

Monash University Procedure

Procedure Title	Disposal of Radioactive Waste Procedure
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Category	Operational
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Scope	This procedure applies to staff, students, visitors and contractors at Monash University. Australian campuses only are covered by the certification to OHS AS 18001 and AS 4801.
Purpose	This procedure sets out the requirements for the correct packaging and disposal of radioactive waste by staff and students.

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1. Abbreviations

RSO: Radiation Safety Officer

RPO: Radiation Protection Officer

2. Definitions

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

Contaminated Liquid Waste: Liquid radioactive waste that contains chemical contamination such that it cannot be disposed of to sewer.

Immiscible Liquid Waste: Liquid radioactive waste that is immiscible with water and therefore not able to be disposed of to sewer.

Low Level Solid Waste: Comprises solid items such as benchcote, gloves, pipettes and empty scintillation vials. Note that no material disposed of as low level solid waste can be marked with radiation “trefoil” symbols as labels or trefoil tape. Any such markings that are not removable must be completely defaced. Each package should contain one radionuclide, and the activity in each package must be less than the figure in the table below before it can be disposed of;

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

Medium Term Solid Waste: Packages that contain more than the amounts in the table above cannot be disposed of to landfill immediately, and are designated medium term radioactive waste.

Miscible Liquid Waste: Liquid radioactive waste that is miscible with water

Occupational Exposure: Occupational exposure is exposure of a person to all radiation that occurs in the course of that person’s work or study.

Overbag: A bag that goes over the 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 a unit responsible for approving and supervising the ionising radiation work and study of staff and students.

Radiation Worker: A radiation worker is a staff member or student who works with ionising radiation source(s) as part of their work/study.

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.

3. Packaging Radioactive Waste

Packaging should be undertaken as follows:

3.1 Low Level Solid Waste – General

- Pack in a thick paper bag with 100µm polyethylene lining (“wetbag”);
- Activity less than that given in table in Section 2 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 4.

3.2 Low Level Solid Waste – Scintillation Vials

- Pack in disposal pails available via Monash Stores;
- Activity less than that given in table in Section 2;
- Single radionuclide per package;
- Surface dose limit less than $5\mu\text{Sv h}^{-1}$ OR for γ -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 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 4.

3.3 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 $5\mu\text{Sv h}^{-1}$ OR for γ -emitters 10 cps on Geiger- Muller detectors OR for γ -emitters 100 cps on scintillation detector;
- No external contamination; and
- Label as per section 4.

3.4 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.

4. Labelling

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, μ Ci or mCi, and date of activity;
- Responsible person;
- Building and room number;
- Phone number; and
- Signature

5. Storage of Radioactive Waste

5.1. Waste Stores

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

- **Clayton Campus**
 - Building 23 compound radiation waste store
 - Building 77 radiation waste store
- **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, Monash University uses these by arrangement with the hospital concerned, and users must comply with the hospital’s packaging, storage, recordkeeping and access requirements.

5.2. Low Level Solid Waste (Wet bags, Scintillation Pails, Sharps Containers)

Comply with packaging and labelling requirements (Sections 3 and 4).

Place in appropriate campus store, and within the allocated area for that radionuclide/package type.

5.3. Medium Term Solid Waste

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.

5.4. 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 4. If an old container is being re-used, the old label must be completely covered or defaced.

5.5. Hazardous Waste

Production of radioactive waste that also has chemical or biological hazards must be minimised as much as possible, especially in the case of long half-life isotopes. Waste with isotopes with shorter half-lives (32P, 33P, 35S, 51Cr, 125I) may be packaged in accordance with all hazards and left to decay until they are no longer radioactive and then disposed of as chemical or biological waste.

Waste with isotopes with longer half-lives (3H, 14C, 22Na) should be treated to neutralise the non-radiation hazard (chemical or biological) and then disposed of as radioactive waste.

Contact the Radiation Protection Officer (RPO) in the planning stage to discuss potential waste with isotopes with longer half-lives that have other hazards that cannot be neutralised must be planned for on a case by case basis. Contact the Radiation Protection Officer (RPO) to discuss the issue.

