

# USING IONISING RADIATION PROCEDURE

## SCOPE

This Procedure relates to all activities under the management and control of Monash University in Australia and applies to affected staff, students, contractors and visitors.

## PROCEDURE STATEMENT

This procedure sets out the requirements for the identification, assessment and control of all practices using Ionising Radiation at Monash University.

### 1. Abbreviations

<b>ARPANSA</b>	Australian Radiation Protection and Nuclear Safety Agency
<b>EPD</b>	Electronic Personal Dosimeter
<b>GBq</b>	Gigabequerel
<b>kVp</b>	Peak kilovoltage
<b>mA</b>	Milliampere
<b>MBq</b>	Megabequerel
<b>μSv</b>	Microsievert
<b>mSv</b>	Millisievert
<b>OH&amp;S</b>	Monash Occupational Health & Safety
<b>OHS</b>	Occupational Health and Safety
<b>OSL</b>	Optically Stimulated Luminescence dosimeter
<b>RPO</b>	Radiation Protection Officer
<b>RSO</b>	Radiation Safety Officer

### 2. Information regarding ionising radiation safety

#### 2.1 Ionising Radiation Safety Information

- 2.1.1 General information on use of Ionising Radiation for Radiation Safety Officers and for radiation users is provided on the safety topic page of the OH&S web site (<http://www.monash.edu.au/ohs/topics/index.html>).

- 2.1.2 More detailed information, including local risk assessments and Safe Work Instructions, can be found in the local Radiation Management Plan
- 2.1.3 For further information, contact your RSO or [OHS Consultant/Advisor](#) of the area.
- 2.2 Radiation Management Plan
  - 2.2.1 The University Radiation Management Plan is an overview of the radiation practices, procedures, and requirements that apply to the use of Ionising Radiation at Monash University. Each academic/administrative unit which uses radiation must have its own local Radiation Management Plan, incorporating the basic University Radiation Management Plan template and with the addition of local contact information, local procedures, and other relevant local information such as laboratory rules, location of safety equipment, Risk Assessments and Safe Work Instructions.
  - 2.2.2 The local Radiation Management Plan must be made available to all radiation workers.

### 3. Commencing new work/study or modifying existing practices

Before commencing new work or study using Ionising Radiation, or modifying existing Ionising Radiation practices, ensure that the following is carried out:

- 3.1 Complete Radiation Training
  - 3.1.1 See Section 11. Training. Both central OH&S and local laboratory induction and training must be completed.
- 3.2 Complete a new Risk Assessment or review and update an existing Risk Assessment
  - 3.2.1 See Section 9. OHS Risk Management.
- 3.3 Ensure personal monitoring covers new practices
  - 3.3.1 See Section 9. OHS Risk Management.
- 3.4 Ensure suitability of facilities
  - 3.4.1 Ensure the area where the work is to be undertaken is suitable in terms of access restriction for non-radiation workers, security, laboratory finishes to allow decontamination, and shielding.
- 3.5 Determine if the work is covered under an existing OHS Prescribed Activity approval
 

A Prescribed Activity approval must be in place for possession of an X-ray, sealed source, or sealed source apparatus, and for any purchase of unsealed radioactive material. See Section Prescribed Activity approvals.
- 3.6 Determine if a personal Use Licence is necessary for use of the Radiation Source(s)
  - 3.6.1 See Section 7. Use Licenses.
- 3.7 Consult your RSO
  - 3.7.1 Contact your RSO to ensure all University requirements are met.
- 3.8 Develop new Safe Work Instructions if necessary
  - 3.8.1 See Section 10. Safe work instructions and safe handling practices.
- 3.9 Update local Radiation Management Plan
  - 3.9.1 Ensure the local radiation management plan is updated with new activities, locations, risk assessments and safe work instructions, as necessary.

### 4. Administration of Ionising Radiation to humans or animals

- 4.1 Ethics approval is required for the administration of Ionising Radiation to humans or animals. Details are available at the [Research Office website](#).

### 5. Purchase and licencing of Ionising Radiation Sources

- 5.1 Use of Ionising Radiation
  - 5.1.1 Irradiating apparatus, sealed sources and sealed source apparatus:

The RSO must:

- Ensure that every irradiating apparatus, sealed source and sealed source apparatus within the academic/administrative unit is licensed and complies with statutory requirements and imposed licence conditions.
- Notify the RPO before any purchases of any irradiating apparatus, sealed source or sealed source apparatus within the academic/administrative unit. Sufficient time must be allowed for a licence to be obtained, if this is necessary, before the unit takes possession of the source.
- Ensure that, if not provided by the importing agent, an ARPANSA import permit is in place for any importation of sealed sources, sealed source apparatus, or unsealed material.
- Inform the RPO of the date of taking possession of any irradiating apparatus, sealed source or sealed source apparatus, and provide the RPO with:
  - The information for the University register as detailed in Section 6.2; and
  - For sealed sources and sealed source apparatus, a copy of the source certificate.
- Ensure that no irradiating apparatus, sealed source or sealed source apparatus is relocated, disposed of, or ownership transferred to another academic/administrative unit or outside organisation, without the prior approval of the RPO.
- Update the radiation source list in the local Radiation Management Plan when any irradiating apparatus, sealed source or sealed source apparatus is acquired or disposed of, or its ownership is transferred.
- Ensure that any user of an irradiating apparatus, sealed source or sealed source apparatus holds the appropriate use licence as required by the state regulator. See Section 8.
- Investigate issues of non-compliance in consultation with the RPO.

The RPO must:

- Ensure that, if necessary, an appropriate variation to the University's radiation management licence is obtained to allow possession of any proposed new source.
- Inform the regulator of any relocation, acquisition or disposal of irradiating apparatus, sealed source or sealed source apparatus.
- Act as the first point of contact with the state regulatory body on issues of compliance with licences and investigate issues of non-compliance in consultation with the RSO.

