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Radiation Protection

Radiation Protection Guidelines for Safe Handling of Decedents

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Radiation Protection Guidelines for Safe Handling of Decedents
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Preface

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

Many medical procedures using nuclear substances are carried out to diagnose and treat diseases. Procedures involving the use of nuclear substances for therapeutic purposes are usually conducted on an outpatient basis, and a patient poses a minimal radiation risk to the public upon release from a treatment centre. In the unlikely event that a patient dies within a short period following a medical procedure that used a nuclear substance, the substance may still be present in the body and certain precautions may be recommended when handling the body.

REGDOC-2.7.3, *Radiation Protection Guidelines for Safe Handling of Decedents*, provides guidance and recommended practices for minimizing radiation dose to death-care professionals and other members of the public who may encounter a decedent with residual nuclear substances from therapeutic medical procedures.

The CNSC does not regulate the safe handling of decedents. The CNSC is publishing this document in accordance with its mandate to disseminate objective scientific and technical information. REGDOC-2.73 was also created in response to a growing number of requests from cancer treatment centres and death-care professionals for advice on handling decedents that contain nuclear substances. It does not purport to, and could not, regulate in this area, and readers are encouraged to consult applicable provincial law in this regard.

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Radiation Protection Guidelines for Safe Handling of Decedents

1. Introduction

Radiation is commonly used in various types of medical procedures to treat and diagnose diseases. The CNSC's Medical Imaging and Radiotherapy infographic provides an overview of these procedures, which use radiation sources that are either external or internal to the body. For general information on radiation, see appendix A of this document.

In a procedure that uses external radiation (for example, X-rays), the radiation passes through the patient to create an image of the body (or parts of the body), or is absorbed by the patient to treat a condition. Once the procedure is completed, no further radiation dose is received by the patient or those around them.

When a nuclear substance is used for diagnosis, a small amount of the substance is placed directly into the body in an internal procedure. The amount of the substance decreases rapidly through radioactive decay, and – as with external procedures like X-rays – no further radiation dose is received by the patient or those around them.

In other internal procedures, nuclear substances are placed inside the patient's body, either directly or by the use of implants. In some cases, a temporary implant containing a nuclear substance is placed inside the body for a specified period of time and then removed. During this time, the patient is under a doctor's supervision and if that patient were to die, the implant would be removed before the body is released to the funeral home or crematorium. Special precautions are not necessary when handling a decedent who underwent a diagnostic procedure or received a temporary implant that was later removed.

This document focuses on therapeutic nuclear medicine and manual brachytherapy procedures, which use nuclear substances that remain in a patient's body for an extended period of time. As the substances decay, residual radiation may remain in the body – thereby affecting how a decedent who underwent such a procedure should be handled. An overview of these medical procedures is provided in section 2.

Therapeutic nuclear medicine and manual brachytherapy procedures are generally carried out on an outpatient basis. As required by section 3 of the *Radiation Protection Regulations*, a treatment centre will instruct a patient on precautions to minimize dose to family members, caregivers and members of the general public. These precautions are usually needed for the first few days to a few weeks after the procedure, but if the patient were to die before the nuclear substance had fully decayed, there could be a minimal radiation dose to death-care professionals and others in the course of their work. Any dose received when handling a decedent containing nuclear substances would usually represent only a small portion of the radiation dose typically received by a person over the course of a year (from naturally occurring radioactive material, for example).

While the handling of decedents containing nuclear substances is typically not dangerous, standard radiation protection principles should be applied to keep the dose to anyone involved in the handling of decedents as low as reasonably achievable. The principles of radiation protection are to minimize time, to maximize distance, and to use shielding whenever possible (see sections 3.1–3.3 for more information on these principles). In a further effort to keep doses as low as possible, the CNSC also recommends taking specific precautions when handling decedents

containing nuclear substances. There precautions vary by nuclear substance, and are described in sections 4 and 5.

1.1 Purpose

This document outlines when and how radiation protection principles can be applied to ensure that doses to death-care professionals, family members and other members of the public are kept as low as possible when coming in contact with decedents containing nuclear substances.

This document also includes guidance on how bodies containing radioactive implants can be safely cremated. At the time of this document's publication, most Canadian provinces and territories do not have legislation that addresses the handling of human remains that contain nuclear substances – with the exception of Ontario, Quebec and Saskatchewan. These three provinces prohibit the cremation of bodies that contain radioactive implants (see appendix B for relevant excerpts of provincial legislation).

