municipal Waste MBq/kg | Sewer MBq/yr | Air kBq/m$^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag-110m | A | 1 MBq | 2.7 MBq | 7.1 MBq | 13.5 MBq | 135 MBq | 1.35 GBq | 3 | 0.3 | 0.01 | 0.1 | |
| Am-241 | A | 10 kBq | 740 Bq | 100 kBq | 3.7 kBq | 37 kBq | 370 kBq | 3 | 0.3 | 0.0037 | 10 | |
| Ar-41* | C | 1 GBq | 45 kBq | N/A | 225 kBq | 2.25 MBq | 22.5 MBq | 300 | 30 | N/A | N/A | 0.037 |
| Au-198 | B | 1 MBq | 18 MBq | 20 MBq | 90 MBq | 900 MBq | 9 GBq | 30 | 3 | 0.1 | 100 | |
| Ba-133 | B | 1 MBq | 11 MBq | 20 MBq | 55 MBq | 550 MBq | 5.5 GBq | 30 | 3 | 0.037 | 1 | |
| Bi-210 | A | 1 MBq | 330 kBq | 15 MBq | 1.65 MBq | 16.5 MBq | 165 MBq | 3 | 0.3 | 0.037 | | |
| Br-82 | B | 1 MBq | 23 MBq | 37 MBq | 115 MBq | 1.15 GBq | 11.5 GBq | 30 | 3 | 0.1 | 0.1 | |
| C-11 | C | 1 MBq | 9.1 GBq | 830 MBq | 45.5 GBq | 455 GBq | 4.55 TBq | 300 | 30 | 0.01 | | |
| C-14 | C | 10 MBq | 1 GBq | 34 MBq | 170 MBq | 1.7 GBq | 17 GBq | 300 | 30 | 3.7 | 10,000 | |
| Ca-45 | C | 10 MBq | 8.7 MBq | 26 MBq | 43.5 MBq | 435 MBq | 4.35 GBq | 300 | 30 | 0.37 | 1,000 | |
| Ca-47 | B | 1 MBq | 9.5 MBq | 13 MBq | 47.5 MBq | 475 MBq | 4.75 GBq | 30 | 3 | 0.01 | 100 | |
| Cd-109 | C | 1 MBq | 2.1 MBq | 10 MBq | 10.5 MBq | 105 MBq | 1.05 GBq | 300 | 30 | 0.37 | 10 | |
| Ce-139 | B | 1 MBq | 14 MBq | 77 MBq | 70 MBq | 700 MBq | 7 GBq | 30 | 3 | 0.1 | 1 | |
| Ce-141 | C | 10 MBq | 6.5 MBq | 28 MBq | 32.5 MBq | 325 MBq | 3.25 GBq | 300 | 30 | 0.037 | 10 | |
| Ce-143 | B | 1 MBq | 20 MBq | 18 MBq | 100 MBq | 1 GBq | 10 GBq | 30 | 3 | 0.1 | 1 | |
| Cl-36 | C | 1 MBq | 3.9 MBq | 22 MBq | 19.5 MBq | 195 MBq | 1.95 GBq | 300 | 30 | 0.37 | 10,000 | |
| Co-56 | A | 100 kBq | 4.1 MBq | 8 MBq | 20.5 MBq | 205 MBq | 2.05 GBq | 3 | 0.3 | 0.01 | | |
| Co-57 | C | 1 MBq | 33 MBq | 95 MBq | 165 MBq | 1.65 GBq | 16.5 GBq | 300 | 30 | 0.37 | 1,000 | |

| Radionuclide | Classification | EQ /Exemption Quantity | ALI Estimate (Inhalation) | ALI Estimate (Ingestion) | Basic Level </=5 ALI | Intermediate Level </=50 ALI | High Level </=500 ALI | Wipes (Controlled Area) Bq/cm$^2$ | Wipes (Public Area) Bq/cm$^2$ | Municipal Waste MBq/kg | Sewer MBq/yr | Air kBq/m$^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Co-58 | B | 1 MBq | 12 MBq | 27 MBq | 60 MBq | 600 MBq | 6 GBq | 30 | 3 | 0.37 | 100 | |
| Co-60 | A | 100 kBq | 1.2 MBq | 5.9 MBq | 6 MBq | 60 MBq | 600 MBq | 3 | 0.3 | 0.01 | 0.1 | |
| Cr-51 | C | 10 MBq | 560 MBq | 530 MBq | 2.65 GBq | 26.5 GBq | 265 GBq | 300 | 30 | 3.7 | 100 | |
| Cs-134 | A | 10 kBq | 2.1 MBq | 1.1 MBq | 10.5 MBq | 105 MBq | 1.05 GBq | 3 | 0.3 | 0.01 | 0.1 | |
| Cs-137 | A | 10 kBq | 3 MBq | 1.5 MBq | 15 MBq | 150 MBq | 1.5 GBq | 3 | 0.3 | 0.01 | 1 | |
| Cu-60 | C | 100 kBq | 320 MBq | 280 MBq | 1.6 GBq | 16 GBq | 160 GBq | 300 | 30 | 0.01 | | |
| Cu-64 | C | 1 MBq | 130 MBq | 170 MBq | 650 MBq | 6.5 GBq | 65 GBq | 300 | 30 | 0.1 | 1 | |
| Cu-67 | B | 1 MBq | 34 MBq | 59 MBq | 170 MBq | 1.7 GBq | 17 GBq | 30 | 3 | 0.1 | | |
| Er-169 | C | 10 MBq | 22 MBq | 54 MBq | 110 MBq | 1,1 GBq | 11 GBq | 300 | 30 | 10 | 10 000 | |
| F-18 | C | 1 MBq | 220 MBq | 410 MBq | 1.1 GBq | 11 GBq | 110 GBq | 300 | 30 | 0.01 | 0.1 | |
| Fe-55 | C | 1 MBq | 22 MBq | 61 MBq | 110 MBq | 1.1 GBq | 11 GBq | 300 | 30 | 3.7 | 10,000 | |
| Fe-59 | B | 1 MBq | 6.3 MBq | 11 MBq | 31.5 MBq | 315 MBq | 3.15 GBq | 30 | 3 | 0.01 | 1 | |
| Ga-67 | C | 1 MBq | 71 MBq | 110 MBq | 355 MBq | 3.55 GBq | 35.5 GBq | 300 | 30 | 0.037 | 100 | |
| Ga-68 | C | | 250 MBq | 200 MBq | 1 GBq | 10 GBq | 100 GBq | 300 | 30 | 0.01 | | |
| Ge-68 | C | 100 kBq | 2.5 MBq | 15 MBq | 12.5 MBq | 125 MBq | 1.25 GBq | 300 | 30 | 0.01 | 0.1 | |
| H-3 | C | 1 GBq | 1 GBq | 1 GBq | 5 GBq | 50 GBq | 500 GBq | 300 | 30 | 37 | 1,000,000 | 37 |
| Hg-194 | B | | 1.1 MBq | 390 kBq | 5.5 MBq | 55 MBq | 550 MBq | 30 | 3 | 0.01 | 10 | |
| Hg-197 | C | 10 MBq | 71 MBq | 87 MBq | 355 MBq | 3.55 GBq | 35.5 GBq | 300 | 30 | 0.1 | 1,000 | |
| Hg-203 | B | 100 kBq | 11 MBq | 37 MBq | 55 MBq | 550 MBq | 5.5 GBq | 30 | 3 | 0.1 | 10 | |
| I-123 | C | 10 MBq | 95 MBq | 95 MBq | 475 MBq | 4.75 GBq | 47.5 GBq | 300 | 30 | 3.7 | 1,000 | 3 |

