Charles Sturt University

Radiation Management Plan

Booklet 9 - Disposal and waste management

IN THIS BOOKLET

1. General

Background

This document describes appropriate methods for the storage and eventual disposal of waste radioactive material. Nuclear medicine procedures and certain laboratory assays will result in small quantities of radioactive waste that require appropriate storage and eventual disposal of this radioactive material. Legislation requires that the Radiation Management Licence Holder through the Radiation Safety Committee is responsible for this waste from the time of acquisition, and this responsibility cannot be delegated. However, the Principal Investigator or Subject Coordinator must ensure that the correct procedures are followed for storage and disposal of radioactive waste.

The International Commission on Radiological Protection (ICRP) has three waste concepts as follows:

- Delay and decay (applicable to radionuclides with short half-lives)
- Concentrate and contain (applicable to all radioactive waste)
- Dilute and disperse (possible, but discouraged and without great care could be in breach of the Regulatory Guidelines. Regulatory authorities may apply a limit of 1 Bq/L (above background) to the sewerage system, above which double delay tanks with other restrictions may be required.)

NOTE:

Half Life	Radionuclide
Five days or less:	Na-24, K-42, Cu-64, Tc-99m, Mo-99
Five days to two months:	P-32, Cr-51, Fe-59, 1-125, 1-131, Cs-131
Two months to one year:	S-35, Ca-45, Sc-46, Sn-113
Greater than one year:	H-3, C-14, Na-22, Cl-36, Co-57, Co-60, Cs-137

NOTE:

The EPA's Waste Classification Guidelines Part 3: Waste Containing Radioactive Material: October 2013, must be adopted into the waste procedures. This document is enacted through the Protection of the Environment Operations Act 1997.

NOTE:
Radioactive Waste is classified as:

- Liquid or non-liquid wastes with a specific activity greater than 100 Becquerels per gram and consisting of, or containing more than, the prescribed activity (see Appendix 18.1) of a radioactive element in Schedule 1 of the Protection from Harmful Radiation Act 1990 No. 13 (2023), whether natural or artificial, must be classified as hazardous wastes.
- For liquid or non-liquid wastes with a specific activity of 100 Becquerels per gram or less and/or consisting of, or containing, the prescribed activity or less of a radioactive element in Schedule 1 of the Protection from Harmful Radiation Regulation 2013 (2023), whether natural or artificial, the total activity ratio and specific activity ratio must be calculated according to the mathematical expressions below:

  Total activity ratio is calculated using the expression:

  Total activity ratio = (A1 x 10-3) + (A2 x 10-4) + (A3 x 10-5) + (A4 x 10-6)

  Where A1 to A4 are the total activity of Group 1 to Group 4 radionuclides, as set out in Column 1 of Schedule 1 of the Protection from Harmful Radiation Regulation 2013 (2023).

  Specific activity ratio is calculated using the expression:

  Specific activity ratio = SA1 + (SA2 x 10-1) + (SA3 x 10-2) + (SA4 x 10-3) where SA1 to SA4 are the specific activity (of the material) of Group 1 to Group 4 radionuclides, as set out in Column 1 of Schedule 1 of the Radiation Control Regulation 2013.

Definitions

Specific activity is defined in the **Code of Practice for the Safe Transport of Radioactive Materials** (Australian Radiation Protection and Nuclear Safety Agency 2008) as follows:

- Specific activity of a radionuclide shall mean the activity per unit mass of that nuclide.
- The specific activity of a material shall mean the activity per unit mass of the material in which the radionuclides are essentially uniformly distributed.

Non-liquid wastes must be classified as restricted solid waste unless:

- other characteristics of the waste mean that it must be classified as hazardous waste (for example, it may be pre-classified as hazardous waste in accordance with Step 3 of Part 1 of the Waste Classification Guidelines [EPA 2008]; or
- it contains chemical contaminants that will lead to its assessment as hazardous waste (see Step 5 of Part 1 of the Waste Classification Guidelines).

NOTE:
Where the specific activity ratio and total activity ratio are equal to or less than one, the waste must be classified according to its other characteristics in line with Part 1 of the Waste Classification Guidelines.

Restricted solid waste

- Currently, no wastes have been pre-classified by the EPA as ‘restricted solid waste’. Restricted solid waste, therefore, only includes wastes assessed and classified as such in accordance with the procedures in Step 5 of this guide.
- However, the EPA may classify waste as restricted solid waste from time to time by a notice published in the NSW Government Gazette. All currently gazetted restricted wastes will be listed on EPA’s website at www.environment.nsw.gov.au/waste/wastetypes.htm.

- According to the Protection from Harmful Radiation Act 1990 No. 13 (2023) and the Protection from Harmful Radiation Regulation 2013 (2023) (and all subsequent amendments) for the Radiation Management Licence Holder to dispose of radioactive waste, they must have received written authority from the Director-General to date, the D-G has not had any need to give such authority to an institute and therefore to be compliant, the radioactive waste must be stored by the licence holder, with the only legal requirement being that complete records of disposal are maintained.

2. Options for disposal of regulated material

Background

This document provides procedures necessary to ensure compliance with this policy in relation to the management of radiation apparatus. This is to ensure compliance with the current legislation as well as NSW Guideline No.1, NSW Guideline No.6, ARPANSA RPS 14, ARPANSA RPS 6, ARPANSA RPS 10, and ARPANSA RPS 17.