1.2 Scope

This document provides death-care professionals and the public with basic guidance on handling decedents who have undergone therapeutic procedures involving nuclear substances, to ensure that radiation dose is kept below limits that have been set to protect the public. Background information is provided on procedure types, the risks they present and methods for reducing dose. The guidance in this document is provided for information only. This information is not regulatory information, and readers should not treat this document as anything more than an information reference. It does not affect any applicable law.

Diagnostic imaging procedures that are used to image the body – using either nuclear medicine or X-rays/CT – do not pose a risk to death-care professionals and are not within the scope of this document. Similarly, there is no risk posed by therapeutic procedures using an external beam of radiation to treat cancer, and these are not addressed.

Temporary implant brachytherapy procedures are not within the scope of this document, since the implants would be removed by the treating physician if the patient were to die during the period of the procedure.

It should be noted that the guidance in this document is specific to human decedents. For guidance on how to safely handle animal remains, veterinarians or pet owners should contact the CNSC.

2. About Therapeutic Nuclear Medicine and Manual Brachytherapy

This section gives an overview of how nuclear substances are used in therapeutic nuclear medicine and manual brachytherapy, as well as what information death-care professionals should obtain before handling decedents that may contain these substances.

2.1 Therapeutic nuclear medicine

Therapeutic nuclear medicine is the administration of nuclear substances – either orally or via injection –for therapeutic procedures such as the use of radioactive iodine to treat thyroid cancer or hyperthyroidism. The desired outcome in these cases is to kill the diseased cells. However,

bodily fluids, organs and other body parts may still contain radioactive material for some time afterward.

2.2 Manual brachytherapy (permanent implants)

Manual brachytherapy is a type of therapeutic nuclear medicine that uses sealed radioactive sources to treat cancer. These sources, commonly referred to as “seeds”, are implanted into or placed close to a tumour to deliver a therapeutic dose of radiation while limiting the dose to surrounding healthy tissues. The most common application is the treatment of prostate cancer.

The seeds are made of a titanium shell with the radioactive source enclosed. Each seed is smaller than a grain of rice (see figure 1). On average, 50 to 100 seeds are distributed throughout the affected tissue. The seeds remain within the organ indefinitely and the nuclear substance decays in the body over time.

Figure 1: Radioactive seeds used in manual brachytherapy

2.3 Radioisotopes used in therapeutic nuclear medicine

The nuclear substances involved in nuclear medicine and manual brachytherapy are commonly called “radioisotopes”. The quantity of the radioisotope varies by procedure, and each radioisotope also decays at a different rate. Once it fully decays, it is no longer radioactive. Table 1 provides examples of nuclear substances commonly used in therapeutic nuclear medicine procedures and manual brachytherapy, and their respective applications.

Table 1: Typical applications of nuclear substances used in therapeutic nuclear medicine and manual brachytherapy

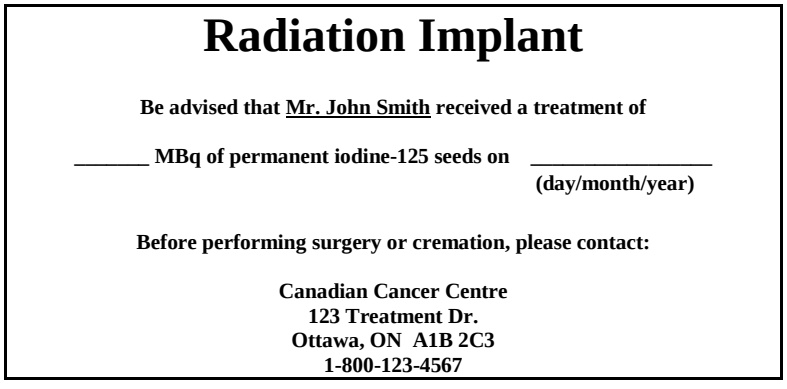
Nuclear substance	Typical applications	
Strontium-89	To provide pain relief from bone cancer	Therapeutic nuclear medicine
Yttrium-90	To treat a variety of conditions and diseases such as arthritis and various cancers	
Phosphorus-32	To treat a family of diseases characterized by increased blood cell production	
Iodine-131	To treat various types of tumours and hyperthyroidism	
Samarium-153	To provide pain relief from bone cancer and to treat prostate and breast cancer	
Lutetium-177	To treat neuroendocrine tumours	
Radium-223	To treat advanced prostate cancer	
Iodine-125	To treat prostate cancer	Manual brachytherapy
Palladium-103	To treat prostate or breast cancer	

2.4 Release from treatment centre

Therapeutic nuclear medicine and manual brachytherapy procedures are routinely done on an outpatient basis. Before leaving the treatment centre, the patient and/or their caregiver are instructed on precautions that should be taken to limit dose to others and will usually receive a wallet card (see figure 2). These precautions are only needed for a limited period of time, after which the nuclear substance will have decayed to a level that makes precautions unnecessary.

