



# PROCEDURE FOR DISPOSAL OF LIQUID 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 liquid 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 supervisor will be held responsible for the correct packaging and disposal of their liquid radioactive waste.

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, *liquid radioactive waste* will be considered in three (3) forms:

- Miscible with water and therefore able to go to the sewer at a defined rate. In practice this means that higher activity waste can be disposed of by this means (subject to daily limits as detailed in this procedure).
- Immiscible with water and therefore not able to go to sewer at any activity or rate. As there is presently nowhere to incinerate liquid radioactive waste in Victoria, this waste is taken to a waste facility where it is solidified and the solids are sent to landfill. This places practical limits on the total activity that may be placed in a single container because the solid residue must comply with requirements for disposal of low level, solid radioactive waste.
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- Liquid radioactive waste that contains significant levels of chemical contamination, (whether it be miscible with water or not), cannot go to the sewer, whatever its activity. Instead, it must be disposed of as chemical waste using the same methods as for immiscible liquid radioactive waste.

Note that different provisions apply to solid waste and these are addressed within the procedure *Waste disposal – low level solid radioactive waste*. Solid radioactive waste includes items such as sharps, solid putrescibles (e.g. animal carcasses), empty scintillation vials and contaminated solid waste (e.g. benchcote, pipettes, columns).

## 3. Packaging radioactive liquids

Liquids should be contained in sturdy containers with a long life expectancy (particularly if the liquids are to be kept to decay), and suitable for transportation. E.g. a disused Winchester or 20 litre drum. Where liquids are to be transported before disposal, the container must allow for this eventuality. 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 into groups:

- Miscible with water
- Immiscible with water
- Those with significant chemical contamination

Please note that no solid material (such as scintillation vials or caps) may be placed into a container with liquid waste. Such action makes the waste difficult to dispose of and compromises Monash's agreements with waste disposal contractors.

#### **4. Disposal of radioactive liquids that are miscible with water**

The accepted means of disposing of liquid radioactive material that is miscible with water is via the sewerage system. Several rules apply:

- Monash University has strict quotas for such disposal per unit time and for individual radioisotopes in miscible, liquid form. Therefore disposal of low level liquid radioactive waste is controlled centrally. Please see your RSO before undertaking such disposal.
- There should be a dedicated sink for disposal of liquid radioactive waste and 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 each time it is used in order to remove residual contamination. Obviously, this is more practical for short half life isotopes than for long half life ones and makes a strong case for choosing short half-life isotopes to work with.
- Where the liquid is too highly active to be put down the sink in a single aliquot, the disposal needs to be spread over a number of days. Obtain advice from your RSO in this regard.

Note:

There is no means at the present time to incinerate liquid radioactive waste. The only alternative disposal method that can apply is for such waste contained in scintillation vials. These are presently sent (in most cases un-emptied) to landfill. The Statutory Authority (Human Services) have advised Monash University that it is preferable to dispose of miscible liquid radioactive waste to the sewer (subject to limits below) than to send it to landfill. Monash University will continue to monitor for more appropriate methods of disposing of this waste.

It is recommended that miscible liquid wastes of high activity and short half life be kept to decay for as long as possible before disposal to the sewer. E.g. P-32, I-125, S-35 in miscible form. They should be stored within the Department itself. They should not be placed into the storage cupboards at Clayton radioactive waste stores as they tend to be forgotten and take up valuable space needed for storing solid radioactive waste. If there is not a suitable facility to store miscible liquid radioactive waste within the Department, then it should be disposed of to the sewer (subject to the limits below), without delay.

The following amounts of individual water soluble radioisotopes represent the maximum activity that any one Department, at any single Monash campus may place down the sewer in any 24 hour period<sup>1</sup>:

Radioisotope	Half-life	Maximum activity allowed to the sewer in a 24 hour period (provided it is miscible with water)
Carbon-14	5,730 years	10 MBq
Hydrogen-3 (tritium)	12.3 years	10 MBq
Phosphorus-32	14.3 days	1 MBq
Phosphorus-33	25.4 days	1 MBq
Sulphur-35	87 days	1 MBq
Chromium-51	27.7 days	10 MBq
Iodine-125	60 days	0.1 MBq
These have been taken from the Health (Radiation Safety) Regulations and suitable factors have been used to account for a number of Departments on a single campus as well as the likely sewer flow and the fact that multiple isotopes may go the sewer in a single day. Possible sink contamination has also been a factor in determining the limits.		

## 5. Disposal of radioactive liquids that are immiscible with water or that contain significant chemical contamination<sup>2</sup>

Radiation users at Monash University are discouraged from generating liquid radioactive waste that is immiscible with water – especially that containing long life radioisotopes and/or high levels of activity.

Radioactive waste in liquid form that is immiscible with water and/or contains significant amounts of chemical contamination cannot be put into the sewer. Unfortunately, it cannot be incinerated either. The only option for disposal in Victoria at the present time is to store it and decay it to the point where it is essentially non-radioactive. It is then sent to a chemical reclamation facility where solvents are reclaimed and the remaining solid waste is land-filled as prescribed waste (by definition this means that any radioactive content must meet the requirements for land-fill of solid, low level radioactive waste). For more information on the definition of “non-radioactive” in this context, see the section on solid, low level radioactive waste in the procedure *Waste disposal – low level solid radioactive waste*.

Chemical reclamation facilities are not equipped to deal with radioactivity in the liquid waste. Therefore, Monash University has no option but to keep its liquid radioactive waste that is immiscible with water, until it has decayed back to background. Efforts are presently underway to find an alternative means of disposal, i.e. a suitable incinerator. If one can be found, it is likely to be interstate and disposal will be very expensive. **This situation makes a strong case for avoiding the generation of liquid radioactive wastes that are immiscible with water.**

## 6. Labeling liquid radioactive waste

<sup>1</sup> These have been taken from the Health (Radiation Safety) Regulations and suitable factors have been used to account for a number of Departments on a single campus as well as the likely sewer flow and the fact that multiple isotopes may go the sewer in a single day.

<sup>2</sup> *Significant chemical contamination* should be taken to mean more than 1% by volume or weight of any chemical substance that may be harmful to the environment (excluding the solvent based material that made the mixture immiscible with water). Examples of such chemicals are acrylamide, beta-propiolactone, paraformaldehyde/formaldehyde, dimethylsulphoxide, chloroform and ether.

Liquid radioactive, liquid waste needs to be labelled with accurate information concerning its contents.

Labels for liquids need to provide accurate information and need to withstand the rigours of transport and possible storage processes. They should contain the same information as for solid low level radioactive waste, but be more rigorously fixed (e.g. firmly taped paper label in a plastic sleeve). I.e.:

- Department name
- Responsible person
- Room number
- Phone number
- Radionuclide
- Total activity and date
- Description of physical contents (including volume for liquids – so that specific activity can be calculated)
- Likely disposal date (assistance from the RSO may be needed)
- Signature

In particular, 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 if they are placed inside a plastic sleeve. For longer term storage, a more permanent label is required such as laminated plastic.

## **7. 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.

## **8. Notes on compliance**

Please note that all packages of liquid waste 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 before disposal.