



Licence Application Guide **Nuclear Substances and Radiation Devices**

RD/GD-371

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Licence Application Guide – Nuclear Substances and Radiation Devices
RD/GD-371

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This document can be viewed on the Canadian Nuclear Safety Commission Web site at nuclearsafety.gc.ca.

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Preface

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.

This licence application guide provides information on the requirements for the Nuclear Substances and Radiation Devices Application Form including detailed instructions for completion. The application form is available at nuclearsafety.gc.ca.

CNSC staff can provide additional guidance upon request; contact the CNSC at info@cnsccsn.gc.ca.

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RD/GD- 371 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 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* Sections 14, 15, 16, 17, 19, 21, and 23
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 use-types.

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

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
- include a copy of the applicant's Radiation Safety Manual (RSM)
- if the applicant is a corporation, include proof of legal status
- the designated payment is enclosed, if subject to the *CNSC 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

For licensees wanting to submit the application electronically, the completed form and supporting documentation can be submitted to the CNSC email address forms-formulaires@cnsccsn.gc.ca.

Documents submitted electronically must include all required signatures.

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, alt 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 Web site at nuclearsafety.gc.ca.

3. Completing the Application Form for New Licences or Renewal of an Existing Licence

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: info@cnsccsn.gc.ca

3.1 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

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 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.

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, if required, 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.

Provide details on the value and form of the financial guarantee, if required by 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 contains a list of use-types with risk rankings.

3.2 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 for a list of unit conversions.

B.1 Canadian 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.

An agent for service must be either an individual of a minimum 18 years of age that is a resident of Canada or a corporation having its head office or registered office in Canada.

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 at nuclearsafety.gc.ca.

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 (except health card) bearing the image and signature of the person designated as the Applicant Authority.

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
- 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

Indicate the main address for the applicant's storage and/or use of nuclear substances and radiation devices.

The address should, as a minimum, consist of either a postal address or GPS coordinates. A post office box is not acceptable as a principal storage location.

For other storage locations, provide either the complete postal address or GPS coordinates of any other location where nuclear substances will be stored and/or used for more than 90 days per calendar year. If there are several sites, submit a complete list with the application.

For all locations, if premises are rented or leased, include a letter from the owner/landlord of each location confirming that they are 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.

B.6 Unsealed sources

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.

Append additional inventory list as required.

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

B.7 Sealed sources

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 50MBq 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 for a list of unit conversions.

B.8 Radiation devices

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 for a list of unit conversions.

3.3 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.

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 Radiation Safety Officer

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.

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 for additional information regarding the qualifications and duties of the RSO.

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 (if applicable)

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

C.6 Signing authorities

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 the 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.

To comply with the *General Nuclear Safety Control Regulations*, every applicant must provide information to the CNSC about its representatives.

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 the signing authority during the term of the licence.

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

3.4 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.

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
- 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 persons designated as NEWs including their job category.
- D.2.3* The applicant must append its policy for designating workers as Nuclear Energy Workers (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 notify workers of their NEW status can be found in Appendix D.

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

D.3 Worker training and authorization

- D.3.1* 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.

- D.3.2* Append the applicant’s policy and procedures which ensure that only workers trained in the use of nuclear substances and radiation devices will be permitted to use nuclear substances and radiation devices.

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.

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, neutron).

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.

For the summary, report the number of persons who receive a cumulative annual dose in the following ranges:

- less than 0.2 mSv
- 0.2 to 0.5 mSv
- 0.5 to 1.0 mSv
- up to 5 mSv
- up to 20 mSv
- greater than 20 mSv

In addition, where required to use a licensed dosimetry provider, append copies of the reports supplied by a licensed dosimetry service for the final report of the most recent licensed period and provide the corporate names of the dosimetry services used. The *Radiation Protection Regulations* stipulate that only a dosimetry service licensed by the CNSC may be used and that the dosimeters must be exchanged at a predetermined frequency.

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 licences (use-type 812); however, the CNSC strongly encourages all applicants to provide action levels in order to manage their radiation protection programs.

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 cm² are as follows:

- 3.0 Bq/cm² for Class A radionuclides, which are typically long-lived and emit alpha radiation
- 30 Bq/cm² for Class B radionuclides, which are typically long-lived and emit beta or gamma radiation
- 300 Bq/cm² 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 cm² are as follows:

- 0.3 Bq/cm² for Class A radionuclides
- 3.0 Bq/cm² for Class B radionuclides
- 30 Bq/cm² for Class C radionuclides

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

List all radiation-detection 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 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.

