

**University of Otago**

**[Insert Department Name here]**

**Radiation Safety Plan**

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# 1. Radiation Hazards and Controls

## 1.1 Introduction

The University of Otago uses ionising radiation where there is a net benefit to society from teaching or research, or to the clinical management of a patient, and where it is the most appropriate methodology.

## 1.2 Uses of Ionising Radiation in the [insert department name here]

The *[insert Department Name here]* has assessed and justifies the following uses of unsealed radiation sources:

|  |  |  |
| --- | --- | --- |
| **Radionuclide** | **Use (include area)** | **Justification** |
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The use of radiation is managed in compliance with the Radiation Protection Act 1965, The Radiation Protection Regulations 1982, the National Radiation Laboratory (NRL) Code of Practices and the University of Otago policy and radiation safety plan.

## 1.3 Licences

The legislation requires the licensing of individuals who have specific responsibilities for the safe use of radiation sources indicated by their license.

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| --- | --- | --- | --- | --- |
| Name of Licensee | Radiation Safety Officer | Radionuclide and form | Maximum Activity | Standard order |
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Specifics of use within dept. (eg: student use, supervision for students, ordering etc.):

# 2. Radiation Protection Principles

## 2.1 Basic Principles

1. No practice shall be adopted unless its introduction produces a positive net benefit to the exposed individuals or to society. This justification for use shall be recorded.
2. In relation to a particular practice, the magnitude of individual radiation doses, the number of people exposed, and the likelihood of incurring exposure shall be kept as low as reasonably achievable, economic and social factors being taken into account.
3. The dose or potential does to individuals shall not exceed the limits set by NRL.

Individual Dose Limits for persons exposed to radiation as a normal condition of employment:

1. An effective does of 20 mSv per year averaged over any five year period and 40 mSv in any one year;
2. An equivalent does of 500 mSv to the skin at the nominal depth of 7 mg/cm2 averaged over 1 cm2, regardless of the total area exposed, in any one year;
3. An equivalent dose of 150 mSv to the lens of either eye in any one year;
4. An equivalent dose of 500 mSv to the hands and feet in any one year;
5. For women who declare themselves pregnant, and equivalent dose of 2 mSv at the surface of the abdomen over the remainder of the pregnancy. The intake of any radioactive materials over the remainder of the pregnancy shall not exceed one-twentieth part of the annual limit intake (ALI).

If the limit (a) is not to be exceeded, then in any year no worker shall take into the body (by ingestion, inhalation, or through a wound) more than one ALI of any radioactive material. In the case of more than one radionuclide, the sum of the fractions of an ALI of each shall be less than one.

# 3. Radiation Hazard Control

## 3.1 External Radiation Hazards

The radiation dose rates in any accessible working area shall be kept to a minimum and in any case the following maximum rates should not be exceeded:

1. At the working position in front of a laboratory workbench the radiation dose rate should be less than 10 μSv/h.
2. On the surface of a container to be held frequently in the hand the radiation dose rate should be less than 250 μSv/h.
3. At the eyes the radiation dose rate should be less than 75 μSv/h.
4. The radiation dose rate in any area next to a laboratory accessible by people not working with radiation should be less than 0.5 μSv/h. This may be relaxed by a factor up to 10 if the area is not occupied all of the time.

Three means of providing protection from external radiation are:

* Shielding – the closer to the source the shielding is, the smaller the area of shielding that is required. It is preferable to shield the container rather than the whole work area.
* Distance – whenever practical in a significant radiation field, equipment or operating procedures should be used to maximise the distance from the radiation source.
* Time – the risk from an exposure to radiation is proportional to the total absorbed dose and is independent of the dose rate. Therefore any reduction in the time of exposure results in a corresponding reduction in risk.

## 3.2 Internal Radiation Hazards

* The annual limit on uptake (ALI) of radionuclides used in this area is:
* This is the ingested or inhaled activity that in an average adult will ultimately give an effective dose of 20 mSv.

The most common routes of internal absorption that must be protected against are:

* Ingestion – there shall be no food or cosmetics allowed in any area where radioactive materials are handled. Procedures shall be designed to contain the radioactive material and minimise the chance of uncontrolled spread.
* Inhalation – there is a risk of inhalation of radioactive material whenever the material is handled in open containers and is in a form that may vaporise, nebulise or be released as a gas. Any radioactive material in a dry powder form can pose an inhalation hazard. Use of a contained workstation or fume cupboard is recommended.
* Through broken skin – any cuts or broken skin on the hands shall be covered with a waterproof dressing and disposable gloves shall be worn.

