



PROCEDURE FOR DISPOSAL OF LOW LEVEL, SOLID RADIOACTIVE WASTE

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1. Responsibility for Waste

The *Health (Radiation Safety) Regulations* and the *Environmental Protection Act* (and associated documents) set down requirements for the packaging and disposal of solid radioactive waste. The University's compliance with these requirements is monitored by the regulatory authorities and any non-compliance may result in restrictions being placed on activities that generate radioactive waste.

University management, in particular, Heads of Departments have a responsibility for ensuring that all persons who generate radioactive waste, package it and place it correctly for disposal. In the main this involves communicating requirements such as policies and procedures and ensuring that all radiation users undertake training that is provided for them. From a practical viewpoint, the person who generated the waste and their immediate supervision will be held responsible for the correct packaging and disposal of their solid radioactive.

The RSO can provide specific advice on local requirements for disposing of waste in accordance with the requirements of this procedure.

2. Scope and Background

For the purposes of this procedure *low level, solid radioactive waste* will be considered in three (3) forms:

- Sharps: may be made of metal, glass or plastic and are packaged and prepared for incineration.
- Putrescibles:¹ able to be decomposed by bacterial action e.g. carcasses or tissue. These are also packaged and prepared for incineration.
- Solid waste: contaminated at low level and packaged and prepared for supervised landfill e.g. benchcote, gloves, empty plastic scintillation vials. The definition of low level, solid waste applies to a single package that ideally contains only one radionuclide in total activity up to the following²:

Radioisotope	Allowable activity in a single package
I-125	0.04 MBq
P-32, P-33, Na-22	0.4 MBq
C-14, S-35	4.0 MBq
Cr-51, H-3	40 MBq
Note that many other radionuclides are listed	

Where the waste in a single package exceeds these activity limits or the surface dose limit (given below), it must be stored to decay further, or re-packaged.

In addition the following provisions apply to solid, low level radioactive waste destined for supervised landfill (within the metropolitan area of Melbourne):

- It is preferable to place only 1 radionuclide into a single package. If placing more than one radionuclide in a package is necessary, radionuclides with similar half-lives should be placed together.

¹ Definition provided from Brooklyn Landfill and Waste Recycling Pty Ltd, EPA License Number ES499.

² Schedule 2 of the *Health (Radiation Safety) Regulations*.

- The dose rate at any position on the external surface of a wet bag must not exceed $5 \mu\text{Sv}/\text{h}^3$. Shielding a high activity source so that a dose rate of $5 \mu\text{Sv}/\text{h}$ on the outside of the package is not exceeded is not permissible. Disposal of a registered sealed source by this method, irrespective of external dose rate, is also not permitted. Solid waste that has medium or high activity and cannot comply with these requirements must be kept in suitable storage to decay to lower activity.
- No liquid waste may be put out in any container going to landfill.
- No sharps may go to landfill.

Note that different provisions apply to liquid waste and these are addressed within the procedure *Waste disposal – liquid radioactive waste*. Liquid radioactive waste includes any liquid waste containing radioactive contamination. The waste may be miscible with water, immiscible with water and/or contaminated with chemicals.

3. Short term storage of low level, solid radioactive waste

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

Clayton campus:

- Medical radioactive waste store
- Science radioactive waste store

Box Hill:

- Hospital facility

Alfred:

- Hospital facility

MMC:

- Hospital facility

In the case of the hospital-based facilities, Monash University uses these by the generosity of the hospital concerned. It is important to comply with local requirements for using these storage areas.

The Clayton campus has two stores with limited capacity to store gamma and beta emitting waste for any length of time. Therefore, it is very important that people generating waste package it with a view to it being removed within a 12-month period and ideally a shorter time. In the case of iodine-125 waste, storage capacity is a particular problem. The user should package items together that have been in contact with stock solution or are very active, (generating tens of counts on a Geiger counter or hundreds of counts on a scintillation detector), for some other reason. It is likely that this type of waste will have to be stored and decayed for some time before disposal. Lower activity waste that can be disposed of immediately or sooner, should be packaged separately, even if this means generating a second container of waste.

Please note that Monash has no storage facilities for low level radioactive waste other than those described above. If the storage areas fill completely and the waste is still too radioactive to send for disposal, there will be no option but to cease the generation of waste until some waste in storage has decayed sufficiently for disposal.

³ NHMRC *Code of Practice for the Disposal of Radioactive Wastes by the User*.

4. Packaging sharps and the use of incinerators

Sharps should be packaged in approved, plastic biohazard containers with a single piece of trefoil symbol tape placed completely around their diameter to indicate radioactive contamination (this is removed prior to incineration).

Although Monash University has incinerators of its own, these are not suitable for incinerating sharps or any other type of radioactive waste. They are however, used for uncontaminated animal bedding and carcasses. Sharps must be transported via a licensed waste contractor to a licensed, commercial high temperature incinerator.