If a patient dies following a nuclear medicine or manual brachytherapy procedure, then special precautions for limiting exposure to radiation may be recommended for processes such as autopsy, embalmment, cremation or alkaline hydrolysis. These precautions are outlined in sections 4 and 5.

Figure 2: Example of a wallet card for a patient who underwent manual brachytherapy



2.5 Important information that death-care professionals should obtain

When a death-care professional receives a body and becomes aware that the individual underwent one of these procedures, the following information should be obtained from family or caregivers:

- The type of radiation procedure (i.e., therapeutic nuclear medicine or a manual brachytherapy implant) and the nuclear substance used
- Where and when the procedure took place
- Contact information for the treatment centre

This information can also be obtained by contacting the treatment centre's radiation safety officer (RSO). RSOs are responsible for all matters related to radiation safety at treatment centres, and can give more details on particular treatments. Once the required information is obtained, a decision can be made if precautions should be taken (see section 3.4).

3. Radiation Protection Guidelines for Safe Handling of Decedents

Radiation doses can occur when an individual is exposed to nuclear substances that are outside of the body (external) or when they are taken into the body (internal). Sections 3.1 to 3.3 outline general radiation protection principles for reducing external and internal radiation doses resulting from exposure to nuclear substances. Section 3.4 includes a table with suggested time frames for additional precautions when handling decedents who had come in contact with specific nuclear substances via therapeutic nuclear medicine or manual brachytherapy.

3.1 Minimize exposure time

The amount of radiation dose is directly related to the time spent in close proximity to the body or the remains.

- Minimize time spent close to the body or remains; spend only as much time as necessary.

- To reduce exposure time, additional efforts should be made to plan and prepare for the handling of decedents that contain nuclear substances, so that required tasks can be completed as efficiently as possible.

3.2 Maximize distance from the radiation source

The further a person is from a nuclear substance, the lower the dose will be.

- Maximize distance from the body or remains, as practicable.

- Use tools to avoid direct contact with organs or tissues that might contain the nuclear substance.

3.3 Use personal protective equipment for protection

The use of shielding between a person and a radiation source will reduce radiation exposure and any resulting dose from that exposure.

- Wear personal protective equipment (PPE), which will provide a protective barrier from radiation when handling decedents that contain nuclear substances. PPE will also prevent the possibility of ingesting or inhaling a nuclear substance and protect the skin from contamination.

  While most safety standards require such equipment to be worn when handling any decedent or remains – even when no nuclear substances are involved – PPE is particularly important from a radiation safety perspective in this case.

- PPE should be worn by anyone handling the body or any remains, as well as by anyone working in the area.

- Appropriate PPE includes the following:
  - gloves (double layer when possible)
  - face mask
  - safety eyewear
  - foot covers
  - gown

3.4 Recommended time frames for additional precautions

Once complete information is known about the decedent's medical procedure that involved nuclear substances (see section 2.5), a decision can be made if additional precautions should be taken for autopsy, embalmment, cremation or alkaline hydrolysis.

Table 2 shows the time frames during which the CNSC recommends taking precautions to ensure that any doses to workers and the general public are kept as low as reasonably achievable. For example, if a person received an iodine-125 treatment five months before death, precautions would be recommended for autopsy and cremation, because the suggested time frame in this case is two years. However, no precautions would be necessary for embalmment, because the suggested time frame is only one month.

Sections 4 and 5 of this document outline recommended precautions for each substance listed in table 2. For more information on these recommendations, or if handling a decedent who may have come in contact with any nuclear substance not listed in table 2, contact the CNSC or the treatment centre's RSO.