| Radionuclide | Classification | EQ /Exemption Quantity | ALI Estimate (Inhalation) | ALI Estimate (Ingestion) | Basic Level </=5 ALI | Intermediate Level </=50 ALI | High Level </=500 ALI | Wipes (Controlled Area) Bq/cm$^2$ | Wipes (Public Area) Bq/cm$^2$ | Municipal Waste MBq/kg | Sewer MBq/yr | Air kBq/m$^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I-124 | A | | 17 MBq | 1.5 MBq | 85 MBq | 850 MBq | 8.5 GBq | 3 | 0.3 | 0.01 | 10 | |
| I-125 | C | 1 MBq | 1.4 MBq | 1.3 MBq | 6.5 MBq | 65 MBq | 650 MBq | 300 | 30 | 0.037 | 100 | 0.03 |
| I-131 | C | 1 MBq | 1 MBq | 910 kBq | 4.55 MBq | 45.5 MBq | 455 MBq | 300 | 30 | 0.037 | 10 | 0.175 |
| In-111 | C | 1 MBq | 65 MBq | 69 MBq | 325 MBq | 3.25 GBq | 32.5 GBq | 300 | 30 | 0.037 | 100 | |
| In-113m | C | 1 MBq | 630 MBq | 710 MBq | 3.15 GBq | 31.5 GBq | 315 GBq | 300 | 30 | 0.1 | 1 | |
| In-114 | C | | | | | | | 300 | 30 | | | |
| Ir-192 | B | 10 kBq | 4.1 Mbq | 14 MBq | 20.5 MBq | 205 MBq | 2.05 GBq | 30 | 3 | 0.37 | 1 | |
| K-42 | C | 1 MBq | 100 MBq | 47 MBq | 500 MBq | 5 GBq | 50 GBq | 300 | 30 | 0.1 | 1,000 | |
| Kr-79* | B | 100 kBq | 250 kBq | N/A | 1.25 MBq | 12.5 MBq | 125 MBq | 30 | 3 | N/A | N/A | 0.37 |
| Kr-85* | C | 10 kBq | 11 MBq | N/A | 55 MBq | 550 MBq | 5.5 GBq | 300 | 30 | N/A | N/A | 3.7 |
| La-140 | B | 100 kBq | 13 MBq | 10 MBq | 65 MBq | 650 MBq | 6.5 GBq | 30 | 3 | 0.01 | 0.1 | |
| Lu-177 | C | 10 MBq | 18 MBq | 38 MBq | 90 MBq | 900 MBq | 9 GBq | 300 | 30 | 1 | 10 | |
| Lu-177m | A | | 1.7 MBq | 12 MBq | 8.5 MBq | 85 MBq | 850 MBq | 3 | 0.3 | 0.01 | 0.1 | |
| Mn-52 | A | 100 kBq | 11 MBq | 11 MBq | 55 MBq | 550 MBq | 5.5 GBq | 3 | 0.3 | 0.01 | | |
| Mn-52m | C | 100 kBq | 400 MBq | 290 MBq | 2 GBq | 20 GBq | 200 GBq | 300 | 30 | 0.01 | | |
| Mn-54 | B | 1 MBq | 17 MBq | 28 MBq | 85 MBq | 850 MBq | 8.5 GBq | 30 | 3 | 0.01 | 1 | |
| Mn-56 | C | 100 kBq | 100 MBq | 80 MBq | 500 MBq | 5 GBq | 50 GBq | 300 | 30 | 0.01 | 0.1 | |
| Mo-99 | B | 1 MBq | 18 MBq | 17 MBq | 90 MBq | 900 MBq | 9 GBq | 30 | 3 | 0.1 | 100 | |
| N-13 | C | 1 GBq | 15 GBq | 1.2 GBq | 7.5 GBq | 75 GBq | 750 GBq | 300 | 30 | 0.1 | | |
| Na-22 | A | 1 MBq | 10 Mbq | 6.3 MBq | 31.5 MBq | 315 MBq | 3.15 GBq | 3 | 0.3 | 0.01 | 0.1 | |

| Radionuclide | Classification | EQ /Exemption Quantity | ALI Estimate (Inhalation) | ALI Estimate (Ingestion) | Basic Level </=5 ALI | Intermediate Level </=50 ALI | High Level </=500 ALI | Wipes (Controlled Area) Bq/cm$^2$ | Wipes (Public Area) Bq/cm$^2$ | Municipal Waste MBq/kg | Sewer MBq/yr | Air kBq/m$^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Na-24 | C | 100 kBq | 38 MBq | 47 MBq | 190 MBq | 1.9 GBq | 19 GBq | 300 | 30 | 0.01 | 100 | |
| Nb-95 | B | 1 MBq | 15 MBq | 34 MBq | 75 MBq | 750 MBq | 7.5 GBq | 30 | 3 | 0.01 | | |
| Nb-98 | C | 100 kBq | 200 MBq | 180 MBq | 1 GBq | 10 GBq | 100 GBq | 300 | 30 | 0.01 | | |
| Ni-63 | C | 100 MBq | 38 MBq | 130 MBq | 190 MBq | 1.9 GBq | 19 GBq | 300 | 30 | 0.1 | 1,000 | |
| O-15 | C | 1 GBq | 41 GBq | 3.7 GBq | 205 GBq | 2.05 TBq | 20.5 TBq | 300 | 30 | 0.1 | | |
| P-32 | C | 100 kBq | 6.9 MBq | 8.3 MBq | 34.5 MBq | 345 MBq | 3.45 GBq | 300 | 30 | 0.37 | 1 | |
| P-33 | C | 100 MBq | 15 MBq | 83 MBq | 75 MBq | 750 MBq | 7.5 GBq | 300 | 30 | 1 | 10 | |
| Pa-233 | B | 10 MBq | 6.3 MBq | 23 MBq | 31.5 MBq | 315 MBq | 3.15 GBq | 30 | 3 | 0.1 | | |
| Pb-210 | A | 0.01 MBq | 18 kBq | 29 kBq | 90 kBq | 900 kBq | 9 MBq | 3 | 0.3 | 0.0037 | 1 | |
| Pm-147 | C | 10 MBq | 5.7 MBq | 77 MBq | 28.5 MBq | 285 MBq | 2.85 GBq | 300 | 30 | 0.37 | 10,000 | |
| Po-210 | B | 0.01 MBq | 9.1 kBq | 83 kBq | 45.5 kBq | 455 kBq | 4.55 GBq | 30 | 3 | 0.0037 | 10 | |
| Pr-144 | C | | 670 MBq | 400 MBq | 3.35 GBq | 33.5 GBq | 335 GBq | 300 | 30 | 0.1 | | |
| Pu-238 | A | 0.01 MBq | 670 Bq | 87 kBq | 3.35 kBq | 33.5 kBq | 335 kBq | 3 | 0.3 | 0.001 | 1 | |
| Pu-239 | A | 0.01 MBq | 630 Bq | 80 kBq | 3.15 kBq | 31.5 kBq | 315 kBq | 3 | 0.3 | 0.001 | 1 | |
| Pu-240 | A | 0.001 MBq | 630 Bq | 80 kBq | 3.15 kBq | 31.5 kBq | 315 kBq | 3 | 0.3 | 0.001 | 1 | |
| Pu-241 | C | 0.1 MBq | 34 kBq | 4.3 MBq | 0.170 MBq | 1.7 MBq | 17 MBq | 300 | 30 | 0.1 | | |
| Ra-223 | B | 0.1 MBq | 3.5 kBq | 100 kBq | 17.5 kBq | 175 kBq | 1.75 MBq | 30 | 3 | 0.1 | 1 | |
| Ra-226 | A | 10 kBq | 9.1 kBq | 71 kBq | 45.5 kBq | 0.455 MBq | 4.55 MBq | 3 | 0.3 | 0.0037 | 1 | |
| Rb-86 | B | 0.1 MBq | 15 MBq | 7.1 MBq | 75 MBq | 750 MBq | 7.5 GBq | 30 | 3 | 0.1 | 10 | |
| Re-186 | B | 1 MBq | 17 MBq | 13 MBq | 85 MBq | 850 MBq | 8.5 GBq | 30 | 3 | 1 | 10 | |

| Radionuclide | Classification | EQ /Exemption Quantity | ALI Estimate (Inhalation) | ALI Estimate (Ingestion) | Basic Level </=5 ALI | Intermediate Level </=50 ALI | High Level </=500 ALI | Wipes (Controlled Area) Bq/cm$^2$ | Wipes (Public Area) Bq/cm$^2$ | Municipal Waste MBq/kg | Sewer MBq/yr | Air kBq/m$^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-188 | B | 0.1 MBq | 27 MBq | 14 MBq | 135 MBq | 1.35 GBq | 13.5 GBq | 30 | 3 | 0.1 | | |
| Ru-103 | B | 1 MBq | 9.1 MBq | 27 MBq | 45.5 MBq | 455 MBq | 4.55 GBq | 30 | 3 | 0.037 | | |
| Ru-106 | B | 0.1 MBq | 570 kBq | 2.9 MBq | 2.85 MBq | 28.5 MBq | 285 MBq | 30 | 3 | 0.037 | | |
| S-35 | C | 100 MBq | 18 MBq | 26 MBq | 90 MBq | 900 MBq | 9 GBq | 300 | 30 | 0.37 | 1,000 | |
| Sb-122 | B | 0.01 MBq | 17 MBq | 12 MBq | 85 MBq | 850 MBq | 8.5 GBq | 30 | 3 | 0.1 | | |
| Sb-124 | A | 1 MBq | 4.3 MBq | 8 MBq | 21.5 MBq | 215 MBq | 2.15 GBq | 3 | 0.3 | 0.37 | 0.1 | |
| Sc-46 | A | 1 MBq | 4.2 MBq | 13 MBq | 21 MBq | 210 MBq | 2.1 GBq | 3 | 0.3 | 0.1 | 0.1 | |
| Se-75 | B | 1 MBq | 12 MBq | 7.7 MBq | 60 MBq | 600 MBq | 6 GBq | 30 | 3 | 0.1 | 1 | |
| Sm-153 | B | 1 MBq | 29 MBq | 27 MBq | 145 MBq | 1.45 GBq | 14.5 GBq | 30 | 3 | 0.1 | 10 | |
| Sn-113 | C | 10 MBq | 11 MBq | 27 MBq | 55 MBq | 550 MBq | 5.5 GBq | 300 | 30 | 1 | | |
| Sr-85 | B | 1 MBq | 31 MBq | 36 MBq | 155 MBq | 1.55 GBq | 15.5 GBq | 30 | 3 | 0.1 | 1 | 0.175 |
| Sr-89 | C | 1 MBq | 3.6 MBq | 7.7 MBq | 18 MBq | 180 MBq | 1.8 GBq | 300 | 30 | 0.37 | 1,000 | |
| Sr-90 | B | 10 kBq | 260 kBq | 710 kBq | 1.3 MBq | 13 MBq | 130 MBq | 30 | 3 | 0.0037 | 1 | |
| Tc-99 | C | 10 MBq | 6.3 MBq | 26 MBq | 31.5 MBq | 315 MBq | 3.15 GBq | 300 | 30 | 0.37 | 10,000 | |
| Tc-99m | C | 10 MBq | 690 MBq | 910 MBq | 3.45 GBq | 34.5 GBq | 345 GBq | 300 | 30 | 3.7 | 1,000 | |
| Te-127 | C | 1 MBq | 110 MBq | 120 MBq | 550 MBq | 5.5 GBq | 55 GBq | 300 | 30 | 1 | | |
| Th-228 | A | 10 kBq | 630 Bq | 290 kBq | 3.15 kBq | 31.5 kBq | 315 kBq | 3 | 0.3 | 0.001 | 100 | |
| Th-230 | A | 10 kBq | 710 Bq | 95 kBq | 3.55 kBq | 35.5 kBq | 355 kBq | 3 | 0.3 | 0.001 | 100 | |
| Th-232 | A | 10 kBq | 690 Bq | 91 kBq | 3.45 kBq | 34.5 kBq | 345 kBq | 3 | 0.3 | 0.001 | 1 | |
| Tl-201 | C | 1 MBq | 260 MBq | 21 MBq | 105 MBq | 1.05 GBq | 10.5 GBq | 300 | 30 | 0.037 | 100 | |