Whenever unsealed radioactive materials are handled and there is a possibility of spillage or splashing, disposable gloves, a laboratory coat or gown and protective glasses shall be worn.

(Departmental specifics should be entered in here).

## 3.4 Controlled Areas and Restricted Areas

**(Useful to include a floor plan identifying the particular areas – floor plans can be obtained from Property Services)**

* Any laboratory or work area where radioactive materials of greater activity than in Column B of Appendix 2 are dispensed shall be designated a Controlled Area as required by Regulation 21 of the Radiation Protection regulations 1982 by the licensee responsible for the materials. If activities greater than Column A are handled frequently, particularly in a busy laboratory, then the licensee should consider declaring the laboratory a Controlled Area.
* The entrance to a Controlled Area shall display a warning sign indicating that entry is prohibited without the permission of the licensee. The sign needs to comply with Section 5 of the second schedule to the Radiation Protection Regulations 1982.
* There shall be a written protocol produced by the licensee detailing under what circumstances entry is permitted, and the procedure for gaining permission. It shall also detail any special rules that must be observed within the controlled area. It shall be readily available to anyone needing to enter the controlled area.

# 4. Approved Users

## 4.1 Register

Approved users will be trained and approved by the licensee concerned. Records of the approved users will be maintained and accessible. A register format is attached as appendix 1.

## 4.2 Key Holders

The Department maintains a register of approved key holders. A copy of the

Register format is attached as appendix 2.

# 5. Records and reports

## 5.1 Records of Radioactive Materials

The receipt of any shipment of radioactive material and the dispensing or disposal shall be recorded. Information recorded shall include the date, radionuclide, activity and in the case of receipts, the importing agents. Records shall be held for 10 years.

An inventory shall be kept of all radioactive materials held. This shall be maintained up to date and kept at a location remote from the storage area. The approximate total activity of each radionuclide stored should be recorded in the inventory. It is not necessary for each individual container to be listed. The inventory is for use in hazard assessment in case of an emergency such as fire or earthquake.

A radioactive materials inventory is attached as appendix 3.

## 5.2 Records of Transfer of Material to Another Licensee

The transfer of any radioactive material from the control of one licensee to another shall be recorded.

A set of all such records shall be supplied to NRL whenever requested or otherwise annually.

Records shall be held for 10 years. An example of a transfer record is attached as appendix 4.

## 5.3 Personal Monitoring

## Laboratory Exit Safety Surveys

Each individual on exiting the radiation area should record safety surveys. An example survey is attached as appendix 5. This sheet may need modification depending on the substances in use.

**Personal Monitoring Requirements**

Some radioactive substances require individual personal monitoring, such as radiation badges or finger rings. If on assessment of the substance in use, monitoring is indicated, contact the University Health and Safety Manager to arrange the testing requirements. Education on the type of monitoring, consent process and management of results will need to be provided to all individuals concerned. Exception reports will be generated where the monitoring levels are high. Further investigation may be required by the Health and Safety Team, and the Radiation Safety Officer.

Each specific project using radiation will identify the personal monitoring requirements if applicable.

**Radiation Type and specific personal monitoring required:**

E. g.: Use of 32P for Project XXXX, licensee \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ finger band monitoring indicated.

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| --- | --- | --- | --- |
| **Name of Approved User** | **Date Monitoring initiated** | **Frequency** | **Results** |
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# 6. Storage

Specify requirements for your department – where, how and who.

## 6.1 Security

Radioactive materials shall be stored in a secure area to minimise risk of loss, theft, or damage by fire. Only authorised users may access the store through the licensee.

## 6.2 Radiation Safety

The external radiation dose rate in any continuously occupied accessible area near stored radioactive material shall be no more than 10 µSv/h. If areas outside the storage room are accessible to non-radiation workers the dose rate at the wall shall be less than 0.5µSv/h.

Once a shipping package of radioactive material has been opened, it shall be stored in a manner designed to prevent spillage, breakage of the container or contamination of other equipment. If gas or vapour is likely to be present, the room should be ventilated, or the material stored in a fume cupboard.

The licensee responsible shall have an inventory of all the stored radioactive material in case of an emergency or fire.

## 6.3 Signs

A prominent warning sign shall indicate any site where radioactive materials are stored.

There shall be a label on the door of a refrigerator or freezer in which radioactive materials are stored. No foodstuffs shall be kept in the same refrigerator or freezer.