#### 5.1.2 Unsealed sources

The RSO must:

- Ensure that any unsealed source purchased or held within the academic/administrative unit is present on the list of radionuclides covered by the University's radiation management licence.
- Coordinate with the RPO to ensure that any radionuclide to be used which is not listed on the University's radiation management licence is added to the licence before purchase.
- Investigate issues of non-compliance in consultation with the RPO.

The RPO must:

- Ensure that, if necessary, an appropriate variation to the University's radiation management licence is obtained to allow possession of any proposed new unsealed source.
- Act as the first point of contact with the state regulatory body on issues of compliance with licences and investigate issues of non-compliance in consultation with the RSO.
- Update the radiation source list in the local Radiation Management Plan when any irradiating apparatus, sealed source or sealed source apparatus is acquired or disposed of, or its ownership is transferred.
- Ensure that any user of an irradiating apparatus, sealed source or sealed source apparatus holds the appropriate use licence as required by the state regulator. See Section 8.
- Investigate issues of non-compliance in consultation with the RPO.

## 5.2 Register

- 5.2.1 The RSO must maintain a register of ionising radiation sources for their respective academic/ administrative unit, which includes the following details:

#### Irradiating apparatus

- Department of Health Reference number
- Manufacturer
- Supplier
- Model
- Serial No
- Maximum energy – kVp & mA
- Location (room, building and campus)

#### Sealed Sources and sealed source apparatus

- Department of Health Reference number
- Manufacturer
- Model
- Serial Number
- Isotope
- Activity
- Date of Activity
- Location (room, building and campus)

#### Unsealed sources

- Isotope
- Chemical form
- Maximum activity
- Location (room, building and campus) of storage and usage areas

5.2.2 The RPO will maintain a consolidated list of information on behalf of the University based on information provided by the academic/administrative unit.

## 6. Prescribed Activity approvals

6.1 An approval issued under the OHS Prescribed Activities and Permit-To-Work Procedure must be in place for any

- Purchase of radioactive material
- Possession of an X-ray, Sealed source, or Sealed source apparatus

Information about Prescribed Activity approvals for ionising radiation activities, and the application form, can be found on the [OH&S Radiation Safety page](#).

## 7. Personal monitoring of Ionising Radiation users

7.1 Personal Monitoring of external radiation dose

7.1.1 All radiation workers must have their radiation dose monitored by wearing an OSL. Organisational units may choose to allow exceptions from this requirement as described in 6.1.2 to 6.1.5:

7.1.2 For individual workers, exemptions may be applied if:

- The worker will only be exposed to forms of ionising radiation that cannot be measured using an OSL (e.g. low-energy beta emitters)

OR

- Risk Assessment shows that the work undertaken by the radiation worker cannot plausibly lead to a cumulative dose in excess of 1000  $\mu\text{Sv}$  per year (including consideration of accidents such as a stock solution spill) due to low dose rates received and/or limited time spent on radiation tasks.

7.1.3 For a facility, an exemption may be applied if:

- A formal dose rate assessment of the radiation sources (e.g. X-ray analysis units) in the facility shows that working in the facility cannot plausibly lead to a cumulative external dose approaching the regulatory 'member of the public' limit of 1000  $\mu\text{Sv}$  per year.

7.1.4 If an organisational unit chooses to permit exemptions from the OSL requirement, the exemptions must be discussed with the RPO before being applied. Alternative dosimetry methods such as EPDs should be considered for persons who are individually exempted.

7.1.5 The existence and conditions of any such exemptions must be documented in the local Radiation Management Plan.

## 7.2 Training

7.2.1 The required training must be completed before the method of dosimetry is issued to the radiation worker.

## 7.3 Pregnancy

7.3.1 The RSO must arrange for the monitoring of radiation users who have declared their pregnancy, with a radiation badge changeover at regular 4 weekly intervals. For further information on radiation use during pregnancy refer to the [Protecting Unborn and Breast-Fed Children from the Effects of Maternal Exposure to Chemicals, Biologicals, Animals and Radiation Procedure](#).

## 7.4 Use of OSL

7.4.1 The radiation worker with an OSL must wear their OSL badge at all times while undertaking radiation work.

7.4.2 Radiation badges must be worn at all times when entering areas where wearing an OSL badge is mandated.

7.4.3 OSL badges must be submitted by their wearer for changeover:

- At the end of each regular wearing period;
- Immediately, in circumstances of a suspected high exposure; and
- On a 4-weekly basis in the case of declaring their pregnancy.

## 7.5 OSL Dosimetry Results

7.5.1 The RPO must ensure that a copy of all OSL results is received and kept at OH&S.

7.5.2 The RPO must examine dose results, investigate any results over the Monash Action Level and communicate the results to the RSO and the radiation worker.

7.5.3 The RSO must examine dose results, investigate any unexpected dose results and communicate the results to the RPO and the radiation worker.

7.5.4 The RPO must maintain a record of all OSL results above the Monash Action Levels.

## 7.6 Radiation Work Investigation

Where the dosimetry result indicates an unexpected dose result or a dose result above the Monash Action Level, the following action must be taken:

7.6.1 The RSO, in conjunction with the RPO, must investigate to attempt to determine the possible cause of the result or if the result is erroneous.

7.6.2 The RSO, in conjunction with the RPO, must determine what corrective actions are necessary to prevent further exposures above the Monash Action Level.

7.6.3 The RPO must maintain a record of the actions taken in investigating these results and any corrective actions taken.

7.6.4 The RSO must assist workers to implement the appropriate corrective actions.

7.6.5 The radiation worker must:

- Cooperate with any investigation into exposures over the Monash Action Level; and

- Assist the RSO to implement appropriate corrective actions to prevent further exposures above the Monash Action Levels.

## 7.7 Assessing intake of radioactive materials

- 7.7.1 Assessment of the intake of radioactive materials to assess the internal radiation dose of Ionising Radiation to users is conducted at Monash University on a risk basis. Contact the RPO if risk assessment shows that intake assessment might be indicated.