D.8 Leak testing of sealed sources

Append the policy and procedures for the leak testing of sealed sources. 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.

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 workers.

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 worker, 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 Receipt of packages

Append the policy 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 Transport Canada's *Transportation of Dangerous Goods Regulations* for other obligations.

See Appendix X for an example of a package receipt and monitor log.

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

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 CNSC's *Packaging and Transport of Nuclear Substances Regulations* and Transport Canada's *Transportation of Dangerous Goods Regulations*.

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* and the *Transportation of Dangerous Goods Regulations* 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.

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

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/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.

To transport radioactive sources, licensees must comply with the CNSC's *Packaging and Transport of Nuclear Substances Regulations* and Transport Canada's *Transportation of Dangerous Goods Regulations*. 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 radioactive wastes

D.13.1 Disposal of nuclear substances and radiation devices

Append the policy and procedures for handling and disposing of waste containing nuclear substances.

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.13.2 *Transfer of nuclear substances (for renewals):*

Append a summary of the annual activity of each nuclear substance and radiation device transferred during the previous licensing period. Include non-deliverable items returned to a supplier.

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 will also have to comply with the requirements of Transport Canada's *Transport of Dangerous Goods Regulations*. 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 persons designated as 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.

The CNSC has a list of documents that should be retained at locations of licensed activity which is available upon request from the Licensing Specialist

D.17 Posting of radiation warning signs

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 $\mu\text{Sv/h}$.

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.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 plan of every nuclear medicine room or department including adjacent areas. Include a list of all storage areas and a description of each.

Provide 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 sketched 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.

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

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.

3.5 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 person designated 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 applicant authority must designate the person who will be acting as the medical practitioner; in doing so, the name, provincial registration number and contact information of the medical practitioner should be supplied.

If there is more than one medical practitioner, provide a separate designation 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

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.

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.

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 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.

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 $\mu\text{Sv/h}$, 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 $\mu\text{Sv/h}$, 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 $\mu\text{Sv/h}$, 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), the relevant surface contamination limits, expressed in terms of removable surface contamination averaged over an area not exceeding 100 cm², are as follows:

- 0.3 Bq/cm² for all Class A nuclear substances, which are typically relatively long-lived and emit alpha radiation
- 3 Bq/cm² for all Class B nuclear substances, which are typically relatively long-lived and emit beta or gamma radiation
- 30 Bq/cm² for all Class C nuclear substances, which are typically short-lived and emit beta or gamma radiation

See Appendix BB 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.

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.

For additional information on procedures to address radioactive spills, consult the CNSC.

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 anytime, 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 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
- 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
- the permit's conditions

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.

E.4.2 CNSC approval for special projects:

Any use of unsealed nuclear substances that are in a quantity of more than 10,000 times any exemption quantity are considered special projects and shall be authorized in writing by the CNSC before issuing any internal authorization.

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.

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

The *Packaging and Transport of Nuclear Substances Regulations* 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* 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.

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 (for renewals only)*

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, 885, 886, 888, 889, 895, 896, 897, 898, 899, 900, 901, 902, 907, 908, 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.

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.

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, mark the box labelled "other" 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 of this document.

Leak tests are not required where the sealed source contains a gaseous nuclear substance, 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:*

Append the policy and procedures for reporting of incidents and events, as required by the NSCA, the Regulations and any applicable licence conditions.

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 persons designated as 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

Notification to the CNSC of the intended date of disposal and the nature of the records to be disposed must be made in writing at least 90 days before the intended date of disposal.

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. Also indicate 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 the effective dose does not exceed 500 μSv to any member of the public

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.

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 $\mu\text{Sv/h}$ 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 $\mu\text{Sv/h}$ 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.

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, isolation procedures for fixed gauges must be documented and provided to maintenance workers and others.

A lockout procedure and a safe work permit are required for all fixed gauges which are designed with access for repairs or inspection and are mounted on vessels or hoppers.

Before entering a vessel or hopper fitted with a nuclear gauge, the shutter of the radiation device is to be closed and padlocked. The closed status of the shutter must be verified by noting an appropriate decrease in the gamma survey meter reading. Licensees are to

maintain records for at least three years of all measurements taken to confirm that the shutter is closed.