| Radionuclide | Classification | EQ /Exemption Quantity | ALI Estimate (Inhalation) | ALI Estimate (Ingestion) | Basic Level </=5 ALI | Intermediate Level </=50 ALI | High Level </=500 ALI | Wipes (Controlled Area) Bq/cm$^2$ | Wipes (Public Area) Bq/cm$^2$ | Municipal Waste MBq/kg | Sewer MBq/yr | Air kBq/m$^3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tl-204 | C | 10 kBq | 32 MBq | 15 MBq | 160 MBq | 1.6 GBq | 1.6 GBq | 300 | 30 | 0.37 | 100 | |
| U Natural | A | 1 kBq | 3.2 kBq | 410 kBq | 16 kBq | 160 kBq | 1600 kBq | 3 | 0.3 | 0.01 | 1.4 kg | |
| U-234 | A | 10 kBq | 2.9 kBq | 410 kBq | 14.5 kBq | 145 kBq | 1450 kBq | 3 | 0.3 | 0.01 | | |
| U-235 | A | 10 kBq | 3.3 kBq | 430 kBq | 16.5 kBq | 165 kBq | 1650 kBq | 3 | 0.3 | 0.01 | | |
| U-238 | A | 10 kBq | 3.5 kBq | 450 kBq | 17.5 kBq | 175 kBq | 1750 kBq | 3 | 0.3 | 0.01 | | |
| V-48 | A | 100 kBq | 7.4 MBq | 10 MBq | 37 MBq | 370 MBq | 3.7 GBq | 3 | 0.3 | 0.01 | | |
| V-49 | C | | 770 MBq | 1.1 GBq | 3.85 GBq | 38.5 GBq | 385 GBq | 300 | 30 | 10 | | |
| Xe-127* | B | | 250 kBq | N/A | 125 MBq | 12.5 MBq | 125 MBq | 30 | 3 | N/A | N/A | |
| Xe-133* | C | 10 kBq | 2 MBq | | 3.35 MBq | 33.5 MBq | 335 MBq | 300 | 30 | N/A | N/A | 3.7 |
| Y-88 | A | | 6.1 MBq | 15 MBq | 15.5 MBq | 155 MBq | 1.55 GBq | 3 | 0.3 | 0.01 | 0.1 | |
| Y-90 | B | 100 kBq | 12 MBq | 7.4 MBq | 60 MBq | 600 MBq | 6 GBq | 3 | 3 | 0.37 | 10,000 | |
| Yb-169 | B | 10 MBq | 8.3 MBq | 28 MBq | 41.5 MBq | 415 MBq | 4.15 GBq | 30 | 3 | 0.1 | 1 | |
| Zn-65 | A | 1 MBq | 7.1 MBq | 5.1 MBq | 35.5 MBq | 355 MBq | 3.55 GBq | 3 | 0.3 | 0.01 | 1 | |
| Zr-89 | A | | 27 MBq | 25 MBq | 135 MBq | 1.35 GBq | 13.5 GBq | 3 | 0.3 | 0.01 | | |
| Zr-95 | B | 1 MBq | 4.8 MBq | 23 MBq | 24 MBq | 240 MBq | 2.4 GBq | 30 | 3 | 0.01 | | |

Note: * Concentration, in Bq/m$^3$, that results in a dose of 20 mSv if one is exposed to this concentration for 2,000 hours.

# Appendix S: Internal Authorization Form or Permit (Example)

Note: This form illustrates the level of detail expected in the completion of an internal authorization form or permit.

| **Sumspot University**<br><br>**Department of Biochemistry** | **RADIOISOTOPE USER PERMIT**<br><br>**Permit Number:** |
|---|---|
| | |
| **Permit Holder** | |
| Dr. IM Permit Holder<br>Department of Biochemistry<br>Room S-4123<br>Science Building | |
| **Period of Validity** | |
| Effective date: | June 1, 2010 |
| Expiry date: | May 31, 2012 |
| **Approved Nuclear Substances and Radiation devices** | |
| Unsealed nuclear substance and possession limit: | $^{3}$H 100 MBq<br>$^{14}$C 50 MBq |
| Sealed source nuclear substance maximum activity in possession: | $^{60}$Co 10MBq |
| Radiation devices make and model: | NIL |
| **Approved Locations** | |
| Room number and laboratory designation for use or storage: | S-4123 Basic Laboratory and Storage |
| **Approved Usage** | |
| In vitro biochemical research projects. | |
| **Waste Disposal** | |
| As appropriate and required. | |

| **Conditions of Approval** | | | | |
|---|---|---|---|---|
| As appropriate and required. | | | | |
| | | | | |
| **Workers authorized to use nuclear substances under this permit:** | | | | |
| Name | Nuclear Energy Worker (Y/N) | Date of Initial Training | Refresher Training | Nuclear Substances Permitted for Use |
| IM Permit-Holder | No | Aug 15, 2001 | Aug 15, 2011 | $^{3}H$, $^{14}C$, $^{60}Co$ |
| I Student | No | June 1, 2010 | June 1, 2011 | $^{14}C$, $^{60}Co$ |

# Appendix T: Inventory Form for Unsealed Materials (Example)

| **Nuclear Substance Inventory Sheet (use one sheet per vial)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Location** | | **Source** | | | **Shipment** | | |
| Building no. or GPS coordinates. | | Nuclear substance | | | Received | | |
| Supervisor | | Product | | | Checked | | |
| | | Quantity | | | P.O. | | |
| | | Date measured | | | Supplier | | |
| | | Volume | | | | | |
| | | Vial ID | | | | | |
| **Date** | **Worker** | **Procedure** | **Material Used** | **Material in stock** | **Waste Form** | **Disposal Method** | **Amount in Waste (%)** |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| **Waste Form** | **Disposal Method** |
|---|---|
| L=Aqueous liquid | 1=Municipal garbage |
| O=Organic Solvent | 2=Municipal sewer |
| S=Solid | 3=Incinerator |
| A=Absorbent Material | 4=Return to supplier |
| | 5=Transfer to another licensee or supplier |
| | 6=Transfer to storage |