## 8. Use Licences

- 8.1 All users of radioactive sources are required to have a personal use licence, unless they are undertaking an activity that falls into one of a number of exemption categories. Formal notification of these exemption categories is printed in the Victorian Government Gazette, and reproduced at <https://www2.health.vic.gov.au/about/publications/policiesandguidelines/Exemptions-from-use-licence-requirements>.

### 8.1.1 Exemption categories include:

- Users of X-ray diffraction, X-ray absorption, or X-ray fluorescence analysers;
- Users of shielded gamma irradiators;
- Staff who use unsealed radioactive material in laboratory tests;
- Undergraduate and postgraduate students, when working with ionising radiation as part of their study, under the supervision of a use licence holder.

### 8.1.2 More information can be obtained by contacting the RPO at OH&S.

## 9. Storage of Ionising Radiation Sources

### 9.1 Register

- 9.1.1 The University is required to maintain a register of Ionising Radiation sources held and used by units. The register of unsealed material is held locally. For sealed sources, sealed source apparatus and irradiating apparatus, the register is maintained by OH&S and is based on information provided by the department/academic/administrative unit

### 9.2 Storage locations

- 9.2.1 Storage locations must be listed in the register and the RSO must consult with the RPO before:

- Irradiating apparatus or sealed source apparatus are relocated; or
- Using a new area for storage of sealed sources and/or unsealed sources.

### 9.3 Storage and Shielding Requirements

#### 9.3.1 Radioactive sources must be stored:

- So that the radiation levels are  $\leq 0.5^* \mu\text{Sv/h}$  above background at any location that could be occupied by a member of the public;

[\*Note: this emission level assumes an occupancy time of 2000 hours per year. If the occupancy time could be higher, then corresponding reductions in this level must be made]

- With secondary containment in order to ensure that the potential for contamination of the storage location is minimised;
- In a secure location to prevent loss, theft or accidental misuse of the source.

#### 9.3.2 For general advice regarding storage requirements and shielding, contact your RSO.

## 10. Risk Management

Risk management must be completed on all processes/procedures/activities that involve Ionising Radiation in accordance with the [OHS Risk Management Procedure](#).

### 10.1 OHS Risk Management

10.1.1 OHS risk management must be completed:

- Before activities using Ionising Radiation commence;
- Before the introduction of new procedures, processes or equipment that use Ionising Radiation;
- When procedures or processes or equipment that use Ionising Radiation are modified.

## 10.2 Risk Assessments

10.2.1 Risk assessments must include assessment of:

- The effects on the local environment such as other processes, personnel or external environmental impacts;
- Types and quantities of wastes generated and their storage, handling, treatment and disposal methods;
- Emergency situations which may arise from the task, procedure or equipment, e.g. from a spill;
- The level of risk associated with the task, procedure or equipment outside of the normal operating hours of the unit, i.e. during times when the immediate emergency response, e.g. First Aid, is limited, in accordance with the OHS [After Hours procedure](#).

## 10.3 Update and Review of Risk Assessments

10.3.1 Risk assessments must be reviewed:

- Following an incident;
- When significant changes are made to the task, procedure, or equipment that uses Ionising Radiation; or
- At least every 3 years.

## 11. Safe Work Instructions and Safe handling Practices

The intent of following safe work instructions and radiation safety procedures is to minimise radiation exposure to Monash staff, students, and members of the public.

### 11.1 Safe Handling practices

11.1.1 Basic safe handling requirements are detailed in the [Radiation Management Plan](#).

### 11.2 Safe Work Instructions

11.2.1 Following risk management of Ionising Radiation procedures, processes or equipment that use Ionising Radiation, local safe work instructions must be developed by supervisors of laboratories/studios/workshops and incorporated into the local Radiation Management Plan.

11.2.2 OH&S has developed [Guidelines for the development of safe work instructions](#), to provide guidance and a template for use by areas.

## 12. Training

### 12.1 Use of Ionising Radiation

#### 12.1.1 External courses

- External courses and/or assessment are necessary for acquisition of a use licence for some categories of radiation source, including Nuclear Soil Moisture Density Gauges and X-rays for human imaging.

#### 12.1.2 OHS courses at a University Level

- The online course Ionising Radiation Safety Principles must be undertaken by all staff, Honours and Postgraduate students that work with unsealed sources of Ionising Radiation before commencement of work. This course must also be undertaken by users of irradiating apparatus, sealed sources, or sealed source apparatus, unless the RPO has substituted an alternate training requirement.
- The online course Unsealed Radioactive Materials Safety Principles must be undertaken by all staff, Honours and Postgraduate students that work with unsealed sources of Ionising Radiation before commencement of work.
- The Talent and Leadership Development Unit offer specialist Radiation Safety training for RSOs.
- Information regarding the content and scheduling of OHS courses offered at Monash University is:

- Provided in myDevelopment; and
- In the [OHS Training Requirements Matrix](#).

#### 12.1.3 Safety personnel and experts at an academic/administrative unit level

- In faculties/divisions/entities with a range of similar risks, training in Ionising Radiation use can be provided at faculty/divisional level by local safety personnel (e.g. RSO), experts and/or the local [OHS Consultant/Advisor](#), e.g. procedure for iodinations, how to dispose of radioactive waste.
- Academic/administrative unit OHS training in Ionising Radiation use can be provided by local safety personnel or experts with specific knowledge of the Ionising Radiation uses in the area.

#### 12.1.4 Supervisors at a local laboratory

Supervisors of each area must provide induction and training in the use of Ionising Radiation in the laboratory that they supervise. This must include information about and access to the local Radiation Management Plan and practical instruction in:

- The location of risk assessments for the Ionising Radiation procedures used in the area;
- The use and location of monitoring devices for the use of Ionising Radiation;
- The use and location of personal protective and emergency equipment for the use of Ionising Radiation;
- Local procedures, processes or equipment that use Ionising Radiation.