Table 2: Recommended time frames for taking precautions when handling decedents containing nuclear substances

Nuclear substance used in prior medical procedure	Recommended time frame for taking precautions*			
	Autopsy	**Embalmment**	**Cremation**	**Alkaline hydrolysis**
Strontium-89	1 year	2 weeks	1 year	1 year
Yttrium-90	6 weeks	1 month	6 weeks	6 weeks
Phosphorus-32	6 months	6 weeks	6 months	6 months
Iodine-131	4 months	1 month	4 months	4 months
Samarium-153	3 weeks	2 weeks	3 weeks	3 weeks
Lutetium-177	3 months	2 weeks	3 months	3 months
Radium-223	3 months	2 weeks	3 months	3 months
Iodine-125	2 years	1 month	2 years	2 years
Palladium-103	3 months	1 month	3 months	3 months

***Notes:**

1. If the therapeutic nuclear medicine procedure or manual brachytherapy procedure took place more than two years ago, the decedent can be treated in the usual manner. No precautions are necessary for autopsy, cremation, embalmment or alkaline hydrolysis.
2. It may be discovered after the fact that an autopsy or cremation occurred within the time frames listed in table 2, but that recommended precautions were not taken. In this case, it is advisable to clean the area thoroughly before further use. Death-care professionals can rest assured that the radiation risk would still be minimal even if the recommended precautions were not taken – since standard procedures for handling decedents already offer adequate radiation protection. Specific radiation-related precautions are simply an additional effort to keep doses as low as reasonably achievable.

4. Precautions for Handling a Decedent Who Underwent a Therapeutic Nuclear Medicine Procedure

Therapeutic nuclear medicine involves the use of unsealed nuclear substances that can remain in tissue and bodily fluids for a period of time, depending on the procedure.

There may be a contamination hazard (e.g., through exposure to bodily fluids during an autopsy) when handling a decedent who has undergone a therapeutic nuclear medicine procedure with an unsealed nuclear substance. Radiation from unsealed nuclear substances may also penetrate through the decedent's body and externally expose those around it. A contamination hazard may also exist where there is potential for the death-care professional to inhale or ingest the nuclear substance, or absorb it through the skin from a puncture wound or skin contamination. If, in the course of handling such a decedent, the death-care professional's skin becomes contaminated with bodily fluids potentially containing nuclear substances, wash well with soap and lukewarm water. Do not abrade the skin. Blot it dry.

The various nuclear substances used in therapeutic nuclear medicine differ in their application and properties. Recommended precautions for handling decedents are addressed according to some of the most commonly used nuclear substances, and/or those that present a special case because of their long decay time or the purpose of the treatment.

Sections 4.1–4.7 outline recommended precautions for autopsy, embalmment, cremation and alkaline hydrolysis for a decedent who underwent a therapeutic nuclear medicine procedure using one of the following nuclear substances: strontium-89, yttrium-90, phosphorus-32, iodine-131, samarium-153, lutetium-177 or radium-223. For any questions about these recommendations, contact the CNSC.

4.1 Strontium-89

Strontium-89 is used to lessen bone pain associated with various cancers, particularly advanced prostate cancer that has spread to the bone. The treatment is typically administered for advanced stages of the disease and is done so for palliative purposes; as such, the patient may die from the disease within a few months of the procedure. Strontium-89 will concentrate in the bones and stay in the cremated remains after cremation. The following precautions are recommended when handling decedents containing strontium-89:

Autopsy	**Time frame: 1 year** • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Do not directly handle bones with lesions. Use tools and tongs to avoid direct contact with bones. • If bones are removed from the body, store them in a low-occupancy area in a sealed container labelled “radioactive” with the date on which precautions are no longer necessary. Workers in the vicinity should be made aware of the container’s presence. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 2 weeks** • Minimize direct contact with the venous drainage tube and use handling tools to manipulate it.
Cremation	**Time frame: 1 year** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container made of plastic or wood. If a stainless steel urn is used, keep cremated remains in a low-occupancy area for three months. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline hydrolysis	**Time frame: 1 year** • Do not dispose of the body by alkaline hydrolysis.

4.2 Yttrium-90

Yttrium-90 is used to treat a variety of conditions and diseases such as arthritic conditions and various forms of cancer. The following precautions are recommended when handling decedents containing yttrium-90:

Autopsy	**Time frame: 6 weeks** • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Avoid direct contact with the body. Use tools and tongs. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 1 month** • Minimize direct contact with the venous drainage tube and use handling tools to manipulate it.
Cremation	**Time frame: 6 weeks** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container made of plastic or wood. If a stainless steel urn is used, keep cremated remains in a low-occupancy area for two weeks. • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline hydrolysis	**Time frame: 6 weeks** • Do not dispose of the body by alkaline hydrolysis.