# Appendix U: Inventory Form for Sealed Sources (Example)

| **Manufacturer:** | | | **Model name and number:** | | | | |
|---|---|---|---|---|---|---|---|
| **Radionuclide** | **Source Size** | **Assay Date** | **Serial Number** | **Location** | **Date of Receipt** | **Date of Transfer** | **Transfer to** |
| | | | | | | | |
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# Appendix V: List of Designated Nuclear Substance Locations (Example)

| Address or Building | Room or Lab No. | Designation Level (Basic/Intermediate) | Contact |
|---|---|---|---|
| | | | |
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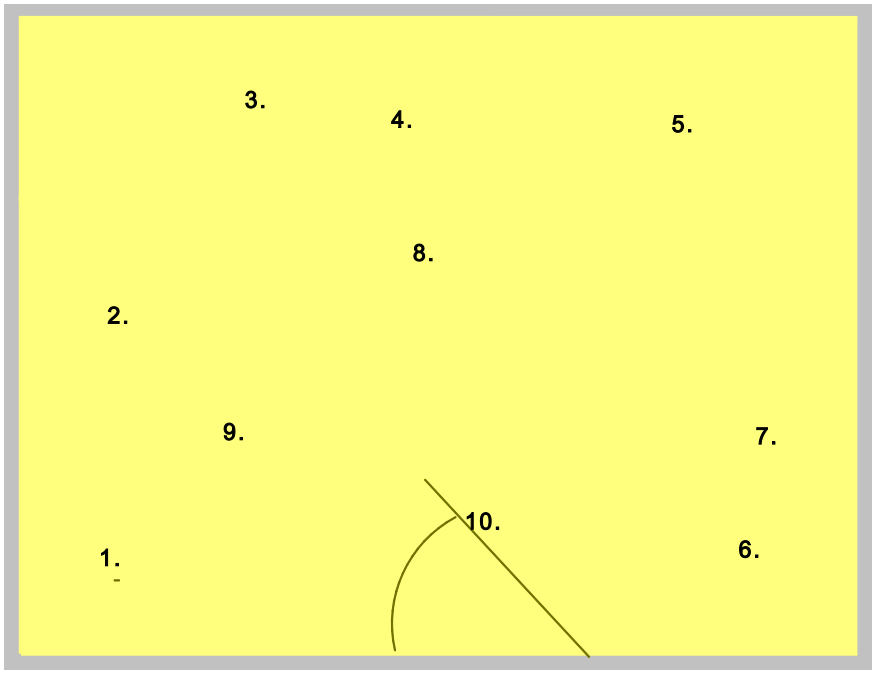
# Appendix W: Contamination Monitoring Results Log (Example)

| **Room/lab:** | | Action level: cpm = 0.3 Bq/cm$^2$ in well counter of Room X (if exceeded -> decontaminate, recount and report) |
|---|---|---|
| Date: | Checked by: | |

| # | Site Wiped | Initial Count | Recount After Decontamination | Notes |
|---|---|---|---|---|
| 0 | Background | | | |
| 1 | Lab bench top | | | |
| 2 | Lab bench top | | | |
| 3 | Centrifuge | | | |
| 4 | Sink | | | |
| 5 | Work desk | | | |
| 6 | Refrigerator shelves | | | |
| 7 | Floor (refrigerator) | | | |
| 8 | Floor (sink) | | | |
| 9 | Floor (bench) | | | |

The following diagram of the room indicates the sites where the wipes were taken.



# Appendix X: Package Receipt and Monitoring Log (Example)

| Receipt Date | Purchase Order | Supplier | Checked by | Damage/Leak | External Dose Rate | Wipe Counts (Outside) | Wipe Counts (Inside) | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
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# Appendix Y: Classes of Nuclear Substances

The following table organizes a number of common nuclear substances, including those for which surface contamination and waste disposal limits are typically incorporated into CNSC licences, into three classes—Class A, Class B, or Class C—on the basis of common radiological characteristics.

To find out the classification, for regulatory purposes, of any nuclear substance that is not listed below, contact a CNSC Licensing Specialist at 1-888-229-2672.

**CLASS A: 3 Bq/cm$^2$ controlled, 0.3 Bq/cm$^2$ public**

| | | | | | | |
|---|---|---|---|---|---|---|
| Ag-110m | Am-241 | Bi-210 | Co-56 | Co-60 | Cs-134 | Cs-137 |
| I-124 | Lu-177m | Mn-52 | Na-22 | Pb-210 | Pu-238 | Pu-239 |
| Pu-240 | Ra-226 | Sb-124 | Sc-46 | Ta-182 | Th-228 | Th-230 |
| Th-232 | U-naturel | U-234 | U-235 | U-238 | V-48 | Y-88 |
| Zn-65 | Zr-89 | All alpha emitters and their daughter isotopes | | | | |

**CLASS B: 30 Bq/cm$^2$ controlled, 3 Bq/cm$^2$ public**

| | | | | | | |
|---|---|---|---|---|---|---|
| As-74 | Au-198 | Ba-133 | Br-82 | Ca-47 | Ce-139 | Ce-143 |
| Co-58 | Cu-67 | Fe-59 | Ga-72 | Gd-153 | Hg-194 | Hg-203 |
| Ir-192 | Kr-79 | La-140 | Mn-54 | Mo-99 | Nb-95 | Pa-233 |
| Po-210 | Ra-223 | Rb-84 | Rb-86 | Re-186 | Re-188 | Ru-103 |
| Ru-106 | Sb-122 | Se-75 | Sm-153 | Sr-85 | Sr-90 | Xe-127 |
| Y-86 | Y-90 | Yb-169 | Zr-95 | | | |

**CLASS C: 300 Bq/cm$^2$ controlled, 30 Bq/cm$^2$ public**

| | | | | | | |
|---|---|---|---|---|---|---|
| Ar-41 | Au-195m | C-11 | C-14 | Ca-45 | Cd-109 | Ce-141 |
| Ce-144 | Cl-36 | Co-57 | Cr-51 | Cu-60 | Cu-64 | Er-169 |
| F-18 | Fe-55 | Ga-67 | Ga-68 | Ge-68 | H-3 | I-123 |
| I-125 | I-131 | In-111 | In-113m | In-114m | In-114 | K-42 |
| Kr-81m | Kr-85 | Lu-177 | Mn-52m | Mn-56 | N-13 | Na-24 |
| Nb-98 | Ni-63 | O-15 | P-32 | P-33 | Pm-147 | Pr-144 |
| Pu-241 | S-35 | Sn-113 | Sn-123 | Sr-89 | Tc-99 | Tc-99m |
| Te-127 | Tl-201 | Tl-204 | V-49 | W-188 | Xe-133 | |

# Appendix Z: Regulatory Expectations for Calibration of Survey Meters

## Z.1 Introduction

The CNSC regulations require radiation survey meters to be calibrated, in order to assure persons using the survey meter that the unit is functioning properly and that the readings obtained are representative of the actual conditions.

This document outlines the CNSC's expectations for applicants and licensees to meet regulatory requirements with respect to the calibration of survey meters.

Nothing in this document shall be construed to imply that the CNSC authorizes, certifies or licences persons to conduct survey meter calibrations. It is the responsibility of the licensee to ensure that any person conducting a survey meter calibration on their behalf can do so in accordance with CNSC regulatory requirements and the expectations outlined in this document.

## Z.2 Regulatory Basis

The regulatory requirement to have a calibrated survey meter is specified in section 20 of the *Nuclear Substances and Radiation Devices Regulations* and in sub-section 18(2) of the *Class II Nuclear Facilities and Prescribed Equipment Regulations*:

*"No person shall use, for the purpose of the Act, the regulations made under the Act or an order or a licence, a radiation survey meter that has not been calibrated within the 12 months preceding its use."*

## Z.3 Program Expectations for Calibration of Survey Meters

In order to ensure that the requirements of the regulations are met for having a survey meter that is calibrated, applicants and licensees must verify that the calibration is carried out in accordance with the following expectations.

### Z.3.1 Calibration Procedure Documentation

Before calibrating any specific make and model of survey meter, the person conducting the calibration shall have available for inspection and assessment a documented calibration procedure consisting of

1. a general description of the method of calibration
2. an identification and proof of verification of uncertainties associated with the jig, the source, attenuators, and decay correction which are associated with the total uncertainty of the calibration
3. step-by-step procedures, preferably including manufacturers' manuals, to show that sufficient information about the survey meter is available to operate, to perform pre-calibration checks and to calibrate the specific survey meter

### Z.3.2 Survey Meter Pre-Calibration Check

Before calibration, each survey meter shall have a pre-calibration check that consists of:

1. a battery check to ensure a satisfactory voltage can be maintained throughout the calibration
2. a verification of operating voltage
3. a comprehensive functional check on all ranges of the survey meter

### Z.3.3 Physical and Environmental Expectations for Jigs and Survey Meters

1. The beam calibrator jig must be located in the following manner:
   a. to minimize radiation scatter and be at least 1 m from the floor, the ceiling, and from any wall. The distance between any scattering object and the source must be at least 0.5 m
   b. in an area free of interference from sources of ionizing radiation other than the calibration source
   c. in an area where electrostatic, electrical and magnetic fields and other non-ionizing radiation, such as radio frequency and microwave, will not affect instrument response
2. The survey meter to be calibrated shall:
   a. be positioned on the jig to minimize bias due to geotropism, directional dependence, and non-uniformity of the source radiation beam across and through the detector volume
   b. have any beta window or shield in the optimum position (normally closed) for best (i.e. flattest) energy response
3. The uncertainty in calibration distance shall not be greater than 2% and shall be the arithmetic sum of the uncertainty of the jig distance scale, the uncertainty in physical placement and repositioning of the survey meter, the uncertainty in location of the source centre when on the jig, and the uncertainty of the centre of the sensitive volume of the survey meter detector
4. The survey meter to be calibrated shall have achieved equilibrium with the temperature, pressure and humidity of the local calibration area. These environmental parameters should be noted and shall be within the approved range as specified by the manufacturer of the survey meter. It is recommended that instruments are calibrated at about 20°C (68°F) and 101.3 kPa (1 atmosphere), or at the anticipated operational parameters. It should be noted that the response of some survey meters must be corrected for temperature and pressure. Therefore, where required, such corrections must be performed
5. The calibration should be carried out where the level of background radiation is known and the appropriate corrections made to compensate for the contribution from this potential source of error. This is particularly important when measuring at the lowest ranges on the survey meter

### Z.3.4 Expectations for Calibration Sources

It is preferable to use the same reference isotope as the manufacturer for the calibration source, especially if the manufacturer's specified energy response is to be assumed. Whatever isotope is used, the energy dependence of the dose rate response of the survey meter shall be known and shall be within 30% of the true dose rate over the energy spectrum of interest.