#### 12.2 Training records

- In order for academic/administrative units and supervisors to demonstrate effectively that they have provided comprehensive OHS training for the staff and students that they supervise, the training in Ionising Radiation use that they undertake must be recorded.
- OH&S has developed a simple proforma to use to record attendance at OHS training in each academic/administrative unit.
- A short description of the points covered in the training must also be documented for all Ionising Radiation training provided in the academic/administrative unit. The description will act as both a reminder regarding the information that should be covered in the training and as a record of the information covered in the training.
- OHS training by supervisors
- When a supervisor provides training in Ionising Radiation procedures, the completion of the training must be recorded.
- Records of Ionising Radiation training should be maintained in each area (e.g. laboratory) where training is provided.
- The student or staff member being trained must be able to demonstrate competence in the task(s) before the supervisor completes the record of training.

### 13. Transport of sealed sources and radioactive material

#### 13.1 Transport within a building

13.1.1 To ensure that the risk of an incident involving Ionising Radiation is minimised, the following practice should be followed when transporting a source within a building:

- When choosing routes and times, consider the distance and ease of travel, and how populated/crowded the route may be. Choose a practical route which minimises the risk;
- Ensure that packaging is robust and includes adequate shielding, and both primary and secondary containment in case of spills;
- Ensure that a second person accompanies you during the transport. In case of accident one person stays at the scene and the other person gets assistance;
- Minimise your exposure during the transport, e.g. use a trolley to maximise the distance between the source and your body (note: if a trolley is used the source must be secured so that it cannot readily fall off the trolley);
- Never leave the source unattended.

#### 13.2 Transport between buildings



- The precautions detailed above for transport within a building also apply to transport of sources between buildings. In addition, you need to consider that there are likely to be more members of the public present. Do not transport Ionising Radiation sources between buildings during peak traffic times, e.g. lecture start and end times.
- Note: Many internal campus roads are gazetted public roads, and thus transport of sources by vehicle on these roads must comply with the requirements of Section 12.3.;

### 13.3 Transport by road

13.3.1 Transport of Ionising Radiation by road must be carried out in accordance with the Code of Practice for the Safe Transport of Radioactive Material and in consultation with RPO. All transport off-campus of radioactive material must be via an appropriately licenced Dangerous Goods courier. The sender must fulfil all responsibilities of the 'Consignor' outlined in the Code of Practice for the Safe Transport of Radioactive Material (2014).

## 14. Waste disposal

### 14.1 Local procedures

14.1.1 Waste disposal must be carried out in accordance with academic/administrative unit rules which must conform to the requirements of this procedure. Academic/administrative unit rules can be found in the local Radiation Management Plan.

### 14.2 Packaging radioactive waste

#### 14.2.1 Low Level Solid Waste – General (e.g. benchcote, gloves)

- Pack in a thick paper bag with 100µm polyethylene lining ("wetbag");
- Activity less than that given in table below;
- Single radionuclide per package;
- No sealed sources;
- Bag contents must not be marked with trefoil tape, or have radiation labels that are not defaced;
- Do not over-fill; bag must be able to be securely sealed;
- Use plastic overbag if exterior is potentially contaminated;
- No objects piercing bag;
- Sealed firmly with adhesive tape;
- Do not place trefoil tape or any radiation symbol on the bag; and
- Label as per section 13.3

#### 14.2.2 Low Level Solid Waste – Scintillation Vials

- Pack in disposal pails available via Monash Stores;
- Activity less than that given in table below;
- Single radionuclide per package;
- Bag contents must not be marked with trefoil tape, or have radiation labels that are not defaced;
- Surface dose limit less than 5µSv-h<sup>-1</sup> OR for β-emitters 10 cps on Geiger- Muller detectors OR for γ-emitters 100 cps on scintillation detector;
- Do not over fill, lid must be securely fitting;
- If the lid does not seal securely, tape with adhesive. NO trefoil tape;
- No external contamination on pail;
- Do not place trefoil tape or any radiation symbol on the pail; and
- Label as per section 13.3

#### 14.2.3 Low Level Solid Waste – Sharps

- Pack in approved plastic sharps container with single piece of trefoil tape around the diameter;

- Activity less than that given in table in Section 2; Surface dose limit less than  $5\mu\text{Sv}\cdot\text{h}^{-1}$  OR for  $\beta$ -emitters 10 cps on Geiger- Muller detectors OR for  $\gamma$ -emitters 100 cps on scintillation detector;
- No external contamination; and
- Label as per Section 13.3

#### 14.2.4 Putrescibles

- Store in freezer until disposal is imminent;
- Bag to avoid leakage; and
- Over-bag with wet bag and comply with low level solid waste requirements

Radioisotope	Activity in a single package less than
P-32	0.1 MBq (2.7 $\mu\text{Ci}$ )
Na-22, I-125	1 MBq (27 $\mu\text{Ci}$ )
C-14, Cr-51	10 MBq (270 $\mu\text{Ci}$ )
P-33, S-35	100 MBq (2.7 mCi)
H-3	1 GBq (27 mCi)
Contact the RPO for information on disposal of other radionuclides	

### 14.3 Labelling Waste

14.3.1 A paper label with the details below should be securely affixed to the external surface of all containers. Label must not include the radiation "trefoil" symbol, or the word 'radioactive'

- Academic/Administrative unit name;
- Description of physical contents e.g. paper/plastic;
- Radionuclide, estimated total activity in MBq,  $\mu\text{Ci}$  or mCi, and date of activity;
- Responsible person;
- Building and room number;
- Phone number; and
- Signature

### 14.4 Storage of waste

#### 14.4.1 Waste stores

Monash University has the following storage areas for low level solid radioactive waste:

- Clayton Campus
  - Building 23 compound radiation waste store (17 Rainforest Walk)
  - Building 77 radiation waste store (23 Innovation Walk)
- Parkville Campus
  - Building 4 store
- Hospital-Based Campuses
  - Hospital based facilities

Academic/Administrative units may use whichever storage area is practical. For Clayton campus stores, collection of waste from the stores is organised by OH&S and costs charged back to the cost centres generating the waste.

