

Information for people handling deceased persons containing radiopharmaceuticals

Introduction

These notes provide information to cemetery and crematorium workers, funeral directors and embalmers and coroners on handling deceased persons who may have recently been treated with a therapeutic radiopharmaceutical. They provide some background information on radiation, radiation risk, recommended work practice and current radiation legislation in Victoria..

For most crematoria workers and embalmers, deceased persons containing therapeutic amounts of radiopharmaceutical will be rarely encountered. Treatment with radiopharmaceuticals is usually given only to patients who are not expected to die shortly after treatment, so patients rarely die with a significant amount of radioactivity.

Human remains containing radiopharmaceuticals, which are buried in a grave or interred in a mausoleum crypt, pose negligible radiation risks to persons handling the coffin or in the vicinity of the burial site or mausoleum.

Radiation protection principles

There are several types of radiation that can be emitted from radioactive substances. The basic types of radiation are alpha, beta and gamma. Radiopharmaceuticals administered to patients are usually either beta or gamma emitting or a combination of both. Generally, beta radiation does not penetrate more than a few millimetres through tissue. Gamma emitting radioactive materials can penetrate through tissue and therefore pose an external radiation hazard.

There is an important difference between radiation **exposure** and radioactive **contamination**.

Radiation **exposure** of a person can occur at a distance from the radioactive material or source. Radiation **exposure** usually occurs as a result of gamma rays being emitted by the radioactive material and travelling through air. Gamma rays that are absorbed by the body can cause harm.

If a person is **contaminated** it means that the person has come into contact with a radioactive substance and that this material is present on the skin, clothing or on objects. **Contamination** is hazardous because the radioactive material can be inhaled or ingested.

There are three ways in which a radiation dose can be controlled. The total dose received depends on the length of **time** exposed, the **distance** from the radiation source and the type and amount of **shielding** around the radiation source.

The radiation dose can be reduced by reducing the time of exposure, by increasing the distance from the radiation source and/or by introducing a shielding material between the radiation source and person.

Risk

In order to minimize radiation risk, Australia has adopted the International Commission of Radiological Protection's (ICRP) recommendations, which set limits on the amount of radiation a person can be exposed to annually. These limits are divided into 3 categories: occupational, medical and public.

Occupational exposures are incurred at work and as a result of activities within a workplace. Medical exposure is the exposure of patients as part of medical diagnosis or therapy and public exposure covers all other exposures that are neither occupational nor medical.

The dose limits for members of the public are set at 1 millisievert (mSv) per year and the occupational dose limit at 20 mSv per year. Despite these limits, the ICRP recommends that exposure to radiation should be kept as low as reasonably practical.

1 mSv of radiation is about half the amount of natural background radiation that everyone in Victoria is exposed to annually.

All human activities involve risk. Driving a car or smoking cigarettes are examples of everyday activities commonly used to illustrate relative risk. It is useful to establish a numerical means of expressing risk for the purposes of comparison between different activities. The most common way of presenting risk is in terms of mortality. Compared to other risks in everyday life the risk from 1mSv of radiation is considered very small. This theoretical risk is approximately the same as the risk of dying from smoking 80 cigarettes in a life time, travelling 4,000 km by car, or travelling 40,000 km by commercial aircraft.

It is extremely unlikely that embalmers and crematoria workers would receive radiation doses in excess of the public dose limit of 1 mSv per year following the introduction of additional conditions on hospital licences for the release of human remains.

Use of radiopharmaceuticals

Radiopharmaceuticals are used for diagnosis and treatment of disease.

Radiopharmaceuticals used in therapy use the radiation emitted to destroy diseased tissue.

Therapeutic procedures can usually be divided into two classes:

- Treatment with sealed sources, which are mechanically inserted
- Treatment with solutions

Sealed sources are encapsulated and therefore the risk of contamination to persons handling the body is very small. An example of a sealed source radiopharmaceutical is Iodine-125 seeds, used to treat prostate cancer.