The calibration source activity (or exposure rate) shall be known to an uncertainty of not greater than ± 10%. This uncertainty shall include attenuators (used singly or in combination), if they are an integral part of the source assembly. A calibration source certificate shall be available for inspection, and as a minimum the source shall be implicitly traceable through a source supplier to a national or international standard. The calibration source activity shall be corrected for decay at a frequency to ensure its activity is within 1 % of its true value.

### Z.3.5 Expectations for Survey Meter Calibration

Each survey meter shall be calibrated up to its highest range or the 10 mSv/h range, whichever is lower. The manufacturer's recommended calibration method, if any, must be followed, and the calibration shall be verified at about 20 to 25% and 75 to 80% of the measurement of each range or decade.

Measurement shall be recorded before and after any necessary (or preferred) calibration adjustments. A survey meter shall be considered to meet the criteria for being adequately calibrated when each observed measurement is within ±20% of the expected dose rate.

Measurements above 10 mSv/h need not be calibrated, but each range shall be checked to ensure response and, as far as practicable, by decreasing calibration distance the appropriate increasing dose rate response shall be checked.

### Z.3.6 Expectations for Record Completion

Immediately following calibration the person completing the calibration must complete a calibration certificate, and complete and affix a durable calibration sticker, bearing the date of calibration, to the survey meter. The person conducting the calibration shall return the original certificate with the survey meter to the user.

If a survey meter fails to meet the criteria for being adequately calibrated, the person conducting the calibration shall immediately notify the person who requested the calibration.

If requested to do so, a person conducting the calibration may, if they are qualified through training or other certification, repair a survey meter before returning to the user. Subsequent to any repair which exceeds the manufacturer's instructions for normal maintenance, a survey meter shall be recalibrated.

### Z.3.7 Documentation of Calibration

In order to meet the requirements of Section 20 of the *Nuclear Substances and Radiation Devices Regulations*, licensees must make available on request to the CNSC a document for each survey meter which includes the following information:

1. licensee name and CNSC Licence Number
2. survey meter make and model, including serial number of the detector unit and the probe used in the calibration, if appropriate
3. the calibration source used, including isotope and activity
4. the results of the pre-calibration checks, including:
   a. battery condition
   b. operating voltage
   c. temperature, pressure and humidity, at the time of calibration
5. for each range calibrated
   a. the range on the survey meter that was calibrated
   b. the expected dose rate using the calibration device
   c. the observed dose rate on the survey meter, with units, including both pre and post calibration
   d. the calculated percent variance of the observed dose rate versus expected dose rate
   e. any notes of concerns or anomalies for that range
6. any notes of anomalies or problems associated with the calibration of the survey meter in general
7. the date of the calibration of the survey meter
8. the name and signature of the person who conducted the calibration
9. acknowledgement that the calibration was carried out in accordance with these requirements

## Z.4 Maintenance of Records

The licensee shall retain a record of each survey meter calibration as required by the NSCA and regulations and shall retain those records for the period specified in the licence or the Regulations, as appropriate.

# Appendix AA: Regulatory Expectations for Leak Testing of Sealed Sources

## AA.1 Introduction

Leak testing of sealed sources is required under CNSC regulations to ensure that a sealed source has not developed defects, has been damaged or has degraded so as to present an unrecognized radiological risk to persons using or working near the source.

This document outlines the CNSC's expectations for applicants and licensees to meet the regulatory requirements for leak testing of sealed sources.

Nothing in this document should be construed to imply that the CNSC authorizes, certifies or licences persons to leak test sealed sources. It is the responsibility of the licensee to ensure that any person conducting a leak test of a sealed source on their behalf can do so in accordance with these expectations.

## AA.2 Regulatory Basis

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* and in section 19 of the *Class II Nuclear Facilities and Prescribed Equipment 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."*

## AA.3 Program Requirements for Leak Testing

In order to ensure that the leak testing requirements of the regulations are met, applicants and licensees must verify that the leak testing is carried out in accordance with the following expectations.

### AA.3.1 Wipe Sampling Procedure Documentation

Before wiping any sealed source the licensee shall have available for inspection, a documented sampling procedure consisting of:

1. a general description of the method of wipe sampling
2. a list of all sealed sources to be leak tested, and their locations
3. a step by step procedure of the method for wipe sampling each type of sealed source and each type of sealed source containment including:
    a. operating instructions for sealed source drives, shutter interlocks and safety features during sampling
    b. a description and reason for choice of physical configuration of the wipe, material of the wipe, and compatible solvent (if required)
    c. a description of the method of wiping
    d. a description of the location of wiping, which depending upon sealed source activity and sealed source accessibility may be from the exterior surface of the sealed source or the immediate environment of the sealed source device or holder
4. a description of the types of wipe sample containers including:
    a. means of identifying the wipe sample or container or both
    b. the method of packaging and transporting to the person who will be conducting the measurement of the swipe

### AA.3.2 Expectations for Sampling

Sampling must be performed by a person who:

1. understands regulatory requirements and these expectations
2. knows the type and activity of the sealed source and the sealed source containment
3. can recognize and minimize the potential contamination and radiation hazards associated with:
    a. the sealed source and its containment, including any sealed source windows
    b. wipe sampling the sealed source or its immediate environment
    c. the wipe sample
4. has available and follows the procedure detailed in section 3.1
5. has available sufficient wipe sampling materials and wipe sample containers
6. follows all manufacturer’s instructions for the safe operation of any radiation device for the purposes of leak testing
7. follows all radiation and other safety precautions for working in the area in which the sealed source is located, including lock-out and personal protection requirements

### AA.3.3 Sampling Records

Immediately following sealed source wipe sampling, the person conducting the sampling shall place the wipe sample in an identified container, recording the:

1. name of the person conducting the sampling
2. licensee name and CNSC licence number
3. sealed source identification information (make, model, serial number and isotope)
4. sample container identification number
5. date that the sample was taken

All of the information in this record should be transferred with the sample container to the person who will be conducting the analysis of the swipe.

### AA.3.4 Measuring Procedure Documentation

Before measuring any sealed source leak test wipe samples, the person conducting the analysis of the swipe shall have available a documented sample measuring procedure consisting of:

1. a general description of the method of measuring; and,
2. a step by step procedure for measuring wipe samples with the measuring equipment including:
   a. a description and identification of measuring equipment (make, model and serial number)
   b. instructions, preferably including manufacturers' manuals, to set up, operate and measure samples
   c. a description of the tests to be performed using traceable standard source of the radioisotope of interest to demonstrate the capability to make reproducible measurements, and to detect 200 Bq or less of each isotope of interest

### AA.3.5 Sample Analysis

Analysis of the swipe sample must be performed by a person who:

1. knows the regulatory requirements and the expectations outlined in this document
2. is familiar with the operation of the measuring equipment
3. can recognize and minimize the potential radiation and contamination hazards associated with the wipe sample
4. has available and follows the procedure detailed in section 3.4

### AA.3.6 Leak Test Record Completion

Immediately following the wipe sample measurement, the person conducting the analysis of the swipe sample shall complete the leak test record, retain a copy and send the original to the licensee. The person who analyzed the swipe sample shall immediately advise the licensee if a sealed source wipe sample has contamination which exceeds the leakage criterion of 200 Bq.

Licensees must notify the CNSC of any sealed source where leakage has been detected in excess of 200 Bq.

## AA.4 Maintenance of Records

The licensee shall retain records of all leak testing as required by the NSCA and Regulations and shall retain those records for the period specified in the licence or the Regulations, as appropriate.

# Appendix BB: Radioisotope Safety – Monitoring for Radioactive Contamination

## BB.1 Introduction

This document provides general guidance for monitoring and controlling radioactive contamination, and relating the monitoring results to the CNSC radioisotope licence criteria. This document pertains primarily to laboratories, but also applies to the control of radioactive contamination in other locations. The document also provides guidance on contamination monitoring instrument selection.

Each CNSC radioisotope licence authorising the use of open source radioactive material contains a condition which states the regulatory criteria pertaining to radioactive contamination. This licence condition can be found in section BB.7.

The specified contamination criteria must be applied to all areas where radioisotopes are used. Notwithstanding these limits, licensees should maintain levels of radioactive contamination as low as reasonably achievable (ALARA).

## BB.2 Elements of a Contamination Monitoring Program

### BB.2.1 Method of measurement

Radioactive contamination may be measured directly or indirectly. Direct measurement means the use of portable radiation detection instruments to detect both fixed and removable contamination. Direct measurement may be used when background radiation levels are negligible compared to licence criteria. Indirect measurement only detects removable contamination by means of wipe tests.