In the case of the hospital-based facilities, where Monash University uses a hospital store by arrangement with the hospital concerned, users must comply with the hospital's packaging, storage, recordkeeping and access requirements.

#### 14.4.2 Low Level Solid Waste (Wet bags, Scintillation Pails, Sharps Containers)

- Comply with packaging and labelling requirements (Sections 2 and 3).
- Place in appropriate campus store, and within the allocated area for that radionuclide/package type.

#### 14.4.3 Medium Term Solid Waste (Waste bags, Scintillation Pails, Sharps Containers)

- Longer-lived isotopes (H-3, C-14, Na-22) must not be packaged in amounts greater than that shown in Section 2, as they will not decay to disposal levels within a reasonable time.
- Isotopes with shorter half-lives (P-32, P-33, S-35, Cr-51, I-125) may be packaged in amounts greater than that in Section 2 and left for decay in appropriate shielding. Bags can be stored locally in consultation with the RPO or storage cabinets in the Building 77 radiation waste store can be used. Packages must contain:
  - P-32, P-33, Cr-51, I-125: no more than 6 times the activity in Section 2
  - Cr-51: no more than 4 times the activity in Section 2, be packaged as per the requirements of Section 3, and be labelled as per the requirements of Section 4, with the addition of an estimated "date of disposal", at which the activity will be below that in Section 2.

#### 14.4.4 Liquid Waste

- Liquids must be contained in appropriate containers with a long life expectancy (particularly if the liquids are to be kept to decay), which are suitable for transportation if necessary e.g. a disused Winchester.
- The following general rules apply to choosing a suitable container:
  - Plastics are usually only suitable for use for aqueous liquids;
  - Liquids containing solvents must be stored in glass or metal;
  - Liquids containing corrosives can usually only be stored in certain types of plastics or glass;
  - Liquids must be separated by isotope and also by:
    - miscible and not chemically contaminated (for sink disposal);
    - short half-life, and immiscible or chemically contaminated, to be kept for decay to background.
      - Solid material (such as scintillation vials or caps) must not be placed into a container with liquid waste.
      - The container must be securely labelled with the details given in section 3. If an old container is being re-used, the old label must be completely covered or defaced.

### 14.5 Disposal of waste

#### 14.5.1 Low Level Solid Waste

- Low level solid waste is checked in storage for compliance by the RPO for Clayton or Radiation Safety Officer (RSO) for the other campuses and centres and then disposed of to secure landfill via a waste contractor.

#### 14.5.2 Miscible Liquid Waste

- Miscible liquid waste of a chemical form that is suitable for sink disposal can be disposed of to sewer so long as it is done in accordance with the Department of Health and Human Services guidelines, AS 2243.4, and this procedure.
- A dedicated sink for disposal of liquid radioactive waste should be made available. The RSO should be involved in selecting this sink and controlling disposal to it. As it is likely to become contaminated, the sink should be flushed copiously with water each time it is used in order to remove residual contamination.
- The following amounts of individual water-soluble radioisotopes represent the maximum activity that any one organisational unit, at any single Monash campus may place down the sewer in any 24 hour period. Where the liquid is too highly active to be put down the sink in a single aliquot, the disposal must be spread over a number of days.

Radioisotope	Maximum activity to sewer per building per 24 hour period	
H-3	10 MBq	270 $\mu$ Ci

C-14	10 MBq	270 µCi
Na-22	1 MBq	27 µCi
P-32	1 MBq	27 µCi
P-33	1 MBq	27 µCi
S-35	1 MBq	27 µCi
Cr-51	10 MBq	270 µCi
Zn-65	1 MBq	27 µCi
I-125	0.1 MBq	2.7 µCi
Contact the RPO for information on disposal of other radionuclides		

#### 14.5.3 Putrescibles

- Animal carcasses or other putrescible waste that is radioactively contaminated must be stored in a freezer dedicated to radioactive materials for ten half-lives.
- If storage for ten half-lives is not practicable, disposal must be planned for on a case-by-case basis. Contact the RPO to discuss the issue.

## 15. Emergencies involving ionising radiation

### 15.1 Incident and emergency response

- Local emergency procedures for radiation spills must be included in the risk assessment for activities involving radioactive material.
- Incidents involving Ionising Radiation must be reported in accordance with the [Managing OHS Hazards and Incidents procedure](#)

### 15.2 Crisis Management

- Monash University has invested considerable resources on planning crisis management and recovery. This planning includes consideration regarding crises involving Ionising Radiation.
- Further details and the crisis management plan are located at the Crisis Management and Recovery web site (<http://adm.monash.edu/cmr/>.)

## 16. Responsibility for Implementation

16.1 A comprehensive list of OHS responsibilities is provided in the document [OHS Roles, Responsibilities and Committees Procedure](#). A summary of the specific responsibilities relevant to Using Ionising Radiation is provided below.

16.1.1 **OH&S:** The responsibilities of OH&S are to:

- Develop, maintain, review and audit the university's policies, procedures and systems related to Ionising Radiation management and to ensure legislative compliance;
- Appoint an appropriately qualified Radiation Protection Officer (RPO) and support staff, e.g. deputy RPO, to supervise radiation safety practices in respect of Ionising Radiation; and
- Specify and provide appropriate training, examination and assessment criteria for users of Ionising Radiation.