6. Disposal of Radioactive Waste

6.1. 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.

6.2. 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	10MBq	270µCi
C-14	10MBq	270µCi
Na-22	1MBq	27µCi
P-32	1MBq	27µCi
P-33	1MBq	27µCi
S-35	1MBq	27µCi
Cr-51	10MBq	270µCi
Zn-65	1MBq	27µCi
I-125	0.1MBq	2.7µCi
Contact the RPO for information on disposal of other radionuclides		

6.3. Putrescibles

Animal carcasses or other putrescible waste that is radioactively contaminated must be stored in a freezer dedicated to radioactive materials until they have decayed to background levels.

If decay to background is not practicable, disposal must be planned for on a case-by-case basis. Contact the RPO to discuss the issue.

7. Responsibility for Implementation

A comprehensive list of OHS responsibilities is provided in the document [OHS Roles, Responsibilities and Committees Procedure](#). A summary of responsibilities with respect to this procedure is provided below.

Head of Academic/Administrative Unit: The head of academic/administrative unit is responsible for:

- Ensuring compliance of the unit with the radioactive waste disposal procedure;
- Providing budgetary resources to cover the cost of the waste disposal for their unit to be carried out by a government approved waste contractor.

Radiation Safety Officer: The RSO is responsible for:

- Providing advice on packaging and storage 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.

Radiation Protection Officer: The RPO is responsible for:

- 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.

Radiation Worker: The radiation worker must follow this radioactive waste disposal procedure.

8. Records

For OHS Records document retention please refer to:
[Monash University OHS Records Management Procedure.](#)

Status	Revised
Approval Body	Monash University OHS Committee
Legislation Mandating Compliance	Radiation Act (2005) Radiation Regulations (2017)
Related Policies	OHS Policy
Related Documents	<p>Codes Of Practice And Related Documents</p> <p>Disposal of radioactive material: Management licence holder’s obligations Department of Health and Human Services</p> <p>Australian Standards</p> <p>AS 2243.4:2018 Safety in Laboratories Part 4 Ionising radiation</p> <p>Monash University Documents</p> <p>OHS Roles, Responsibilities and Committees Procedure</p> <p>Protecting unborn and breast-fed children from the effects of maternal exposure to chemicals, biologicals, animals and radiation</p> <p>Using Ionising Radiation Procedure</p>

9. Document History

Version	Date of Issue	Changes made to document
1	November 2010	Procedures for disposal of radioactive waste
2	November 2013	<ol style="list-style-type: none"> 1. Changed name to “Disposal of Radioactive Waste procedure 2. Section 6 changed to reflect that any colour sticky tape can be used, as long as it is not trefoil tape. 3. Section 6 changed to reflect that “no more than 2/3 full” is overly prescriptive, when the intent is just that it not be over-full. 4. Removal of one definition not specific to this procedure 5. Additions to procedure: <ol style="list-style-type: none"> a. to acknowledge the complications when waste is both radioactive AND another hazard class. b. Added section on what to do with radioactive waste with additional hazards.

3	November 2016	<ol style="list-style-type: none"> 1. Removal of some definitions 2. Clarified definition of contaminated liquid waste 3. Removal of requirement for half-life on solid waste label 4. Removal of reference to Monash Health Research Precinct (now Hudson Institute) 5. Clarified explanation of packaging and disposal paths for liquid radioactive waste 6. Added Compliance section
3.1	August 2017	<ol style="list-style-type: none"> 1. Updated logos in header 2. Updated Radiation Regulations to 2017
4.0	November 2019	<ol style="list-style-type: none"> 1. Clarified wording of several definitions 2. Added requirement throughout for no items to be marked with the radiation “trefoil” symbol, as per DHHS requirements. 3. Added activity measurements in alternate units of Curies to definition table 4. Re-ordered items in packaging and labelling requirements 5. Extended section on “medium term solid waste” to clarify the circumstances under which waste of higher activity can be left for decay. 6. Updated certification logo in header.