### BB.2.2 Instrument selection

The ability of various radiation instruments to detect radioisotopes of interest will vary with the instrument and the manufacturer. Guidance on the selection of instruments can be found in section BB.8. For specific information on a particular make or model, contact the manufacturer.

### BB.2.3 Locations of measurement

The locations that are to be monitored should be numbered on a plan of the radioisotope work area. These locations should include working surfaces, such as benches, countertops, fume hoods, etc., storage areas, and non-working surfaces such as floors, instruments and equipment, door handles, light switches, sink taps and telephone receivers. Several random locations should also be monitored. Too rigid a set of locations may overlook problem areas.

### BB.2.4 Instrument checks and calibration

Non-portable instruments used for counting wipes, such as liquid scintillation counters, well-crystal type gamma counters, gas-flow proportional counters, semiconductor gamma spectrometers and gamma cameras, should be routinely serviced according to the manufacturer’s instructions. Keep a record of the service information and dates.

Before monitoring for contamination, portable instruments should be given operational checks as specified by the manufacturer (i.e. battery check, high-voltage check, response check, etc) and the background radiation level should be measured. Record the operational checks and background measurement. Similarly, non-portable instruments used to count wipes should count and record a blank and standard with each set of wipes.

Instruments that are not operating within the parameters of the operational checks or which show anomalous background, blank or standard measurements, should not be used until their proper operation can be verified.

### BB.2.5 Frequency of monitoring

Contamination monitoring frequencies must conform to the requirements on the requirements indicated on the appropriate CNSC Laboratory Rules Poster (Basic Level INFO-0728-1, Intermediate Level INFO-0728-2, High Level INFO-0728-3 or Nuclear Medicine INFO-0728-4), or in a radioisotope licence condition. Copies of the CNSC Laboratory Posters can be found on the CNSC website or by contacting the CNSC.

When radioactive material is not used for a prolonged period of time, contamination monitoring is not required, but such a period should be identified in the records.

### BB.2.6 Decontamination

Any area that is found to have non-fixed contamination exceeding the regulatory criteria must be cleaned and re-monitored. If the area cannot be cleaned to meet the criteria, the contaminated surface must be sealed, removed or shielded until the criteria are met.

Note: For short-lived radionuclides, the room or area may be posted and secured until the radioisotope decays.

### BB.2.7 Monitoring Records

Contamination monitoring records must be kept for one year after the expiry of the licence and must be available for inspection by CNSC staff. These records should include:

- date of measurement
- make and model of the instrument
- monitoring locations
- contamination monitoring results in $Bq/cm^2$ (before and after contamination)
- for portable instruments, the results of operational checks and background measurements
- for non-portable instruments, blank and standard measurement results
- instrument calibration data should be recorded and updated as necessary

## BB.3 Direct Measurement of Contamination Using a Portable Meter

Depending upon the detector and the radioisotopes, direct measurement is often convenient for monitoring large areas. Direct measurement instrument readings include both fixed and non-fixed contamination. Thus a reading which satisfies the licence criteria gives a conservative estimate of non-fixed contamination.

- monitor the locations marked on the plan of the working area by slowly passing the detector over each area
- keep the detector face towards the surface being monitored and keep the distance between the detector and the surface as small as possible without touching (and possibly contaminating) the detector
- if contamination is detected, stop and obtain a measurement. Clean the area until the instrument measurement is below the licence criteria. A reading in excess of licence criteria after repeated cleaning is an indication of fixed contamination or a high radiation background
- identify and mark the contaminated area on the plan
- record the highest measurement for each area and the final measurement after decontamination

## BB.4 Indirect Measurement of Contamination with Wipes

- wipe each of the locations shown on the plan of the working area with a filter paper, wipe or cotton swab lightly moistened with alcohol or water. Use one numbered wipe per location One "screening" wipe can be used to monitor several locations. If contamination is found, the contaminated area must be identified and decontaminated
- wipe an area of 100 $cm^2$. Using uniform and constant pressure ensure the area is wiped.
- if necessary, carefully dry the wipe to prevent loss of activity. Since the contamination may be absorbed into the wipe material, the use of a wetting agent may lead to a significant underestimate of alpha and low-energy beta contamination with some counting methods
- count the wipes in a low-background area and record all results
- if the wipes are to be counted on a contamination meter, the wipe should be smaller than or equal to the sensitive area of the detector
- clean any contaminated areas and re-monitor. Record results before and after decontamination.

## BB.5 Relating Measurement Readings to Regulatory Criteria

The readings from contamination meters and non-portable instruments can be related to regulatory criteria if the efficiency of the instrument for a specific radioisotope is known.

Instrument efficiencies for specific radioisotopes can be obtained from the manufacturer or determined using an appropriate standard of known activity. For a description of instrument efficiency refer to the Detector Efficiency section below.

For mixtures of radioisotopes, do all the calculations using the radioisotope for which the instrument has the lowest detection efficiency.

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

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

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 survey instrument or the blank

E = the instrument efficiency factor (expressed as a decimal, i.e. for 26% efficiency, E=0.26) 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. For more information see section BB.9

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.

## BB.6 Instrument Sensitivity

Potable contamination monitoring instruments must be capable of making reproducible measurements at the licence criteria limits. A minimum detection limit is approximately twice the background measurement.

## BB.7 Radioisotope Licence Criteria for Radioactive Contamination

The licensee shall ensure that for nuclear substances listed in the Appendix Y: Classes of Nuclear Substances:

- 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$^2$
- 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$^2$

## BB.8 Selection of Contamination Monitoring Instruments

The following is a general list of the various types of contamination monitoring instruments for some commonly used radioisotopes. Please consult the manufacturer for the exact specification of the instrument you are interested in.

| Hand-held Contamination Monitoring Instrument | |
|---|---|
| **Type of Instrument** | **Code** |
| Thin-window G-M detector | 1 |
| Ion chamber with beta window | 2 |
| Gas-filled proportional detector | 3 |
| Thin-layer sodium iodide scintillation detector | 4 |
| Thick-crystal sodium iodide scintillation detector | 5 |
| Organic crystal/plastic scintillation detector | 6 |
| Zinc sulphide scintillation detector | 7 |

| Non-portable Monitoring Instruments (Wipe Counters) | |
|---|---|
| **Type of Instrument** | **Code** |
| Gas-flow proportional counter | A |
| Liquid scintillation counter | B |
| Well-crystal sodium iodide counter | C |
| Semiconductor gamma spectrometer | D |

| Common Radioisotopes and Suggested Monitoring Instrument Selection | | | | | |
|---|---|---|---|---|---|
| **Radioisotope** | **Half-life** | **Principle Emission** | **Energy (keV)** | **Hand-Held Instruments** | **Non-Portable Instruments** |
| H-3 | 12 years | beta | 5.7 | 6 | B |
| C-14 | 5730 years | beta | 49 | 1 2 3 6 | A B |
| P-32 | 14 days | beta | 695 | 1 2 3 6 | A B |
| S-35 | 83 days | beta | 49 | 1 2 3 6 | A B |
| Ca-45 | 163 days | beta | 77 | 1 2 3 6 | A B |
| Cr-51 | 28 days | photon | 320 (10%) | 3 6 | B C D |
| Mn-54 | 312 days | photon | 835 (100%) | 2 3 6 | B C D |
| Fe-55 | 3 years | photon | 5.9 (25%) | 6 | B C D |
| Co-57 | 272 days | photon | 122 (86%) | 2 3 4 5 6 | B C D |
| Co-60 | 5 years | photon | 1170, 1330 | 1 2 3 5 6 | A B C D |
| Ni-63 | 92 years | beta | 17 | 2 3 6 | A B |
| Ga-67 | 3 days | photon | 93 (36%) | 2 3 4 5 6 | A B C D |
| Rb-86 | 19 days | beta | 709 | 1 2 3 6 | A B C D |
| Sr-90 | 28 years | beta | 196 | 1 2 3 6 | A B |
| Tc-99m | 6 hours | photon | 141 (89%) | 2 3 4 5 6 | A B C D |

| Common Radioisotopes and Suggested Monitoring Instrument Selection | | | | | |
|---|---|---|---|---|---|
| **Radioisotope** | **Half-life** | **Principle Emission** | **Energy (keV)** | **Hand-Held Instruments** | **Non-Portable Instruments** |
| In-111 | 3 days | photon | 245 (94%) | 2 3 4 5 6 | A B C D |
| I-125 | 60 days | photon | 35 (6.5%) | 2 4 6 | B C D |
| I-131 | 8 days | photon | 364 | 1 2 3 4 5 6 | A B C D |
| Ba-133 | 11 years | photon | 356 (60%) | 1 2 3 4 5 6 | A B C D |
| Cs-137 | 30 years | photon | 662 | 1 2 3 5 6 | A B C D |
| Ir-192 | 74 days | photon | 300 | 1 2 3 4 5 6 | A B C D |
| Tl-201 | 3 days | photon | 167 (10%) | 2 3 4 5 6 | A B C D |
| Pb-210 | 22 years | photon | 11 (25%) | 1 2 3 4 5 6 | A B C D |
| Ra-226 | 1600 years | alpha | 4780 | 1 2 3 4 5 6 7 | A B C D |