16.1.2 **Head of Academic/Administrative Unit:** It is the responsibility of the head of academic/administrative unit to ensure that procedures and systems are in place in their academic/administrative unit to manage Ionising Radiation effectively, including to:

- Ensure that adequate resources are available for provision and maintenance of the radiation safety program, including personal dosimetry, monitoring, calibrations, shielding and containment, and maintenance and distribution of the local Radiation Management Plan;

- Appoint a Radiation Safety Officer (RSO) and deputy RSO where Ionising Radiation sources are held or used in the academic/administrative unit;
- Ensure that a system is in place to ensure that staff and students complete the training and examination requirements provided by OH&S.
- Ensure that a local purchasing procedure is in place, which ensures that OH&S is notified before any purchase of ionising radiation sealed sources, sealed source apparatus or irradiating apparatus, to allow the RPO to initiate the process of acquiring the appropriate Department of Health licencing;
- Ensure that a local purchasing procedure is in place, which ensures that, where necessary, an import permit is obtained prior to any purchase of sealed sources, sealed source apparatus, or unsealed sources from outside Australia;
- Ensure that no sealed source, sealed source apparatus or irradiating apparatus is delivered to the University before the appropriate licencing is obtained;
- Comply with any practice specific conditions imposed under the licencing; and
- Ensure that before purchasing any ionising radiation source, a plan has been developed for its future disposal.
- Ensure that an up to date and feasible OSL badge allocation system is maintained and administered in their unit, when OSLs are deemed appropriate for monitoring radiation dose;
- Facilitate all radiation workers in successfully completing relevant ionising radiation training before they use ionising radiation.
- Ensure compliance of the unit with the radioactive waste disposal procedure; and
- Provide budgetary resources to cover the cost of the waste disposal for their unit to be carried out by a government approved waste contractor.

16.1.3 **Supervisors:** It is the responsibility of supervisors to ensure that procedures and systems are in place in the areas of their responsibility to manage Ionising Radiation effectively in order to protect the health and safety of staff, students, visitors and contractors and the environment from the harmful effects of radiation. They must ensure that:

- Staff and students undertake recommended OHS training in the use of Ionising Radiation, and are provided with the local radiation Management Plan;
- Mandatory examination requirements are passed by all staff and students that work or study with Ionising Radiation before commencement of work.
- Local standards and practices comply with university policies and procedures;
- All radiation risk assessments and Safe Work Instructions that are developed are available for distribution in the local Radiation Management Plan; and
- Monitoring, shielding and containment equipment that is appropriate to the tasks undertaken is provided and used;

16.1.4 **Staff and students using ionising radiation:** Staff and students using Ionising Radiation must:

- Comply with OHS instructions, policies and procedures using control measures and/or personal protective equipment to ensure their own health and safety as well as the health and safety of others;
- Ensure they hold a current 'use licence' for the radiation activities they undertake (where required);
- Be familiar with the local Radiation Management Plan
- Consult with the RSO before:
  - Undertaking work with Ionising Radiation sources
  - Before any new processes with Ionising Radiation are started (for example use of a new radioisotope).
- Follow the dosimetry requirements as outlined for the entire period of working with ionising radiation.

16.1.5 **Radiation Protection Officer (RPO):** The responsibilities of the RPO include:

- Development, implementation and management of the Ionising Radiation safety program at Monash University to achieve legislative compliance;
- Development of the Radiation Management Plan template;
- Being the primary contact for the Regulator;

- Provision of advice, training and information regarding Ionising Radiation safety to staff and students; and
- Advising on processes for the acquisition of Ionising Radiation sources and their disposal.
- Maintaining all records as necessary to ensure compliance with statutory requirements.
- Managing on behalf of the University all necessary applications and notifications to the Department of Health to permit acquisition of new radiation sources, transfer of ownership of sources, or disposal of sources.
- Providing guidance to academic/administrative units concerning licencing and permit application procedures.
- Overseeing all compliance of the University's ionising radiation sealed source and irradiating apparatus licencing requirements.
- Maintaining records for all site wide licences of ionising radiation sources and practices. Selecting a suitable external provider to facilitate the badge allocation system;
- Maintaining a database of all dose results for all OSL badge wearers within the University.
- Examining all dose results and initiating and coordinating investigation of results which exceed the Monash Action Levels.
- Providing advice on alternative dosimetry methods when OSLs are not appropriate for the radiation work being conducted.
- Overseeing the compliance of all campuses with the University's radioactive waste disposal procedure;
- Selecting the external waste contractor; and
- Ensuring the implementation of a system for monitoring surface dose rates of each waste package and the clearance of university managed stores by the external contractor.

16.1.6 **Radiation Safety Officers (RSOs):** The responsibilities of RSOs include:

- Overseeing the purchase of radioactive substances and Ionising Radiation apparatus for the academic/administrative unit;
- Working with the University's Radiation Protection Officer (RPO) to ensure radioactive material and Ionising Radiation apparatus used or possessed by the unit are licenced as required under the Radiation Act 2005;
- Maintaining personal monitoring programs for users of Ionising Radiation;
- Providing advice, information, instruction and training on the local use, storage, transport and disposal of radioactive substances and Ionising Radiation apparatus, including through distribution of the local Radiation Management Plan;
- Assisting with risk management of hazards and risks associated with radioactive substances and Ionising Radiation apparatus;
- Formulating and implementing local OHS policies and procedures with regard to use of Ionising Radiation;
- Reviewing the radiation safety aspects of new research projects and teaching activities;
- Providing the initial response to, and investigation of, accidents and emergencies involving Ionising Radiation, including reporting to the Radiation Protection Officer (RPO), OH&S and assisting with the development of corrective actions;
- Liaising with the RPO, OH&S, the local OHS committee and the head of academic/administrative unit;
- Consulting with local Health & Safety Representatives on OHS issues regarding radioactive substances, sealed sources and Ionising Radiation apparatus;
- Maintaining records related to the purchase, use, storage, transport and disposal of radioactive substances;
- Monitoring OHS standards and compliance with OHS policies and procedures at a local level with regard to radioactive substances;
- Auditing and analysing the OHS compliance of the academic/administrative unit with regard to the radiation management licence conditions relating to licenced radiation sources in the unit, including reporting breaches of compliance to the RPO; and
- Assisting with the promotion of Ionising Radiation safety awareness. Ensuring that licencing of existing sealed sources of ionising radiation and irradiating apparatus is kept up to date and complies with statutory requirements;