4.3 Phosphorus-32

Phosphorus-32 is used to treat a family of diseases characterized by increased blood cell production. The following precautions are recommended when handling decedents containing phosphorus-32:

Autopsy	**Time frame: 6 months** • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Avoid direct contact with the body. Use tools and tongs. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 6 weeks** • Minimize direct contact with the venous drainage tube and use handling tools to manipulate it.
Cremation	**Time frame: 6 months** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container made of plastic or wood. If a stainless steel urn is used, keep cremated remains in a low-occupancy area for one month. • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline hydrolysis	**Time frame: 6 months** • Do not dispose of the body by alkaline hydrolysis.

4.4 Iodine-131

Iodine-131 is the most widely used of all nuclear substances in therapeutic applications. It is used to treat thyroid conditions, specifically hyperthyroidism and thyroid cancer. The following precautions are recommended when handling decedents containing iodine-131:

Autopsy	**Time frame: 4 months** • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Avoid direct contact with the body (especially the thyroid). Use tools and tongs. • If the thyroid must be removed during autopsy, store it in a low-occupancy area in a sealed container labelled “radioactive” with the date on which precautions are no longer necessary. Workers in the vicinity should be made aware of the container’s presence. • Limit autopsy to two hours if the patient died within one month of the medical procedure that used iodine-131. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 1 month** • Limit embalmment to two hours.
Cremation	**Time frame: 4 months** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container, preferably one made of stainless steel. Keep cremated remains in a low-occupancy area for three months. • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline hydrolysis	**Time frame: 4 months** • Do not dispose of the body by alkaline hydrolysis.

4.5 Samarium-153

Samarium-153 is used to relieve pain as a result of bone cancers and to treat prostate and breast cancer. The following precautions are recommended when handling decedents containing samarium-153:

Autopsy	**Time frame: 3 weeks** • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Do not directly handle bones with lesions. Use tools and tongs to avoid direct contact with bones. • If bones are removed from the body, store them in a low-occupancy area in a sealed container labelled “radioactive” with the date on which precautions are no longer necessary. Workers in the vicinity should be made aware of the container’s presence. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 2 weeks** • During embalmment, minimize direct contact with the venous drainage tube and use handling tools to manipulate it.
Cremation	**Time frame: 3 weeks** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container, preferably one made of stainless steel. Keep cremated remains in a low-occupancy area for two weeks. • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline hydrolysis	**Time frame: 3 weeks** • Do not dispose of the body by alkaline hydrolysis.

4.6 Lutetium-177

Lutetium-177 is used to treat neuroendocrine tumours. The following precautions are recommended when handling decedents containing lutetium-177:

Autopsy	**Time frame: 3 months** • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Avoid handling tissues directly. Use tools and tongs. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 2 weeks** Minimize direct contact with the arterial drainage tube and use handling tools to manipulate it.
Cremation	**Time frame: 3 months** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize time spent handling the remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container. Keep cremated remains in a low-occupancy area for two months. • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline hydrolysis	**Time frame: 3 months** Do not dispose of the body by alkaline hydrolysis.

4.7 Radium-223

Radium-223 is used to treat advanced prostate cancer. The following precautions are recommended when handling decedents containing radium-223:

Autopsy	**Time frame: 3 months** Precautions: • In addition to the appropriate personal protective equipment, use a double layer of disposable gloves when handling the body to avoid the presence and spread of contamination. • Wear safety glasses or goggles. • Avoid handling tissues directly. Use tools and tongs. • Minimize time spent in the vicinity of the body.
Embalmment	**Time frame: 2 weeks** • Minimize direct contact with the venous drainage tube and use handling tools to manipulate it.
Cremation	**Time frame: 3 months** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the cremated remains to prevent the contamination of equipment. • Minimize handling time of the remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container, preferably one made of stainless steel, Keep cremated remains in a low-occupancy area for two weeks. • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains. • Do not directly handle/touch the cremated remains.
Alkaline Hydrolysis	**Time frame: 3 months** • Do not dispose of the body by alkaline hydrolysis.

5. Precautions for Handling a Decedent Who Underwent Manual Brachytherapy

In a decedent who underwent a manual brachytherapy procedure, the nuclear substance will remain sealed within the seed and will be contained within a single organ or site (usually the prostate or breast). There is minimal risk of the presence of contamination as long as the seeds have not ruptured. There will be a small amount of dose received while conducting an autopsy or embalmment, due to external radiation from the nuclear substance within the body.