Examples of common radiopharmaceuticals, which are administered in solution, include Iodine-131, Strontium-89. Iodine-131 is used to treat hyperthyroidism and thyroid tumours. I-131 is selectively taken up by the thyroid and produces localised destruction of diseased tissue. Strontium-89 is used for the relief of bone cancer pain and is taken up in the bone.

Controls relating to patients treated with radiopharmaceuticals in Victoria

The Department of Human Services regulates the use of radioactive substances throughout Victoria. Hospitals and nuclear medicine practices treat various health conditions using therapeutic radiopharmaceuticals. Any hospital or nuclear medicine practice administering radiopharmaceuticals to patients must possess a licence from the Department of Human Services.

One of the conditions of such a licence is that the licensee must ensure that the discharge of any patient treated with radioactive substances is in accordance with the Australian Radiation Protection and Nuclear Safety Agency's *Recommendations for the discharge of patients undergoing treatment with radioactive substances*.

Following these Recommendations will ensure that any patient treated with radiopharmaceuticals will present negligible risks to the public when discharged from hospital. When the patient is released from hospital any radioactivity left in the body would be very small and if they die following discharge will present negligible radiation risk to an embalmer or any other person handling the body.

A number of new conditions have been introduced to hospital licences that relate to death of a patient who has been treated with radiopharmaceuticals. These conditions will ensure that no body is released from hospital until the radioactivity left in the body meets acceptable limits specified in the ARPANSA *Recommendations*. Patients who die in hospital will be kept in hospital until the activity in the body meets acceptable levels. This will ensure that any person who may subsequently handle the body will not be exposed to an excessive amount of radiation.

The new conditions will ensure that the radioactivity is reduced before release by, for example, removing temporary implants of radionuclides or by holding the body for a period of time. The new conditions will state that if the body must be released for religious or other purposes before the radioactivity has decreased to an acceptable level then the body must be labelled as radioactive. If embalming is carried out on such a body it should be done under the supervision of a Radiation Safety Officer (RSO) or physicist.

A further licence condition is the requirement that all patients who have been treated with '*bone-seeking*' radiopharmaceuticals and that are discharged from hospital must be provided with an instruction card relevant to the patient's medical circumstances. The medical specialist must provide these instructions both orally and in writing. The instructions must include precautions to follow in medical emergencies and contact numbers for the prescribing doctor, RSO or physicist. If such a patient dies outside the hospital environment, then the prescribing doctor, RSO or hospital physicist will be able to determine the activity left in the body. In these cases, funeral directors, cemetery and crematorium staff will be notified by the hospital if the body is potentially radioactive and advised what precautions need to be taken.

Radiation risks during cremation

Hospitals are required to ensure that patients and deceased persons treated with radiopharmaceuticals are not released until they are considered safe for handling. Therefore normal cremation procedures should provide adequate protection.

While the risk of exposure to radiation from the cremation process is below public safety limits, potentially the biggest radiation dose to a crematorium worker would be from handling cremated remains containing '*bone-seeking*' radiopharmaceuticals. These radiopharmaceuticals, which are used in prostate cancer patients, are taken up in the bone. When a body is cremated, most of the bone mass remains in the residual material, therefore most of the radioactive material stays in the cremated remains.

Cremation may present a small radiation contamination hazard to crematoria workers

due to dust generated from raking and granulation of the bone remains after cremation and generally from handling unconfined cremated remains. Since these radiopharmaceuticals emit beta radiation, a radiation dose can only be obtained by inadvertently ingesting material on hands and from the inhalation of dust particles.

Typically any dose received from dust will be small and much less than the amount of radiation received by everyone from normal background radiation. Without respiratory protection, doses a few thousandths of annual background radiation doses may result.

By following the procedures outlined below, exposure to radiation from remains with radiopharmaceuticals will be further minimized and the potential for contamination significantly reduced to achieve doses "as low as reasonably practical".