E.8.3 *Installation and dismantling of fixed gauges:*

Append the policy and procedures for installing and/or dismantling fixed gauges. If the applicant does not intend to install or dismantle 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 dismantle 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 sub-section 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 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 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.

If during assessment of the licence application 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 may be exempt from requirements for assessments under the CEAA or other provincial authorities having jurisdiction over this work. P

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.

E10 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 sub-section 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 (μ Gy)
1 microrad (μ rad)	=	10 nanograys (nGy)

The gray (Gy) replaces the rad

1 gray (Gy)	=	100 rad (rad)
1 milligray (mGy)	=	100 millirad (mrad)
1 microgray (μ Gy)	=	100 microrad (μ rad)
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 (μ Sv)
1 microrem (μ rem)	=	10 nanosieverts (nSv)

The sievert (Sv) replaces the rem

1 sievert (Sv)	=	100 rem (rem)
1 millisievert (mSv)	=	100 millirem (mrem)
1 microsievert (μ Sv)	=	100 microrem (μ rem)
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 (μ Ci)	=	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 (μ Ci)
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 licences	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 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
822–823	Servicing, installation and dismantling of devices containing radioisotopes	Possession of radiation devices for the purpose of servicing, installation or dismantling of devices containing radioisotopes.	
822	Basic servicing	Servicing of either fixed or portable gauges (not both).	High
823	Complex servicing	Servicing of both fixed and portable gauges as well as exposure devices.	High
824–826	Distribution	Possession of nuclear substances and radiation devices for transfer only.	

Use-type Number	Use-type Name	Description	Risk Ranking
824	Distribution – drop shipment	Direct shipment from manufacturer to licensed end user, no possession for import/export only.	Medium
825	Distribution – 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 – 740 MBq or more	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	Release of sand, gel, cement or other material labelled with unsealed nuclear substances into a well during fracturing or cementing operating 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 a quantity exceeding 10 GBq	Preparation or treatment of unsealed nuclear substances for distribution where the possession limit is greater than 10 GBq but less than 1,000 TBq per calendar year for each unsealed nuclear substance.	High
851	Manufacturing of 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

Use-type Number	Use-type Name	Description	Risk Ranking
862	Diagnostic nuclear medicine procedures	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 a quantity not exceeding 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	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: more 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	Irradiation: self-shielded type	Use of a radiation device to irradiate materials, but where the source remains	Medium

Use-type Number	Use-type Name	Description	Risk Ranking
		shielded at all times during use.	
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
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: up to 50 MBq	Use of sealed sources for research purposes. The maximum activity for each sealed source is less than 50 MBq.	Low
894	Teaching: more than 50 MBq	Use of sealed sources for teaching purposes. The maximum activity for each sealed source is greater than 50 MBq.	Medium
895	Fuel gauges onboard aircraft	Use of radiation devices to measure fuel level in aircraft wing tanks.	Low
896	Dew point detection	Use of sealed nuclear substances in dew pointers.	Low
897	Static elimination (use of sealed radioactive sources in static elimination devices)	Possession and use of radiation devices for static elimination.	Low

Use-type Number	Use-type Name	Description	Risk Ranking
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.	Medium
907	Teaching: 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
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	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

Use-type Number	Use-type Name	Description	Risk Ranking
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 institution 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:

- a. 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
- b. 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
- c. 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
- d. 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
- e. Designate workers as Nuclear Energy Workers in accordance with the regulations
- f. 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
- g. 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

- h. Design and implement, in accordance with regulatory requirements, appropriate personnel monitoring programs
- i. Administer or control the distribution, use, and maintenance of personnel radiation monitoring devices and equipment, and the recording of results
- j. 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
- k. 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
- l. Assess the adequacy of survey programs that measure or control radiation fields and radioactive contamination during licensed activities
- m. Ensure that sealed sources are leak tested and radiation-monitoring instruments are calibrated in accordance with the regulatory requirements
- n. Coordinate or participate in emergency responses to accidents and incidents involving nuclear substances and radiation devices
- o. 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

Date of birth: _____

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 at all times 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 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.

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) 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 $DOSE = DOSE\ RATE \times TIME\ (OCCUPANCY)$.
- 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 and the *Transportation of Dangerous Goods Regulations* (TDGR) to hold a Training Certificate.

Section 6.1(2) of the *Transportation of Dangerous Goods Regulations* 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 safe handling and transportation procedures, documentation requirements, placarding of vehicles, other safety marking requirements, emergency response procedures for transportation incidents and reporting of dangerous occurrences.