- Ensuring that licensing of existing sealed sources of ionising radiation and irradiating apparatus is kept up to date and complies with statutory requirements;
- Maintaining a register of all ionising radiation sources held within the academic/administrative unit, and their locations, as outlined in this procedure.
- Ensuring that new radiation users follow dosimetry requirements for the entire period of working with ionising radiation;
- Examining dose results and initiating investigation where results are unexpectedly high;
- Working with the RPO to investigate dosimetry results, which exceed the Monash Action Levels.
- Providing advice on packaging and storage of radioactive waste within their area;
- Ensuring that all radiation workers correctly package and store radioactive waste as per guidelines;
- Ensuring suitable storage of immiscible and contaminated liquid waste for the appropriate amount of time; and
- Monitoring the amount of waste generated and disposed via the sewer and maintaining a record of the volume and radioisotopes in each case.

## 17. Tools

- [Radiation Management Plan](#)
- [Radiation module induction checklist](#)

## 18. Records

18.1 For OHS Records document retention please refer to:

- [OHS Records Management Procedure](#)

## DEFINITIONS

A comprehensive list of definitions is provided in the [Definitions tool](#). Definitions specific to this procedure are provided below.

Key word	Definition
Contaminated Liquid Waste	Liquid radioactive waste that contains chemical contamination such that it cannot be disposed of to sewer.
Designated Radiation Area	A designated radiation area is any area that is under the supervision of an RSO. These areas include storage facilities, laboratories or other areas where sources of ionising radiation are present and exposures may be above background levels.
Dosimetry	Dosimetry is the measurement of radiation dose.
Electronic Personal Dosimeters (EPD)	Electronic Personal Dosimeters give a real-time record of the amount of radiation received to the worker during the wearing period. These are an alternative form of dosimeter to OSLs.
Immiscible Liquid Waste	Liquid radioactive waste that is immiscible with water and therefore not able to be disposed of to sewer.
Ionising Radiation	Ionising Radiation is electromagnetic or particulate radiation capable of producing ions directly or indirectly but does not include electromagnetic radiation of a wavelength of greater than 100 nanometres.
Ionising Radiation Source	Ionising Radiation source is defined as radioactive material, an irradiating apparatus, a sealed source or a sealed source apparatus.
Irradiating Apparatus	Irradiating apparatus is defined as an apparatus that produces Ionising Radiation when energised (e.g. an X-ray tube) but does not include a sealed source apparatus. An x-ray machine is an example of an irradiating apparatus.

Member of the Public	A member of the public is a staff member, student, contractor or visitor who is not classified as a radiation worker.
Monash Action Levels	The Monash Action Levels are the quantity of radiation that if exceed in a dosimetry report, prompts an investigation on the radiation worker's activity. The Monash Action Levels are defined as: <ul style="list-style-type: none"> <li>• An annual effective dose of 1mSv, observed on a pro rata basis throughout the monitoring period. This is equivalent to the public limit as defined in Schedule 2, Table B of the Radiation Regulations 2017.</li> <li>• An annual extremity dose of 50mSv, observed on a pro rata basis throughout the monitoring period.</li> </ul>
OSL Dosimeter	OSL dosimeter badges are the standard means used to measure external radiation dose to radiation workers on an ongoing basis.
Overbag	A bag that goes over a primary waste bag.
Putrescibles Waste	Putrescibles waste is solid waste that contains organic matter capable of being decomposed by microorganisms (e.g. carcasses, tissue samples).
Radiation Protection Officer	The Radiation Protection Officer is the OH&S staff member responsible for providing and coordinating radiation protection services at Monash University.
Radiation Safety Officer	A radiation safety officer is a designated staff member in an academic/administrative unit responsible for overseeing management of radiation hazards in the unit.
Radiation Source	A radiation source is any irradiating apparatus, sealed source, sealed source apparatus, or radioactive material.
Radiation Worker	A radiation worker is a staff member or student who is exposed to ionising radiation from Ionising Radiation source(s) they use in their work or study.
Radioactive Material	Radioactive material is defined as any natural or artificial material that spontaneously emits Ionising Radiation that has activity concentration or level equal to or greater than the level specified in Schedule 1 of the Radiation Regulations 2007.
Regulations	Regulations refers to the Radiation Regulations 2007.
Regulator	The Regulator is the Radiation Safety unit of the Victorian Department of Health and Human Services (DHHS).
Sealed Source	A sealed source is radioactive material that is permanently sealed in a capsule or closely bound and in solid form.
Sealed Source Apparatus	Sealed source apparatus are apparatus that produce Ionising Radiation because they contain a sealed source. A liquid scintillation counter with an internal, sealed source is an example of a sealed source apparatus.
Sharps Waste	Sharps waste comprises objects that can pierce or penetrate the skin or the waste container, e.g. pipette tips, serological pipettes, broken glass.
Unsealed Source	An unsealed source is a radioactive substance that is not a sealed source

## GOVERNANCE

Parent policy	<a href="#">OHS&amp;W Policy</a>
Supporting schedules	N/A
Associated procedures	<b>Australian and International Standards</b> ISO 45001:2018 Occupational Health and Safety Management Systems AS 2243.4 Safety in laboratories: Ionizing radiation (2018)