Sharps should be labeled and subjected to the same activity and dose rate limitations, (that is 5 $\mu\text{Sv/h}$ on the surface of the sharps container and activity limits as in the table above), as wet bagged radioactive materials which are destined for landfill.

5. Packaging putrescibles for incineration

Animal carcasses or other putrescible waste that is heavily radioactively contaminated must be stored in a freezer for radioactive materials until disposal via landfill is imminent. They should then be bagged (to avoid leakage) and packed in a wet bag for transport. In the case of very lightly contaminated carcasses, it may be possible to incinerate these within Monash University incinerators. Speak with your RSO if you are unsure.

6. Packaging solid waste in wet bags for land fill

Solid radioactive waste that does not contain sharps must be packaged in preparation for eventual disposal at a supervised landfill. Monash University uses a licensed contractor to transport this as a prescribed waste⁴ from its short-term radioactive waste stores and to deliver it to appropriately licensed disposal points.

It is important to understand that at the point of transport and disposal, solid (as well as liquid and sharps), low level radioactive waste is treated as non-radioactive.

The aim of the packaging is to protect the people who must handle it during transport and disposal. Once, it has been disposed of, the packaging should lend itself to decomposing quickly. Packaging should be undertaken as follows:

1. Thick paper bags with a 100 μm thick polyethylene lining, (commonly known as a "wet bag"), are suitable for storage and disposal of solid waste which is going to landfill. In a laboratory, radioactive waste is easily packed by lining a foot-operated bin with a wet bag. Do not fill wet bags any more than $\frac{2}{3}$ full as this makes the task of sealing them safely, more difficult.
2. It is necessary to tally (approximately) all activity being put into a wet bag, particularly if it is filled over a period of time, for three reasons:
 - It is impossible to estimate total activity (via dose rate or count rate) accurately in an object as non-uniform as a wet bag. The best that can be done is to measure the count rate near the surface of the bag or container, however that is not the same as total activity within the wet bag. Measuring some soft beta emitters such as tritium and sulphur-35 is also impossible.

⁴ Prescribed waste is defined under the Environmental Protection Act.

- Tallying activity allows accurate cut-off when the maximum amount has been added to the bag. This prevents the risky and unpleasant task of re-packing bags of radioactive waste.
 - An approximate tally of activity is required on the label of a wetbag.
3. Package the waste in such a way that there is no external contamination and no objects sticking out through wet bags. Place a plastic overbag around the wetbag as a precaution if there is likelihood of the wetbag being breached. It should be remembered that waste is physically picked up by workers as part of the transport and disposal processes.
 4. Wet bags and outer bags should be secured firmly with a minimum of brown or clear plastic packaging tape so that this will rot away relatively quickly once the bag has been placed into landfill, but will last a reasonable time if storage to decay is required for a time. **Trefoil tape should not be used.**
 5. The dose rate at any position on the external surface of the wet bag must not exceed 5 μ Sv/h (in reality, Monash does not dispose of the waste until it is almost back to background). Using most count rate meters, a rough guide to this is as follows⁵:
 - Scintillation counters – no more than 100 counts per second
 - Geiger counters – no more than 10 counts per second

If a more accurate calibration of a count rate meter is available for the isotope in question, this should be used in preference to the above figures.
 6. Label the waste using a paper label as described below.

7. Packaging solid waste in pails for land fill

Pails are provided by the licensed waste removalist. Surrogate containers are not satisfactory.

The only licensed, commercial high temperature incinerator available in Victoria for burning waste does not take chemical or radioactive waste. They also do not like burning excessive quantities of glass, metal or plastic. Therefore, the contents of pails must be sent for land fill as for wet bagged, solid waste (the pails and their contents are simply placed into secure landfill) Bearing this in mind, the following must be observed when using pails for waste disposal:

1. Use biodegradable materials as much as possible for items that must be landfilled. Plastic is preferable to glass.
2. Wherever possible it is preferable to empty all liquids from scintillation vials and other containers and collect them for alternate disposal methods (keep liquids that are miscible with water separate from those that are not). Note that no attempt should be made to empty crimped or very small vials where the risk of contamination due to this operation is high.
3. Remove trefoil tape from containers before disposing of them to pails.
4. Do not overfill pails. Ensure that the lid fits on fully and comfortably and is not likely to come loose during transportation or disposal. If a lid does not seal well, either replace it or tape it closed with packing tape. Do not completely fill a pail if it makes it too heavy to lift

⁵ These are approximate only and are based on experience within the OHSE Department. In time, the RPO will organize a calibration program for all monitors in order that this may be more accurately estimated.

easily. It should be remembered that waste is physically picked up by workers as part of the transport and disposal processes.