Sections 5.1 and 5.2 outline recommended precautions for autopsy, embalmment and cremation for a decedent who underwent a manual brachytherapy procedure using iodine-125 or palladium-103. For questions about these recommendations, contact the CNSC.

5.1 Iodine-125

Iodine-125 is commonly used in manual brachytherapy to treat prostate cancer. The following precautions are recommended when handling decedents containing iodine-125:

Autopsy	**Time frame: 2 years** • Ensure that tissue around the implant remains intact during the autopsy. In the case of implants in the prostate, for example, the prostate should remain intact. This will provide shielding from the nuclear substance and prevent unintended dissection of the seeds. • Avoid direct contact with the tissue around the implant. Use tools and tongs. • Tissues containing seeds should not be removed from the decedent. If it is essential to remove tissues containing seeds, store these tissues in a low-occupancy area in a sealed container labelled “radioactive” with the date of disposal. Workers in the vicinity should be made aware of the container’s presence. • Limit autopsy to two hours if the patient died within one month of brachytherapy seeds being implanted in the body.
Embalmment	**Time frame: 1 month** • Limit embalmment to two hours.
Cremation	**Time frame: 2 years** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the remains to prevent the contamination of equipment and rupture of any remaining seeds. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container, preferably one made of stainless steel. This will shield the radiation more than some other materials. • Store the cremated remains in a low-occupancy area (e.g., in a room that is rarely occupied or in a basement). • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains.
Alkaline hydrolysis	**Time frame: 2 years** • Do not dispose of the body by alkaline hydrolysis.

5.2 Palladium-103

Palladium-103 is commonly used in manual brachytherapy to treat breast cancer and prostate cancer. The following precautions are recommended when handling decedents containing palladium-103:

Autopsy	**Time frame: 3 months** • Ensure that tissue around the implant remains intact during the autopsy. In the case of implants in the prostate, for example, the prostate should remain intact. This will provide shielding from the nuclear substance and prevent unintended dissection of the seeds. • Avoid direct contact with the tissue around the implant. Use tools and tongs. • Tissues containing seeds should not be removed from the decedent. If it is essential to remove tissues containing seeds, store these tissues in a low-occupancy area in a sealed container labelled “radioactive” with the date of disposal. Workers in the vicinity should be made aware of the container’s presence. • Limit autopsy to two hours if the patient died within one month of brachytherapy seeds being implanted in the body.
Embalmment	**Time frame: 1 month** • Limit embalmment to two hours.
Cremation	**Time frame: 3 months** Precautions for death-care professionals: • Use standard personal protective equipment when cremating the body and handling the cremated remains. • Clean the cremation chamber as thoroughly as possible to avoid contamination of future cremations. • Leave the exhaust fan on at all times until the cremated remains are placed in their final container and the area has been cleaned. • Avoid pulverizing the remains to prevent the contamination of equipment and rupture of any remaining seeds. • Minimize time spent handling the cremated remains. Precautions for handling cremated remains: • Store the cremated remains in a closed container, preferably one made of stainless steel. This will shield the radiation more than some other materials. • Store the cremated remains in a low-occupancy area (e.g., in a room that is rarely occupied or in a basement). • Do not scatter the cremated remains. Label the container with the date on which cremated remains may be scattered. • Do not make memorial keepsake jewellery or tattoos with the cremated remains.
Alkaline hydrolysis	**Time frame: 3 months** • Do not dispose of the body by alkaline hydrolysis.

6. Precautions for Handling of Waste

The following guidelines apply to the handling of waste in the course of autopsy, embalmment or cremation:

- Dispose of any bodily fluids in the usual fashion.
- Return any tissue that was removed during autopsy to the body for burial or cremation, unless cremation of a body containing radioactive implants is explicitly forbidden by provincial legislation (see appendix B).
- When tissues cannot be returned to the body, store them in sealed bags or containers in an unoccupied location to decay for the time periods specified in table 2 for autopsy or cremation. Bags or containers containing the tissues should be labelled “radioactive” and should indicate the date on which they may be disposed of. Workers in the vicinity should be informed of the presence of tissues stored with residual activity.
- Store any used disposable personal protective equipment in bags or containers for the time periods specified in table 2 for autopsy or cremation. Bags and containers should be labelled “radioactive” with the date on which they may be disposed of. Workers in the vicinity should be notified of their presence.