	<p><b>Guidance material</b></p> <ul style="list-style-type: none"> <li>Code of Practice for the Safe Transport of Radioactive Material (2008) and Safety Guide for the Safe Transport of Radioactive Material (2008) (ARPANSA)</li> <li>Code for the Safe Transport of Radioactive Material (2014) and IAEA safety guides SSG-26 and SSG-33</li> <li>Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) (ARPANSA)</li> <li>Disposal of radioactive material: Management licence holder's obligations (DHHS)</li> <li>Code of Practice for the Exposure of Humans to Ionising Radiation for Research Purposes (2005) (ARPANSA)</li> <li>Code of Practice for Radiation Protection in the Medical Applications of</li> <li>Ionizing radiation (2008) (ARPANSA)</li> <li>Code of Practice for Safe Use of Fixed Radiation Gauges (2007) (ARPANSA)</li> <li>Code of Practice for the Security of Radioactive Sources (2007) (ARPANSA)</li> <li>Code of Practice and Safety Guide for Portable Density/Moisture Gauges Containing Radioactive Sources (2004) (ARPANSA)</li> <li>Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005) (ARPANSA)</li> <li>Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine (2009) (ARPANSA)</li> <li>NHMRC Code of Practice for protection against ionising radiation emitted from X-ray analysis equipment (1984)</li> </ul> <p><b>Monash University OHS Documents</b></p> <ul style="list-style-type: none"> <li><a href="#">OHS roles, responsibilities and committees procedure</a></li> <li><a href="#">OHS Induction and Training Procedure</a></li> <li><a href="#">Development of safe work instructions guidelines</a></li> <li><a href="#">Protecting Unborn and Breast-Fed Children from the Effects of Maternal Exposure to Chemicals, Biologicals, Animals and Radiation Procedure</a></li> <li><a href="#">OHS Risk Management Procedure</a></li> </ul>
Legislation mandating compliance	Radiation Act (2005) Radiation Regulations 2017
Category	Operational
Endorsement	Monash University OHS Committee 15 June 2021
Approval	Office of the Chief Operating Officer & Senior Vice-President (a delegate of the President & Vice-Chancellor) 5 July 2021
Procedure owner	Manager, OH&S
Date effective	July 2021
Review date	2024
Version	6.1
Content enquiries	<a href="mailto:ohshelpline@monash.edu">ohshelpline@monash.edu</a>

## DOCUMENT HISTORY

Version	Date Approved	Changes made to document
2	June 2010	Procedures for Hazard and Incident Reporting, Investigation and Recording.
3	September 2014	1. Removal of references to the Nuclear Non-Proliferation (Safeguards) Act, as the requirements of this

		<p>Act are not addressed in this document</p> <ol style="list-style-type: none"> <li>2. Removal of definitions contained elsewhere</li> <li>3. Addition of the requirement for a Radiation Management Plan, and references to responsibilities for this Plan and information to be contained in it (at 4.2, 4.3, 4.4, 4.5, 4.6, 5.1, 5.2, 5.3, 6.8, 13.1, 13.2, 14.2, 16.2)</li> <li>4. Removal of requirement for RSO to track compliance against legislation/standards, as this is the responsibility of OH&amp;S. RSO tracks compliance against university procedures and licence conditions only.</li> <li>5. Removal of references to outdated Radiation Safety Manual and Manual for users of Ionising Radiation (replaced by Radiation Management Plan)</li> <li>6. Updated titles and URLs of referenced Monash documents</li> <li>7. Clarification of radiation training requirements.</li> <li>8. Removal of details about Risk Management Program and Safe Work Instructions, which are covered in other procedures.</li> <li>9. Transport of radioactive substances off-campus now only to be done via Dangerous Goods courier.</li> </ol>
4	September 2017	<p>Title changed to: Ionising Radiation Procedure</p> <ol style="list-style-type: none"> <li>1. Responsibilities updated to extend RSO purchase, personal monitoring, risk management advice, and incident response responsibilities to include all radiation sources, not only radioactive material.</li> <li>2. Responsibilities updated to reference staff/student requirement to hold a radiation use licence in some circumstances</li> <li>3. Reference to thermoluminescent dosimeters edited to reflect change to dosimetry service.</li> <li>4. Transport section edited to clarify that it does not apply to irradiating apparatus</li> </ol>
5	March 2020	<ol style="list-style-type: none"> <li>1. Change to wording of definition of 'ionising radiation worker'</li> <li>2. Removal of references to Monash procedures for radiation dosimetry, disposal of radioactive waste and radiation source purchasing and licencing</li> <li>3. Requirements of <i>Ionising Radiation Source Purchase and Licencing Procedure</i> transferred to this document</li> <li>4. Addition of reference to conditions imposed under the <i>OHS Prescribed Activities and Permit-To-Work Procedure</i></li> <li>5. Requirements of <i>Ionising Radiation Dosimetry Procedure</i> transferred to this document</li> <li>6. References to Staff Development unit replaced with Talent and Leadership Development</li> <li>7. Removal of the requirement that the second person accompanying a radiation worker transporting radiation sources must themselves be a radiation worker</li> <li>8. Requirements of the <i>Disposal of Radioactive Waste Procedure</i> transferred to this document</li> <li>9. Clarification of the requirement for no undefaced trefoil symbols to remain on any items disposed of as radiation waste</li> <li>10. Addition of timeframes (number of half-lives) for radiation waste items left to decay in the university short-term waste stores</li> <li>11. Requirement that radiation workers be provided with a copy of the local Radiation Management Plan changed to requirement to be given access to the document</li> <li>12. Requirement that radiation Risk Assessments and Safe Work Instructions be 'included for distribution' in the local Radiation Management Plan changed to 'can be identified and accessed'.</li> </ol>
6	July 2021	<ol style="list-style-type: none"> <li>1. Addition of further details for the requirement that all ionising radiation activities are to be covered by an OHS Prescribed Activities approval.</li> <li>2. Names of online radiation safety training courses updated</li> <li>3. Updated date of Radiation Regulations</li> </ol>
6.1	July 2021	<ol style="list-style-type: none"> <li>1. Updated certification logo in footer to ISO 45001</li> <li>2. Updated the Standard to ISO 45001 under "Associated procedures" in the Governance table</li> <li>3. Updated OHS Policy under 'Parent Policy' to OHS&amp;W Policy</li> </ol>