A Certified Exposure Device Operator is a person who has successfully completed the CNSC's certification program and is recognized by the CNSC as a Certified Exposure Device Operator by the issuance of a certified exposure device operator card. A Certified Exposure Device Operator 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 *Transportation of Dangerous Goods Regulations*.

The following list summarizes the requirements of Transport Canada's *Transportation of Dangerous Regulations* that relate to the offering for transport (and the transport itself) of radioactive materials.

<u>TDG Section</u>	<u>Subject</u>
1.2	Definitions
4.4	Shipping Document - Consignor requirements
4.8	Shipping Document - General information requirements
4.11	Shipping Document - Specific requirements for nuclear substances
4.20	Shipping Document - Additional documents (eg. Type B Certificates required for radiography devices)
4.23	Shipping Document - Location during transport
4.27	Shipping Document - Retention requirements (two years)
5.4	Safety Marks - Package requirements
5.16	Safety Marks - Placarding requirements
5.29	Safety Marks - Location of placards on vehicle

5.37	Other Safety Marks - Shipping name & product identification number (UN or PIN) required on packages
7.24	Handling or offering for transport nuclear substances
7.38	Packages Secured during Transport
8.5	Transporting nuclear substances
9.1	Training and Dangerous Occurrence definitions
9.2 - 9.7	TDG Training requirements
9.10	Notification of lost or stolen radioactive material
9.13	Immediate reporting requirements (telephone report)
9.1430	Day reporting requirements (written report)
11	Permit for Equivalent Level of Safety requirements
Schedule II, List II	Proper shipping names and UN numbers
Schedule V	Labels and Placards specifications
Schedule IX	Dangerous Occurrence Report form
Schedule X	Application for Equivalent Level of Safety Permit

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 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. TLD
 - b. 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 μ Sv/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: <ul style="list-style-type: none"> • Radiation warning symbol • Source tag • Name plate • Yellow III radiation sticker • 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: Camera 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 Resp.	Job Loc.	Return Date	Returned By	Comments

Appendix P : Source Inventory Form (Example)

Date Received	Source	Quantity	Ser. #	Date Installed	Surface Dose Reading	Disposal Date

Appendix Q: Application for Registration of Use of Packages (Example)**CANADIAN NUCLEAR SAFETY COMMISSION****COMMISSION CANADIENNE DE SÛRETÉ NUCLÉAIRE**

Application for Registration of Use of Packages

Demande d'inscription de l'usage des colis

Certificate details / Détails du certificat

CNSC file no: _____
Dossier de la CCSN

Canadian certificate no.: _____
Numéro du certificat canadien

Foreign certificate no: _____
Numéro du certificat étranger

Package identification (make/model): _____
Identification du colis (marque/modèle)

Canadian certificate issue date: _____
Date d'émission du certificat canadien

Canadian certificate expiry date: _____
Date d'expiration du certificat canadien

Registered user details / Détails de l'utilisateur inscrit

Contact name: _____
Agent de liaison

Name and address of organization: _____
Nom et adresse de l'organisation

Telephone no: _____
Numéro de téléphone

Fax no.: _____
Numéro de télécopieur

CNSC Licence no. (If applicable): _____
Numéro de dossier de la CCSN (si approprié)

Serial numbers of packages (if purchased): _____
Numéro de série du colis (si acheté)

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.

Nous confirmons que nous disposons des instructions nécessaires pour préparer le colis pour l'expédition, selon ce qu'indique l'homologation du modèle de colis pertinente.

Signature : _____ Date : _____

Title/Titre : _____ RSO/RRP : _____

Send copy to:

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

Envoyer la copie à l'adresse suivante :

Commission canadienne de sûreté nucléaire
Case postale 1046
Ottawa ON K1P 5S9
CANADA
Téléphone : (613) 995-5894
Télécopieur : (613) 995-5086