For health reasons, the following procedures are recommended for all cremations:

- Crematoria staff should wear disposable gloves and masks when raking out the furnace. When handling ashes, special handling implements should be used rather than hands. A disposable gown is also recommended.
- The furnace should be raked out as thoroughly as possible to avoid possible cross contamination of cremated remains between cremations.
- The exhaust fan should be on at all times while granulating the cremated remains and transferring them into the urn. After each lot of remains is containerised, any spilt remains around the bench, on the floor, around the furnace and granulator should be cleaned up with the vacuum cleaner. The receptacle containing the remains and the bench top should be wiped down with a damp cloth to remove all traces of remains.

On the rare occasion that a body containing radiopharmaceuticals is to be cremated, and the radioactive material has not yet decayed away to an acceptable level, funeral directors and cemetery and crematorium staff will be notified by the administering hospital.

Where a notification is received that a deceased person is radioactive, the following *additional* procedures need to be followed during the cremation:

- All waste material including left over remains, vacuum cleaner bags, cloth used for wiping, disposable gloves, mask and gown should be isolated to avoid regular contact with workers over a period of about 18 months, prior to disposal with general rubbish. Disposable gloves should be worn when handling waste and should be disposed of last, turning them inside out as they are removed. Waste bags should be labelled as radioactive with the date that the waste was bagged. After this period all labels should be removed and waste can be disposed of normally. Any implements and containers used should be rinsed out after the cremation.
- It is preferable that radioactive cremated remains be buried rather than returned to the family as it may take at least 8 months before the radioactivity of cremated remains has decreased to a safe level.
- If the family choose not to bury the cremated remains, either the remains must be stored at the crematorium until the radioactivity has decreased to a safe level or the family should be given information about the radiation risks and what measures should be taken to avoid those risks.
- The administering hospital's RSO can assist with determining when the cremated remains will be safe, or advice can be obtained from the Department of Human Services, Radiation Safety Program. Cremated remains must be stored in an appropriate container of wood, plastic, perspex or ceramic but excluding metals, and the container must remain unopened for at least 8 months. The container should be labelled with the date the safe activity level will be reached and the date the activity was measured. The date that the cremated remains can be released should also be included.
- The family should be advised that the cremated remains should not be divided or scattered until the date specified on the container and that the container should remain unopened and stored in a safe place. This is because a radiation dose

may be received by handling the cremated remains or from inhalation of dust particles.

Radiation risks during embalming

Unless specific notification is given that a deceased person is radioactive, normal embalming procedures will ensure optimum protection for any low-levels of residual radioactivity contained in a deceased person released under the hospital licence conditions. Under conditions of licence, hospitals are required to remove any sealed source radioactive implants before the body is released. With *unsealed sources*, in the vast majority of cases the activity in the body will have reduced significantly by the time it is released for embalming.

In such cases, an embalmer working for five hours on a deceased person containing radiopharmaceuticals that has been released from hospital (therefore meeting the safe radiation limit specified in the patient discharge recommendations,) would receive less than the annual public exposure limit per year.

In very rare circumstances, for example when embalming must take place within 24 hours of death and the level of radiation is such that embalmers may be exposed to a potentially high radiation dose, special precautions will need to be taken. In these circumstances, mortuary staff and funeral directors will be notified by the hospital that the body is radioactive as per hospital licence conditions. Embalming should be carried out under the instruction of the hospital Radiation Safety Officer.

Further Information

For further information please contact:

Radiation Safety Program

Department of Human Services

Phone: 1300 767 469

Facsimile: 1300 769 274

Email: radiation.safety@dhs.vic.gov.au

Web: www.health.vic.gov.au/environment/radiation/program.htm

Medical Radiation Technologists Board

Phone: 1300 767 469

Email: registrar@mrpb.vic.gov.au

Web: www.mrpv.vic.gov.au