The container in which radioactive material is stored shall be clearly labelled with the following:

The trefoil sign;

The name of the radionuclide;

The activity, and the reference date for the activity;

The name of the licensee responsible.

Radioactive materials stored in transport packaging labelled to comply with the IAEA Transport Regulations shall be deemed to meet this requirement, if a subsidiary label shows the name of the licensee responsible.

# 7. Waste Disposal

## 7.1 General Principles

Radioactive material shall not be disposed of unless this is the safest practical option (in terms of risk from radiation exposure) compared to storage, selling, re-exporting etc. The total activity and the activity concentration of radioactive waste shall be as low as can be reasonably achieved.

No package that has contained radioactive material shall be disposed of or used for other purpose unless all warning and other labels indicating that the package may have contained radioactive material have been obliterated.

## 7.2 Solid Waste

Short half-life waste, including contaminated disposable gloves, paper towels, syringes etc, should be stored in a safe place to allow decay to near background levels, and then discarded with other laboratory waste.

Other radioactive waste shall be disposed of via the University Hazardous Substances Disposal system.

## 7.3 Liquid Waste

Disposal of radioactive liquids shall be restricted to a sewerage system where this means a system that treats or dilutes domestic and trade sewage to an acceptable pollutant level before release to the environment.

Radioactive liquid shall always be tipped slowly into a sink or sluice with the water running (but no so it can splash). This practise will minimise the activity concentration in the drain in case there is a tendency for the material to bind to it.

If the radioactive liquid has a short half-life it should be stored safely in a suitable sealed container to decay to near background level before disposal. Because of the risk of spillage, depending on the storage and disposal facilities it may be safer to dispose of liquid radioactive waste immediately. The licensee shall take this into consideration when deciding which practice to follow.

## 7.4 Gaseous Waste

Gaseous waste shall not be release to the atmosphere.

Gaseous radioactive waste shall be disposed of via the University Hazardous Substances Disposal system.

# 8. Emergency Management

## 8.1 Contact Details

#### List the contacts for the department

## 8.2 Spillage of an unsealed source

**You will need to detail to fit your department.**

Evacuate all uncontaminated personnel from the affected area.

Put on protective clothing and gloves.

Mark the area of the spill and restrict access.

Prevent spread of the material by soaking up the bulk of liquids using absorbent towels held in tongs and placing in a plastic bag.

Clean the area, always wiping towards the centre using a decontaminating agent if necessary.

Monitor the area afterwards to ensure sufficient decontamination and that all contaminated articles and towels have been appropriately disposed of.

## 8.3 Personal Decontamination

Wash any contaminated skin areas as soon as possible with warm water, mild soap or mild chelating agent and a soft sponge, being careful not to damage the skin or spread the contamination to other areas. Rinse we, dry with absorbent paper towels, and then monitor the site. Repeat if necessary until no further improvement is achieved.

Rinse eyes, nose, mouth or any broken skin immediately with copious quantities of water to help prevent uptake of the material. The absorption of some materials can be reduced after ingestion by taking appropriate medication **but only on medical advice**.

## 8.4 Fire

The hazard from a fire will probably be much greater than that of the radioactive material. Therefore fire-fighting requirements shall have precedence over restrictions on entry to controlled areas.

# Appendices

## Appendix 1: Register of Approved Users

The following staff and Postgraduate Students have been trained by the licensees in the correct method of use for (radiation source), including safety procedures, and are approved to use the facility.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Radio isotope and Procedure** | **Supervised or Unsupervised** | **Trained by** | **Date** |
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## Appendix 2: Key Holders

The following people have been issued keys to the Suite (via the Departmental Office)

|  |  |  |
| --- | --- | --- |
| **Controlled Area** | **Name** | **Contact information** |
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## Appendix 3: Radioactive Materials Inventory

## Appendix 4: Transfer of Substances

### The transfer of any substance to another licensee must be recorded and the records held by the department with a copy for the licensees for at least 10 years. Remember to update your inventories.

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| --- | --- | --- | --- | --- |
| **Date** | **Substance Transferred** | Original Licensee | **Amount** | **Receiving Licensee** |
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## Appendix 5: Safety Surveys

The safety surveys in use will depend on the substance in use. The records of surveys must remain in the work area.

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| --- |
| **Room Number and location:** |
| **Substance in use:** |
| **Principle Licensee and Contact:** |
| **Nature of Survey required:** |
|  |
|  |
| **Date** | **Name** | **Survey** | **OK** | **Signature** |
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