Appendix R: Regulatory Quantities for Typical Radionuclides

Radionuclide	EQ MBq	ALI Estimate (Inhalation) Bq	ALI Estimate (Ingestion) Bq	Basic Level MBq	Interim Level MBq	High Level MBq	Wipes (Controlled Area) Bq/cm ²	Wipes (Public Area) Bq/cm ²	Municipal Waste MBq/kg	Sewer MBq/yr	Air kBq/m ³
Br-82	1	2.30E+07	3.70E+07	115	1150	11,500	3	0.3			
C-14	10	1.00E+09	3.40E+07	170	1,700	17,000	300	30	3.7	10,000	
Co-57	1	3.30E+07	9.50E+07	165	1650	16,500	300	30	0.37	1,000	
Co-58	1	1.20E+07	2.70E+07	60	600	6,000	30	3	0.37	100	
Co-60	0.1	1.20E+06	5.90E+06	6	60	600	3	0.3	0.01	0.1	
Cr-51	10	5.60E+08	5.30E+08	2,650	26,500	265,000	300	30	3.7	100	
F-18	1	2.20E+08	4.10E+08	1100	11,000	110,000	3	0.3	0.01	0.1	
Fe-59	1	6.30E+06	1.10E+07	31.5	315	3,150	30	3	0.01	1	
Ga-67	1	7.10E+07	1.10E+08	355	3550	35,500	30	3	0.037	100	
H-3	1,000	1.00E+09	1.00E+09	5,000	50,000	500,000	300	30	37	1,000,000	37
I-123	10	9.50E+07	9.50E+07	475	4,750	47,500	300	30	3.7	1,000	3
I-125	1	1.40E+06	1.30E+06	6.5	65	650	300	30	0.037	100	0.03
I-131	1	1.00E+06	9.10E+05	4.55	45.5	455	30	3	0.037	10	0.175
In-111	1	6.50E+07	6.90E+07	325	3,250	32,500	30	3	0.037	100	
Na-22	1	1.00E+07	6.30E+06	31.5	315	3,150	3	0.3	0.01	0.1	
P-32	0.1	6.90E+06	8.30E+06	34.5	345	3,450	300	30	0.37	1	
P-33	100	1.50E+07	8.30E+07	75	750	7,500	300	30	1	10	
Ra-226	0.01	9.10E+03	7.10E+04	0.0455	0.455	4.55	3	0.3	0.0037	1	
S-35	100	1.80E+07	2.6E+07	90	900	9,000	300	30	0.37	1,000	
Sb-124	1	4.30E+06	8.00E+06	21.5	215	2,150	3	0.3	0.37	0.1	
Sr-85	1	3.10E+07	3.60E+07	155	1,550	15,500	30	3	0.1	1	0.175
Tc-99m	10	6.90E+08	9.10E+08	3450	34,500	345,000	300	30	3.7	1,000	
Tl-201	1	2.60E+08	2.10E+07	105	1,050	10,500	300	30	0.037	100	
Xe-133	0.01	6.70E+05		3.35	33.5	335	300	30			3.7

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	RADIOISOTOPE USER PERMIT
Department of Biochemistry	Permit Number:
Permit Holder	
Dr. IM Permit Holder Department of Biochemistry Rm S-4123 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:	^3H 100 MBq ^{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	^3H , ^{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 or GPS No.		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			

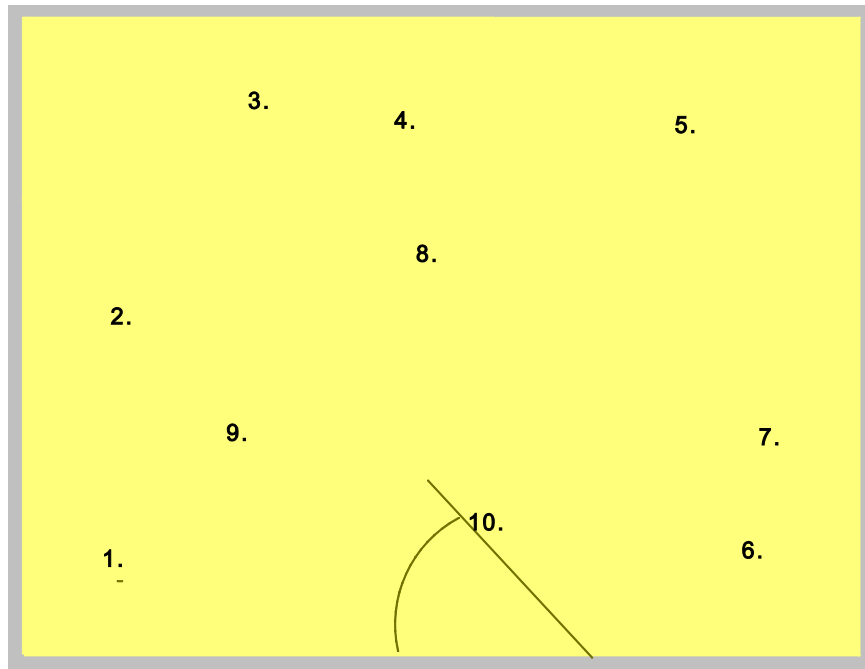
Appendix U: Inventory Form for Sealed Sources (Example)