7. Notes on Burial and Funeral Rites

- No precautions or restrictions are required for viewing bodies with residual activity.
- Burial or entombment of bodies with residual activity can be performed at any time. This usually involves placing the decedent underground or in a crypt in a wood or metal casket. Because of the shielding from the casket and the earth or crypt walls, the radioactivity will pose no safety concerns.
- For natural burial (where the body decomposes naturally in the earth), the nuclear substance will decay before it can contaminate any part of the surrounding environment and does not pose any hazards.
- Transportation of bodies with residual activity is not a concern. Note that the regulations governing transport of nuclear substances provide a specific exemption from the application of those regulations for nuclear substances implanted in, or incorporated into, a person for medical purposes (see subsection 2(b) of the *Packaging and Transport of Nuclear Substances Regulations, 2015*).

8. Conclusion

If the precautions outlined in this document are followed, the radiation hazards associated with handling decedents with residual radioactivity are minimal. Death-care professionals can reduce or avoid radiation-related risk by applying the CNSC’s recommendations. These guidelines aim to ensure that death-care professionals, decedents’ family members and the environment are protected, while allowing the wishes of decedents and their loved ones to be met to the extent possible.

9. CNSC Contact Information

For more information, contact the CNSC:

Phone: 1-800-668-5284 (in Canada) or 613-995-5894 (within the National Capital Region or outside Canada)
Fax: 613-995-5086
Email: cnsc.info.ccsn@canada.ca
Mail: Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046 Station B
Ottawa, ON K1P 5S9

Appendix A:What Is Radiation?

Radiation is energy transmitted in the form of waves or streams of particles. Radiation has always been present and is all around us in many forms. Life has evolved in a world filled with radiation, which is part of our everyday lives.

Radiation can be described based on the effect it has on things. There are two types of radiation: ionizing and non-ionizing. Ionizing radiation includes the radiation that comes from both natural and man-made radioactive materials such as cosmic rays, nuclear power plants, X-ray machines, and nuclear substances used in medical procedures. Non-ionizing radiation is a lower-energy radiation and includes forms such as radio waves, ultraviolet rays, microwaves, and sunlight.

When ionizing radiation penetrates matter, such as the human body, it deposits energy. The degree of a biological effect on the human body will depend on the amount of radiation deposited, the type of radiation and the tissue or organ in the body that has been exposed. The amount of energy deposited and its effect are represented by a quantity called a “dose”. Various activities listed in the table below put doses into perspective. More information on radiation can also be found on the CNSC website.

Effective dose (mSv)	Limit or source
> 1000	Acute dose that may cause symptoms of radiation sickness
150	Average annual dose to astronauts working on the International Space Station
100	Five-year dose limit for nuclear energy workers
50	Annual dose limit for nuclear energy workers (set out in section 13 of the *Radiation Protection Regulations*)
7	Typical chest CT (computed tomography) scan
1.8	Annual Canadian average of natural background radiation
1	Annual public dose limit (section 13 of the *Radiation Protection Regulations*)
0.1	Typical chest X-ray
0.02	Typical cross-Canada flight
0.001	Typical dose from living for one year within a few kilometres of an operating nuclear power plant in Canada

Appendix B: Relevant Provincial Legislation

Most provinces and territories do not have legislation that addresses the handling of human remains that contain nuclear substances. The exceptions are Saskatchewan, Ontario and Quebec, which prohibit the cremation of bodies that contain radioactive implants.

Note: The following excerpts from provincial legislation were in effect when this document was written. Readers should consult the acts and regulations directly for the most current information.

Saskatchewan

Section 28 of the *Funeral and Cremation Services Regulations* states that "no person shall provide human remains to a crematorium for cremation if the person knows or ought reasonably to know that: (a) a radioactive implant is in the human remains;".

Contact information:

Funeral and Cremation Services
Council of Saskatchewan
3847C Albert Street
Regina, SK S4S 3R4
Canada
Telephone: 306-584-1575
Fax: 306-584-1576

Ontario

The following provisions of the general regulations made under the *Funeral, Burial and Cremation Services Act* are relevant to this document:

- Paragraph 31(2)(b) states that "The crematorium operator shall not permit the cremation of a dead human body if…the body has a pacemaker or radioactive implant, is in a casket that consists of or has on or in it material made of or containing non-flammable or hazardous material or chlorinated or fibre-reinforced plastic, other than incidental metal used in the construction of the casket or accompanying material."