Notes:

- the principal energy quoted for the beta emitters is the average beta energy
- the (%) beside the gamma emitters is the percent abundance for that energy
- certain radioisotopes, such as Po-210 and Ra-226, are part of a decay chain and can be detected by measuring for the decay products. Ra-226 plus its daughters is an alpha, beta and gamma emitter and can be efficiently detected using thin-window Geiger detector, a well-crystal sodium iodide counter or a liquid scintillation detector
- some hand-held instruments may also be used to screen wipes if used in low-background area

## BB.9 Detector Efficiency

The detector efficiency depends upon:

- the type of detector (GM, NaI Scintillation, Plastic Scintillation, Proportional)
- the detector size and shape
- the distance from the detector to the radioactive material
- the radioisotope and the type of radiation measured (alpha, beta and gamma radiations and their energies)
- the backscatter of radiation toward the detector
- the absorption of the radiation before it reaches the detector (by air and by the detector covering)

The detector efficiency can be found by:

1. counting the standard source of known activity with your detector.

$$\text{Efficiency} = \frac{\text{(detector count rate – background count rate)}}{\text{known activity of standard source}}$$

2. asking the manufacturer about the efficiency of the detector for your specific radioisotope(s)

# Glossary

**abandon** *(abandonner)*
Remove from regulatory control.

**action level** *(seuil d'intervention)*
A specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program and triggers a requirement for specific action to be taken. (Source: *Radiation Protection Regulations*)

OR

A specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program or environmental protection program, and triggers a requirement for specific action to be taken. (Source: *Uranium Mines and Mills Regulations*)

**activity** *(activité)*
The number of nuclear transformations occurring per unit of time, as measured in becquerels. (Source: *Packaging and Transport of Nuclear Substances Regulations, 2015* )

**as low as reasonably achievable [ALARA]** *(niveau le plus faible qu'il soit raisonnablement possible d'atteindre [ALARA])*
A principle of radiation protection that holds that exposures to radiation are kept as low as reasonably achievable, social and economic factors taken into account. Section 4 of the *Radiation Protection Regulations* stipulates licensee requirements with respect to ALARA.

**beta backscatter gauging** [Beta Backscatter] *(jaugeage de rétrodiffiusion bêta)*
The use of beta-emitting nuclear substances incorporated in a radiation device to measure the thickness of material. The term is used as a licence use-type.

**bioassay** *(essai biologique)*
The study of all living organisms to measure the effect of a substance, factor or condition by comparing before-and-after exposure or other data. Note: Specific to radiation exposure in humans, bioassay is any procedure used to determine the nature, activity, location or retention of radionuclides in the body by direct (*in vivo*) measurement or by indirect (*in vitro*) analysis of material excreted or otherwise removed from the body. In vivo bioassay may be referred to as direct bioassay; in vitro bioassay may be referred to as indirect bioassay.

**borehole tube tagging** *(marquage de tuyaux de sondage)*
The use of nuclear substances placed subsurface or in equipment intended for subsurface use for determining borehole depth or direction. This term is used as a licence use-type.

**contamination meter** *(contaminamètre)*
A radiation detection instrument designed to measure surface contamination; this meter is not designed to measure radiation dose or dose rate.

**crawler control [crawler]** *(commande de chenille)*
The use of sealed sources to remotely direct the movement of an industrial radiography pipeline crawler unit.

**diagnostic nuclear medicine** *(médecine nucléaire diagnostique)*
The administration of unsealed sources (nuclear substances) to humans for diagnostic purposes related to their health care. Diagnostic nuclear medicine includes the processing of radiopharmaceuticals and laboratory studies that are part of the diagnostic studies.

**dismantle** *(démanteler)*
Take apart radiation devices to repair, replace or remove faulty components that may include the nuclear substance of that device (part of the licensed activity of servicing, installation and dismantling of devices containing radioisotopes).

**dismounting** *(démontage)*
See install.

**dosimeter** *(dosimètre)*
A device for measuring a dose of radiation that is worn or carried by an individual. (Sources: *Nuclear Substances and Radiation Devices Regulations; Radiation Protection Regulations*) Note: Among common types are thermoluminescent and optically stimulated luminescence dosimeters.

**dosimetry period–one-year** *(période de dosimétrie d'un an)*
See one-year dosimetry period.

**dosimetry period–five-year** *(période de dosimétrie de cinq ans)*
See five-year dosimetry period.

**exemption quantity** *(quantité d'exemption)*
Any of the following:
(a) in respect of a radioactive nuclear substance set out in column 1 of Schedule 1,
  (i) if the radioactive nuclear substance is uniformly distributed in material and not in bulk quantity, the corresponding activity concentration set out in column 2, or
  (ii) the corresponding activity set out in column 3;
(b) in respect of a radioactive nuclear substance that is not set out in column 1 of Schedule 1,
  (i) if the atomic number of the substance is equal to or less than 81,
    (A) 10 becquerels/gram (Bq/g) if the radioactive nuclear substance is uniformly distributed in material and not in bulk quantity, or
    (B) 10,000 Bq,
  (ii) if the atomic number of the substance is greater than 81 and the substance, or its short-lived radioactive progeny, does not emit alpha radiation,
    (A) 10 Bq/g if the radioactive nuclear substance is uniformly distributed in material and not in bulk quantity, or
    (B) 10,000 Bq, or
  (iii) if the atomic number of the substance is greater than 81 and the substance, or its short-lived radioactive progeny, emits alpha radiation,
    (A) 1 Bq/g if the radioactive nuclear substance is uniformly distributed in material and not in bulk quantity, or
    (B) 1,000 Bq; or
(c) in respect of more than one radioactive nuclear substance,
  (i) if the radioactive nuclear substances are uniformly distributed in material and not in bulk quantity, the quotient obtained by dividing the total activity concentration by the sum of quotients obtained by dividing the activity concentration of each radioactive nuclear substance by its corresponding exemption quantity as referred to in paragraph (*a*) or (*b*), or
  (ii) the quotient obtained by dividing the total activity by the corresponding sum of quotients obtained by dividing the activity of each radioactive nuclear substance by its corresponding exemption quantity as referred to in paragraph (*a*) or (*b*).
(Source: *Nuclear Substances and Radiation Devices Regulations*)

**export** *(exportation)*
The transfer of a nuclear substance, prescribed equipment or prescribed information from Canada to a foreign destination.

**exposure device** *(appareil d'exposition)*
A radiation device that is designed for carrying out gamma radiography, and includes any accessory to the device such as a sealed source assembly, a drive mechanism, a sealed assembly guide tube and an exposure head. (Source: *Nuclear Substances and Radiation Devices Regulations)*

**five-year dosimetry period** *(période de dosimétrie de cinq ans)*
The period of five calendar years beginning on January 1 of the year following the year in which these Regulations come into force, and every period of five calendar years after that period. (Source: *Radiation Protection Regulations*)
**Note:** These periods cover 2001–2005, 2006–2010 and 2011–2015.

**fixed gauge** *(jauge fixe)*
See fixed nuclear gauge.

**fixed nuclear gauge** (*jauge nucléaire fixe*)
A radiation device that is attached to a structure and enables the nuclear substance contained in it to be used for its radiation properties to measure process-related parameters (such as liquid flow or liquid level).

**human research study** *(étude sur les humains)*
The administration of unsealed sources (nuclear substances) to or external irradiation of humans for purposes not related to their personal health care; includes processing of radiopharmaceuticals and laboratory studies that are part of the human research study.

**import** *(importation)*
The transfer of a nuclear substance, prescribed equipment or prescribed information into Canada from a foreign destination.

**industrial radiography** *(gammagraphie industrielle)*
The use of certified exposure devices to conduct non-destructive examination of the structure of welds, castings and building components. Also called gamma radiography.

**install** (*installer [montage/démontage])*
Mount and dismount a radiation device into its measuring position within a location authorized by a licence (part of the licensed activity of servicing, installation and dismantling of devices containing radioisotopes).

**licence purpose** *(objet du permis)*
A particular use of nuclear substances as described in the *Canadian Nuclear Safety Commission Cost Recovery Fees Regulations*.

**licensed activity** *(activité autorisée)*
An activity described in paragraph 26(*e*) of the Act that a licence authorizes the licensee to carry on in relation to a Class I nuclear facility. (Source: *Class I Nuclear Facilities Regulations*)
OR
An activity described in paragraph 26(*a*), (*c*) or (*e*) of the Act that a licence authorizes the licensee to carry on in relation to a Class II nuclear facility or Class II prescribed equipment. (Source: *Class II Nuclear Facilities and Prescribed Equipment Regulations*)
OR

An activity described in any of paragraphs 26(*a*) to (*f*) of the Act that a licence authorizes the licensee to carry on. (Sources: *General Nuclear Safety and Control Regulations*; *Radiation Protection Devices*)

OR

An activity described in any of paragraphs 26(*a*) to (*c*) of the Act that a licence authorizes the licensee to carry on in relation to a nuclear substance or a radiation device. (Source: *Nuclear Substances and Radiation Devices Regulations*)

OR

An activity described in any of paragraphs 26(*a*) to (*c*) of the Act that a licence authorizes the licensee to carry on. (Source: *Packaging and Transport of Nuclear Substances Regulations, 2015* )

OR

An activity described in paragraph 26(*e*) of the Act that a licence authorizes the licensee to carry on in relation to a uranium mine or mill. (Source: *Uranium Mines and Mills Regulations*)

**licensing basis** *(fondement d'autorisation)*
A set of requirements and documents for a regulated facility or activity comprising:

- the regulatory requirements set out in the applicable laws and regulations
- the conditions and the safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence
- the safety and control measures described in the licence application and the documents needed to support that licence application

**location** *(emplacement)*
With respect to nuclear substances and radiation devices, any room, area, enclosure, land or base(s) of operations the licensee occupies where the licensee uses or stores nuclear substances for more than 90 consecutive days per calendar year. The location may be identified by a postal address or global positioning system coordinates.