Manufacturer:			Model name and number:				
Radionuclide	Source Size	Assay Date	Serial Number	Location	Date of Receipt	Date of Transfer	Transfer to

Appendix V: List of Designated Nuclear Substance Locations (Example)

Address or Building	Room or Lab No.	Designation Level (Basic/Intermediate)	Contact

Appendix W: Contamination Monitoring Results Log (Example)



Room/lab:		Action level:		
Date:	Checked by:	cpm = 0.5 Bq/cm ² in well counter of Room X (if exceeded -> decontaminate, recount and report)		
#	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)			

Appendix X: Package Receipt and Monitor Log (Example)

Receipt Date	Purchase Order	Supplier	Checked by	Damage/ Leak	External Dose Rate	Wipe Counts (Outside)	Wipe Counts (Inside)	Notes

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	RADIONUCLIDE				
CLASS A	All alpha emitters and their daughter isotopes			Ag-110m	Ar-41
	C-11	Co-56	Co-60	F-18	Ga-68
	Ga-72	I-124	La-140	Mn-56	N-13
	Na-22	Na-24	Nb-98	O-15	Sb-124
	Ta-182	V-48	Y-86	Zn-65	
CLASS B	As-74	Au-198	Ba-133	Br-82	Co-58
	Cu-64	Fe-59	Ga-67	Gd-153	Hg-194
	Hg-203	I-131	In-111	In-113m	In-114m
	Ir-192	K-42	Kr-79	Kr-81m	Nb-95
	Pa-233	Rb-84	Rb-86	Ru-103	Sc-46
	Se-75	Sm-153	Sn-123	Sr-85	Sr-90
	Xe-127				
CLASS C	Au-195m	C-14	Ca-45	Cd-109	Ce-141
	Ce-144	Cl-36	Co-57	Cr-51	Fe-55
	Ge-68	H-3	I-123	I-125	In-114
	Kr-85	Lu-177	Ni-63	P-32	P-33
	Re-186	Re-188	S-35	Sn-113	Sr-89
	Tc-99	Tc-99m	Tl-201	V-49	W-188
	Xe-133	Y-86	Y-90	Yb-169	

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

- a. a general description of the method of calibration
- b. 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
- c. step-by-step procedures, preferably including manufacturers' manuals, to show that sufficient information about the survey meter is available to operate, to perform precalibration 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:

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

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

- a. The beam calibrator jig must be located in the following manner:
 - i. 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
 - ii. in an area free of interference from sources of ionizing radiation other than the calibration source
 - iii. 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
- b. The survey meter to be calibrated shall:
 - i. 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
 - ii. have any beta window or shield in the optimum position (normally closed) for best (i.e. flattest) energy response
- c. 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
- d. 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
- e. 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 $\pm 10\%$. 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 $\pm 20\%$ 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:

- a. licensee name and CNSC Licence Number
- b. survey meter make and model, including serial number of the detector unit and the probe used in the calibration, if appropriate
- c. the calibration source used, including isotope and activity
- d. the results of the pre-calibration checks, including:
 - i. battery condition
 - ii. operating voltage
 - iii. temperature, pressure and humidity, at the time of calibration
- e. for each range calibrated
 - i. the range on the survey meter that was calibrated
 - ii. the expected dose rate using the calibration device
 - iii. the observed dose rate on the survey meter, with units, including both pre and post calibration
 - iv. the calculated percent variance of the observed dose rate versus expected dose rate
 - v. any notes of concerns or anomalies for that range
- f. any notes of anomalies or problems associated with the calibration of the survey meter in general

- g. the date of the calibration of the survey meter
- h. the name and signature of the person who conducted the calibration
- i. 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 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:

- a. a general description of the method of wipe sampling
- b. a list of all sealed sources to be leak tested, and their locations
- c. a step by step procedure of the method for wipe sampling each type of sealed source and each type of sealed source containment including:
 - i. operating instructions for sealed source drives, shutter interlocks and safety features during sampling
 - ii. a description and reason for choice of physical configuration of the wipe, material of the wipe, and compatible solvent (if required)
 - iii. a description of the method of wiping
 - iv. 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
- d. a description of the types of wipe sample containers including:
 - i. means of identifying the wipe sample or container or both
 - ii. 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:

- a. understands regulatory requirements and these expectations
- b. knows the type and activity of the sealed source and the sealed source containment
- c. can recognize and minimize the potential contamination and radiation hazards associated with:
 - i. the sealed source and its containment, including any sealed source windows
 - ii. wipe sampling the sealed source or its immediate environment
 - iii. the wipe sample
- d. has available and follows the procedure detailed in section 3.1
- e. has available sufficient wipe sampling materials and wipe sample containers
- f. follows all manufacturers instructions for the safe operation of any radiation device for the purposes of leak testing
- g. 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:

- a. name of the person conducting the sampling
- b. licensee name and CNSC licence number
- c. sealed source identification information (make, model, serial number and isotope)
- d. sample container identification number
- e. 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:

- a. a general description of the method of measuring; and,
- b. a step by step procedure for measuring wipe samples with the measuring equipment including:
 - i. a description and identification of measuring equipment (make, model and serial number)
 - ii. instructions, preferably including manufacturers' manuals, to set up, operate and measure samples
 - iii. a description of the tests to be performed using check sources 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:

- a. knows the regulatory requirements and the expectations outlined in this document
- b. is familiar with the operation of the measuring equipment
- c. can recognize and minimize the potential radiation and contamination hazards associated with the wipe sample
- d. 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 remonitored. 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 three years 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/cm² (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 cm². 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 remonitor. 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/cm²

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

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 cm²) or area of the detector in cm² (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 Radionuclides:

- non-fixed contamination in all areas, rooms or enclosures where unsealed nuclear substances are used or stored does not exceed:
 - 3 becquerels per square centimetre for all Class A radionuclides;
 - 30 becquerels per square centimetre for all Class B radionuclides; or
 - 300 becquerels per square centimetre for all Class C radionuclides; averaged over an area not exceeding 100 square centimetres; and
- non-fixed contamination in all other areas does not exceed:
 - 0.3 becquerels per square centimetre for all Class A radionuclides;
 - 3 becquerels per square centimetre for all Class B radionuclides; or
 - 30 becquerels per square centimetre for all Class C radionuclides; averaged over an area not exceeding 100 square centimetres.

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
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)

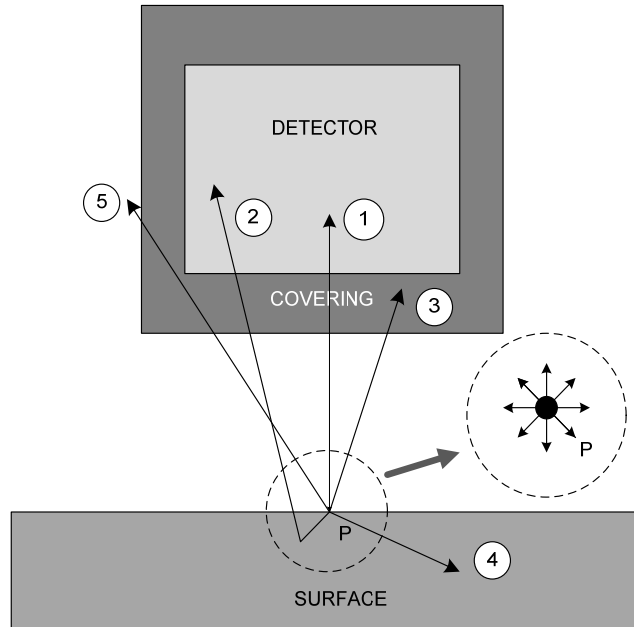
The detector efficiency can be found by:

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

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

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

The factors affecting the efficiency are shown in the diagram below.



1. Some radiation goes directly from the radioactive material P, into the detector.
2. Some radiation will backscatter off the surface, into the detector.
3. Some radiation is absorbed by the detector covering.
4. Most radiation doesn't even get detected.
5. If the detector was closer, this radiation would be detected.

Glossary

abandon

To remove from regulatory control.

activity

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

action level

A specific dose of radiation or other parameter that, if reached, may indicate a loss of control on the part of the licensee's radiation protection program and triggers a requirement for a specific action to be taken.