- Paragraph 31(3) states that "The crematorium operator may contract out or arrange for the removal of a pacemaker or radioactive implant from a dead human body if the person carrying out the removal is a person described in section 52."

- Paragraph 33(7) states that "The funeral establishment operator may contract out or arrange for the removal of a pacemaker or radioactive implant from a dead human body if the person carrying out the removal is a person described in section 52."

- Paragraph 35(3) states that "The transfer service operator may contract out or arrange for the removal of a pacemaker or radioactive implant from a dead human body if the person carrying out the removal is a person described in section 52."

- Section 52 states that "An operator shall not engage a person to remove a pacemaker or a radioactive implant from a dead human body unless,

  (a) the person holds a Funeral Director – Class 1 licence and is acting on behalf of an operator that holds a Funeral Establishment Operator – Class 1 licence or a Transfer Service Operator – Class 1 licence; or

  (b) the person is a legally qualified medical practitioner."

Contact information:

Funeral, Burial and Cremation Services Act, 2002
Bereavement Authority Ontario (BAO)
100 Sheppard Avenue East, Suite 505
Toronto, ON M2N 6N6
Canada
Telephone: 647-483-2645 or 1-844-493-6356
Email: info@thebao.ca

Quebec

Section 42 of the *Regulation respecting the application of the Act respecting medical laboratories, organ and tissue conservation and the disposal of human bodies* of the Government of Quebec states the following: "A funeral director or embalmer who takes possession of a human body which might possibly contain radioisotopes must take all the necessary steps to protect the members of his staff who are called upon to handle the body, and he must take the necessary measures to eliminate any radioactive source. Every sealed source of radioactivity must be removed from a body before embalming or incineration thereof."

Contact information:

Ministry of Health of Québec
Ministère de la Santé et des Services sociaux
Direction des équipements, de la logistique et de la conservation des infrastructures
1075, chemin Sainte-Foy
Québec, QC G1S 2M1
Canada
Telephone: 418-266-5835
Email: Use the online email form

Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

Additional Information

- Institute of Physics and Engineering in Medicine, Report 106: *UK Guidance on Radiation Protection Issues following Permanent Iodine-125 Seed Prostate Brachytherapy*, London, 2012.
- Institute of Physics and Engineering in Medicine, Report 109: *Radiation Protection in Nuclear Medicine*, York, UK, 2014.
- International Atomic Energy Agency, Safety Reports Series No. 40: *Applying Radiation Safety Standards in Nuclear Medicine*, Vienna, 2005.
- International Atomic Energy Agency, Safety Report Series No.63: *Release of Patients After Radionuclide Therapy*, Vienna, 2009.
- International Commission on Radiological Protection (ICRP), ICRP Publication 94: *Release of Patients after Therapy with Unsealed Radionuclides*. *Annals of the ICRP* 34(2), Amsterdam, 2004.
- ICRP, ICRP Publication 98: *Radiation Safety Aspects of Brachytherapy for Prostate Cancer using Permanently Implanted Sources*, *Annals of the ICRP* 35(3), Amsterdam, 2005.
- National Commission on Radiation Protection and Measurements, NCRP Report No. 155: *Management of Radionuclide Therapy Patients*, USA, 2006.
- National Health and Medical Research Council, Australian Government Publishing Service: *Code of practice for the safe handling of corpses containing radioactive materials*, Australia, 1986.
- Que, W. “Radiation Safety Issues regarding the Cremation of the Body of an I-125 Prostate Implant Patient”. *Journal of Applied Clinical Medical Physics*. 2(3): 174–77, Alexandria, VA, 2001.

CNSC Regulatory Document Series

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

Effective April 2013, the CNSC's catalogue of existing and planned regulatory documents has been organized under three key categories and twenty-five series, as set out below. Regulatory documents produced by the CNSC fall under one of the following series:

1.0 Regulated facilities and activities

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

2.0 Safety and control areas

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

3.0 Other regulatory areas

Series
- 3.1 Reporting requirements
- 3.2 Public and Aboriginal engagement
- 3.3 Financial guarantees
- 3.4 Commission proceedings
- 3.5 CNSC processes and practices
- 3.6 Glossary of CNSC terminology

Note: The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. For the latest list of regulatory documents, visit the CNSC's website.