5. Avoid contamination on the external surface of pails and their lids. After closing them up, wipe them down if contamination is suspected.
6. Do not place trefoil tape on the outside of the pail.
7. The dose rate at any position on the external surface of the pail must not exceed 5 $\mu\text{Sv/h}$. Using most count rate meters, a rough guide to this is as follows⁴:
 - Scintillation counters – no more than 100 counts per second
 - Geiger counters – no more than 10 counts per second
8. If a more accurate calibration of a count rate meter is available for the isotope in question, this should be used in preference to the above figures.
9. Label with a paper label adhered using plastic packing tape.

8. Lead pots

Note that lead pots which may be lightly contaminated with radioactive material cannot be disposed of to landfill or by incineration due to the lead alone. Instead they must be decontaminated or left to decay before being sent for recycling as non-radioactive waste. *Do not place lead pots, with or without their radioactive contents into the short term, low level waste stores without permission from the RPO.* Instead undertake the following steps (assuming that the radioactive contents have decayed to low level and the pot is no longer needed):

1. Remove the radioactive contents from the lead pot and, subject to disposal requirements for low level solid and liquid radioactive materials, dispose of the liquid contents and the glass, plastic or metal vial. The liquid can be disposed of via the sewer (water soluble) or by delay and decay and then chemical reclamation (not water soluble), subject to the procedure for disposal of liquid waste. The vial can be disposed of via a pail as for solid, low level waste, once it is empty.
2. Remove any labels indicating radioactivity on the outside of the pot, as it will go to a recycling facility as a non-radioactive entity. Radiation labels left on pots after they no longer hold radioactive materials only serve to unnecessarily alarm people. If the labels are very difficult to remove, then at least put a line through them to indicate that the radioactive content has been removed.
3. There are two options for cleaning pots that are contaminated or suspected contaminated:
 - Obtain a scintillation pail from one of the low-level radioactive waste stores and place a minimum of soapy water into the pail. Soak the lead pot in this and scrub carefully with a scourer (do not generate spray) to remove the contamination. Unless it is to remove additional contamination, there is no need to rinse.
 - Alternately, soak the lead pot in Count-Off[®] (or an equivalent strong detergent) three (3) times (i.e. place in one solution, then remove and place in a second solution and then into a third solution).

The wastewater can usually be disposed of to the sewer as for water soluble, low level radioactive waste. Any pails used can be kept for disposal of vials (do not return it to the store in a contaminated state), and any scrubbing implements should be disposed of via a wetbag as solid, low level radioactive waste.

4. In the case of gamma emitters (e.g. I-125) or hard beta emitters (i.e. S-35, P-32), use a hand monitor to ensure that contamination left on the pot is very low level (less than about 10 counts per minute on a scintillation counter, or 5 counts per minute on a Geiger counter) before putting aside for disposal. Where there may be contamination from soft beta emitters (e.g. H-3, C-14), wipe test (e.g. by moistening a Whatman filter paper and swiping it across the pot surface) and count in a suitable liquid scintillation counter. Aim for background before putting aside the pot for disposal.
5. A special steel drum needs to be ordered from the waste contractor ahead of time, for transport of lead pots (Using a waste collection service such as Chemsal – 03 9369 4222). Therefore, it is suggested that a number of pots be done together in order to make this cost effective. A costing for this as well as the removal can be organized privately with Chemsal or as part of the routine monthly pickup (second Tuesday or each month). The drum should be clearly labeled as containing non-radioactive lead pots for recycling, as well as contact names, telephone numbers and Department name if it is to be handled as part of the routine pickup. *Do not place lead pots into wetbags or other containers and simply leave them in the low level radiation waste stores.*

If a Department desires to send the drums of lead pots away via the routine waste pick-up, then the RPO should be notified to expect this ahead of time. Subject to space constraints, a limited number of drums can be transported and stored in the bottom (open) shelves of the Medical radioactive waste store or on the floor in the Science radioactive waste store.

9. Labelling low level radioactive waste

In the case of materials going straight to landfill or for incineration, a paper label should be affixed to the external surface using a minimum of plastic tape (the idea is that it rots quickly with the waste) with the following details:

- Department name
- Responsible person
- Room number
- Phone number
- Radionuclide
- Half life
- Total activity and date
- Description of physical contents
- Signature

Waste that is to be stored to decay needs to have a more permanent label. For storage of up to a year, paper labels suffice as long as they are placed inside a plastic sleeve. For longer-term storage, a more permanent label is required.

10. Record keeping

All cost centers should keep a record of waste generated and sent for disposal. This can be simple eg:

- Number of bags
- Number of pails
- Number of sharps containers
- Number of litres of liquid
- Radioisotopes in each case

It should be held by the Resources Manager or RSO and be available for inspection in the event of an inspection by the RPO and/or a statutory authority.

11. Notes on compliance

Please note that all packages, pails and sharps containers sent for disposal are checked by the OHSE Branch. Any package put out for disposal that does not meet the necessary criteria will be kept and the owner will be required to re-package it prior to disposal.