**logging** *(diagraphie)*
The use of sealed sources to obtain subsurface geological information.

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

**nuclear substance** *(substance nucléaire)*
Means:
(a) deuterium, thorium, uranium or an element with an atomic number greater than 92;
(b) a derivative or compound of deuterium, thorium, uranium or of an element with an atomic number greater than 92;
(c) a radioactive nuclide;
(d) a substance that is prescribed as being capable of releasing nuclear energy or as being required for the production or use of nuclear energy;
(e) a radioactive by-product of the development, production or use of nuclear energy; and
(f) a radioactive substance or radioactive thing that was used for the development or production, or in connection with the use, of nuclear energy.
(Source: *Nuclear Safety and Control Act*)

**one-year dosimetry period** *(période de dosimétrie d'un an)*
The period of one calendar year beginning on January 1 of the year following the year in which these Regulations come into force, and every period of one calendar year after that period. (Source: *Radiation Protection Regulations*) Note: These Regulations came into force in May 2000; therefore the first dosimetry period began on January 1, 2001.

**package** (*emballage/colis*)
Packaging with its radioactive contents, as presented for transport. (Source: *Packaging and Transport of Nuclear Substances Regulations, 2015* )

**portable gauge** *(jauge portative)*
See portable nuclear gauge.

**portable nuclear gauge** (*jauge nucléaire portative*)
A portable radiation device used to measure density, level, thickness or moisture content.

**possess** *(avoir en sa possession)*
For licensing purposes, have the care and control of a nuclear substance(s) or radiation device(s). Note that having possession is distinct from ownership.

**possession limit** (*limite de possession*)
The total quantity for each unsealed source (nuclear substance) in storage, in use and being held before disposal. Note: The maximum quantity in possession for each unsealed source (nuclear substance) is specified on the licence that may not be exceeded at any time.

**produce** *(produire)*
Manufacture sealed sources and goods containing nuclear substances and/or manufacture of radiation devices.

**radiation device** *(appareil à rayonnement)*
Means:
(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.
(Source: *Nuclear Substances and Radiation Devices Regulations*)

**radiation survey meter** *(radiamètre)*
An instrument that is capable of measuring radiation dose rates. (Sources: *Class II Nuclear Facilities and Prescribed Equipment Regulations*; *Nuclear Substances and Radiation Devices Regulations*)

**registered user** *(usager inscrit)*
A person who has received confirmation from the Commission that their use of a package has been registered under section 14. (Source: *Packaging and Transport of Nuclear Substances Regulations, 2015* )

**screening [thyroid]** *(dépistage [thyroïde])*
See thyroid screening.

**sealed source** *(source scellée)*
A radioactive nuclear substance in a sealed capsule or in a cover to which the substance is bonded, where the capsule or cover is strong enough to prevent contact with or the dispersion of the substance under the conditions for which the capsule or cover is designed. (Sources: *Class I Nuclear Facilities Regulations*;

*Class II Nuclear Facilities and Prescribed Equipment Regulations*; *Nuclear Substances and Radiation Devices Regulations*)

**sealed source assembly** *(assemblage de source scellée)*
A sealed source that is designed to be used in an exposure device and that includes the components that are permanently attached to the sealed source. (Source: *Nuclear Substances and Radiation Devices Regulations*)

**servicing** *(entretien)*
In respect of radiation devices, means any maintenance of a device, including installation, repair or dismantling, other than maintenance that
(a) constitutes routine operating procedures as indicated in the manufacturer's operating manual for the device; or
(b) is authorized in the licence issued in respect of the possession or use of the device.
(Source: *Nuclear Substances and Radiation Devices Regulations*)
OR
In respect of Class II prescribed equipment, means any maintenance of the equipment, including installation, repair or dismantling, other than any installation, repair or dismantling that constitutes routine operating procedures
(a) as indicated in the manufacturer's operating manual for the equipment; or
(b) as authorized in the licence issued in respect of the possession or use of the equipment.
(Source: *Class II Nuclear Facilities and Prescribed Equipment Regulations*)
**Note:** Sealed source installation or replacement, as well as any repair that could expose the sealed source, reduce the shielding around the sealed source, or affect the drive control for radiotherapy, is considered as servicing.

**servicing, installation and dismantling of devices containing radioisotopes** *(entretien, installation et démontage d'appareils contenant des radio-isotopes)*
The possession of radiation devices for the purpose of servicing, installation or dismantling. The term is used as a licence use-type.

**storage** *(stockage)*
With respect to nuclear substances and radiation devices, possession for storage only.

**store** *(stocker)*
Put in storage; hold for safekeeping; a quantity or supply kept for use as needed.

**subsurface zone location** *(localisation des zones souterraines)*
The release of sand, gel, cement or other material labelled with nuclear substances into a well during fracturing or cementing operations to determine the depth and extent of a fractured or cemented zone. This term is used as a licence purpose.

**therapeutic nuclear medicine** *(médecine nucléaire thérapeutique)*
The administration of unsealed sources (nuclear substances) to humans for therapeutic purposes related to their health care. Therapeutic nuclear medicine also includes the processing of radiopharmaceuticals and laboratory studies that are part of the therapy.

**thyroid screening** *(dépistage [thyroïde])*
The monitoring of workers for the purpose of detecting the presence of radioiodine deposited in the thyroid as an indication of radioiodine intake. Note: Thyroid screening is not intended for quantitative dose assessment.

**tracer studies** *(études à partir de traceurs)*
The field use of nuclear substances for industrial, environmental or research purposes other than subsurface tracer studies.

**transfer** *(transférer)*
Move nuclear material, both domestic (between Canadian material balance areas) and foreign (imports and exports). **Note:** This definition applies specifically to nuclear material accounting.
OR
Change possession of a nuclear substance or radiation device from one licensee to another where both are located within Canada.
OR
Move a nuclear substance or radiation device from one location to another, where both places are located within Canada.
OR
See export *or* import.

**transport** *(transporter)*
The handling, carrying or storage in transit and receipt at the final destination of packages. Transport includes normal and accident conditions encountered in carriage and in storage during transit.

**unsealed source** *(source non scellée)*
A source other than a sealed source. (Source: *Nuclear Substances and Radiation Devices Regulations*)
**Note:** These nuclear substances are in a physical form where dispersion of the radioactive material is possible during use or handling. Usually a liquid, they may also be in solid, powder or gaseous form. Unsealed sources are commonly used in medical diagnostic and therapeutic treatments, as well as in laboratory research applications. Also called open source.

**use** *(utiliser)*
Manipulate or handle nuclear substances and radiation devices; operate radiation devices. **Note:** This definition is specific for nuclear substances and radiation devices.

**use-type** *(type d'utilisation)*
The purpose for which the licence has been issued.

**wipe test** *(épreuve de contamination par frottis)*
An indirect form of contamination monitoring that involves wiping a suspect surface and measuring the nuclear substances collected on the wipe sample.

**worker** *(travailleur)*
A person who performs an activity that is referred to in the licence. (Sources: *Class I Nuclear Facilities Regulations*; *Class II Nuclear Facilities and Prescribed Equipment Regulations*; *General Nuclear Safety and Control Regulations*; *Nuclear Substances and Radiation Devices Regulations*; *Radiation Protection Regulations*; *Uranium Mines and Mills Regulations*)
**Note:** This definition applies to workers directly employed by a licensee, as well as to contractors and to subcontractors.

# CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the Canadian Nuclear Safety Commission (CNSC). In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

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Series 1.1 Reactor facilities
1.2 Class IB facilities
1.3 Uranium mines and mills
1.4 Class II facilities
1.5 Certification of prescribed equipment
1.6 Nuclear substances and radiation devices

**2.0 Safety and control areas**

Series 2.1 Management system
2.2 Human performance management
2.3 Operating performance
2.4 Safety analysis
2.5 Physical design
2.6 Fitness for service
2.7 Radiation protection
2.8 Conventional health and safety
2.9 Environmental protection
2.10 Emergency management and fire protection
2.11 Waste management
2.12 Security
2.13 Safeguards and non-proliferation
2.14 Packaging and transport

**3.0 Other regulatory areas**

Series 3.1 Reporting requirements
3.2 Public and Aboriginal engagement
3.3 Financial guarantees
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