As Low As Reasonably Achievable (ALARA)

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

beta backscatter gauging

A licensed use-type that means the use of beta-emitting nuclear substances incorporated in a radiation device to measure the thickness of material.

bioassay

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

borehole tube tagging

A licence purpose that means the use of nuclear substances placed subsurface or in equipment intended for subsurface use for the purpose of borehole depth or direction determination.

contamination meter

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

crawler control

Use of sealed nuclear substances to remotely direct the movement of a radiography pipeline crawler unit.

diagnostic nuclear medicine

Administration of unsealed nuclear substances to humans for diagnostic purposes related to their health care; processing of radiopharmaceuticals and laboratory studies that are part of the diagnostic studies are included.

dismantle

To take apart radiation devices for the purpose of repairing, replacing or removing 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

See "install".

dosimeter

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

dosimetry period (one year)

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

dosimetry period (five year)

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

exemption quantity

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

exposure device

A radiation device that is designed for carrying out radiography and includes any accessory to the device, including any sealed source assembly, drive mechanism, sealed assembly guide tube and exposure head.

export

To send goods or services, such as a nuclear substance or radiation devices, to a country other than Canada for sale or return.

fixed gauge

A radiation device in a fixed configuration to measure density, level, thickness or flow.

human research study

Administration of unsealed 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

To bring goods or services, such as a nuclear substance or radiation devices, into Canada from abroad.

industrial radiography

Use of sealed nuclear substances in exposure devices for non-destructive testing. Sealed nuclear substances for crawler control may be included.

install

To mount and dismount a radiation device into its measuring position within a location authorized by a licence (part of the licensed use-type of servicing, installation and dismantling of devices containing radioisotopes).

licence purpose

A particular use of nuclear substances as described in the *CNSC Cost Recovery Fees Regulations*.

licensed activity

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

location

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

logging

The use of sealed sources to obtain subsurface geological information.

nuclear energy worker (NEW)

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

nuclear substance

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

- deuterium, thorium, uranium or an element with an atomic number greater than 92
- a derivative or compound of deuterium, thorium, uranium or of an element with an atomic number greater than 92
- a radioactive nuclide
- a substance that is prescribed as being capable of releasing nuclear energy or as being required for the production or use of nuclear energy
- a radioactive by-product of the development, production or use of nuclear energy
- a radioactive substance or radioactive thing that was used for the development or production, or in connection with the use, of nuclear energy

package

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

portable gauge

A portable radiation device used to measure density, level, thickness or moisture content.

possess

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

possession limit

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

produce

The manufacture of sealed sources and goods from nuclear substances and/or manufacture of radiation devices (devices containing sealed sources).

radiation device

A device certified for use in Canada that contains:

- more than the exemption quantity of a nuclear substance and that enables the nuclear substance to be used for its radiation properties
- a radium luminous compound

radiation survey meter

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

registered user

A person who has received confirmation from the CNSC that his/her use of a package has been registered under section 14 of the *Packaging and Transport of Nuclear Substances Regulations*.

screening (thyroid)

The practice of estimating the activity of radioiodines deposited in the thyroid. Also known as a bioassay.

sealed source

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

sealed source assembly

A sealed source that is designed to be used in an exposure device; includes the components that are permanently attached to the sealed source.

service

In respect of radiation devices, any maintenance of a device, including installation, repair or dismantling, other than maintenance. Maintenance is limited to that which:

- constitutes routine operating procedures as indicated in the manufacturer's operating manual for the device
- is authorized in the licence issued in respect of the possession or use of the device

source in device

A sealed source that remains in a device giving mechanical protection from damage during use.

servicing, installation and dismantling of devices containing radioisotopes

A licensed use-type that means possession of radiation devices for the purpose of servicing, installation or dismantling.

storage

Possession of nuclear substances and radiation devices for storage only.

store

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

subsurface zone location

A licence purpose that means 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.

therapeutic nuclear medicine

Administration of unsealed nuclear substances to humans for therapeutic purposes related to their health care; processing of radiopharmaceuticals and laboratory studies that are part of the therapy are included.

tracer studies

The field use of nuclear substances for industrial, environmental or research purposes other than subsurface tracer studies.

transfer

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

transport

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

unsealed source

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

use

The manipulation of, handling of or otherwise operation of nuclear substances and radiation devices.

use-type

The purpose for which the licence has been issued.

wipe test

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

worker

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