From time to time random inspections of equipment registers and documentation will take place to ensure the necessary documentation and records are kept and maintained.

Responsibilities

The University and the Radiation Management Licence Holder

The University (the owner of the radiation apparatus) via the Radiation Management Licence (RML) holder alone is responsible for the disposal of radiation apparatus and for ensuring that records of disposal are maintained.

The University via the Radiation Management Licence Holder will be responsible for ensuring:

(a) that obligations regarding the repair, maintenance, disposal, or sale of radiation apparatus comply with the Protection from Harmful Radiation Regulation 2013 (2023);

(b) copies of all maintenance and inspection reports and summaries of QA tests undertaken on radiation apparatus, together with a copy of the registration certificate are kept; and

(c) annual and random inspections in regard to the management of this apparatus are conducted by the WHS Unit.

NOTE:

The records may be in hardcopy or electronic form.

NOTE:

The records must be kept for at least 6 years and made available on request to an authorised officer of the EPA.

The Radiation Management Licence Holder and the Designated Faculty Staff

Both the RML Holder and designated Faculty staff responsible for the instrument must ensure compliance with the following procedures relating to the repair, maintenance, disposal, or sale of radiation apparatus. Normally, the process would occur jointly between these parties.

Disposal of Radiation Apparatus

The named person responsible for the instrument will notify the RSC/WHS:

(a) of an intention to dispose of radiation equipment

(b) when the apparatus has been rendered permanently inoperable (a condition of disposal) and “safe”

(c) only dispose of the equipment following written approval by the WHS.

The RSC will notify the RML:

(a) the intention to dispose of radiation equipment.
(b) when the radiation equipment has been disposed of.

The RML holder will ensure that the EPA has been notified, using the appropriate EPA form, that radiation equipment has been disposed of.

Trade of Radiation Apparatus

The RML Holder may trade radiation apparatus only if:

(a) the RML has a condition of licence to sell/possess radiation apparatus, or an appropriate licence to use the apparatus;
(b) the EPA has been notified within 21 days, using the appropriate EPA form; and
(c) The University Equipment Disposal has been appropriately authorised.

Transfer of Registration

The RML Holder may transfer the radiation apparatus to another person only if:

(a) the purchaser holds a licence to sell/possess radiation apparatus, or an appropriate licence to use the apparatus; and
(b) the EPA has been notified within 21 days using the appropriate EPA form; and
(c) The University Equipment Disposal has been appropriately authorised.

3. Record keeping of waste held and disposed of

Generators of Radioactive Waste

Generators of radioactive waste (researchers, students, laboratory personnel, etc.) must:

- collect the radioactive waste as it is being generated;
- appropriately package and store waste for the short term;
- label waste containers [trefoil, date, generator, generator's location, contact phone number, isotope, mass, estimated activity];
- complete all required documentation and local records;
- when the waste container is full, or it is appropriate time for the waste to be processed by the University, complete the waste form, and contact the Faculty of Science & Health Technical Support Unit to arrange the transfer to the University central Radioactive Waste Store;
- Complete all necessary disposal and transfer forms and advise the RSC accordingly;

Disposal will then be the responsibility of the Radiation Management Licence holder, who will delegate the management to the WHS Unit (and the RSC) for final management and disposal (if possible).

Principal Investigators

Principal investigators who are responsible for projects and procedures that generate radioactive waste must:

- inform and obtain permission from the Radiation Safety Committee or their delegate before storing or disposing of radioactive waste;
- ensure compliance with current legislation regarding storage and disposal of radioactive waste;

- ensure that others involved with the project or procedure comply with the current legislation regarding storage and disposal of radioactive waste;
- •ensure that they, or others who generate radioactive waste, record the nature and storage of such radioactive waste in the logbook provided in the facility or storage area;
- •ensure that all dealings with radioactive waste storage or procedures are kept in a written form (could be electronic) and the documents stored for at least 5 years, and destroyed only if permission is gained from the Director-General of the EPA; and
- •ensure that personnel involved with the project or procedure are properly trained, and wear personal protective equipment (PPE) appropriate to the hazard.

Procedure

Storage Procedures (Identification, Location, Record Keeping)

Radioactive waste must:

(a) have appropriately shielded and labelled waste containers dedicated to the project
(b) NOT be mixed with waste from other projects
(c) be stored in appropriately shielded and labelled containers in an area approved for storage of radioactive material
(d) be clearly identified with the University Radioactive Waste Label (see Appendix 18.2)
(e) NOT be stored with explosive, combustible, or corrosive material

Sharps (e.g. needles or needles with syringes attached) which may be contaminated with radioactivity must be stored in a trefoil labelled sharps container. The sharps containers must not be overfilled and labelled with the University Radiation Waste Label.

If the radioactive waste includes another type of hazardous waste (e.g. biological waste), then storage must comply with the conditions for radioactive waste storage and for the storage conditions for the other hazardous waste.

NOTE:

Mixed waste is defined as a waste that is both radioactive and contains a non-radioactive contaminant that is itself considered a hazardous material, such as biological waste. Such wastes are subject to regulation for both hazards, which adds to their complexity when dealing with them. For this reason, mixed wastes should be avoided, but with research and teaching this is often unavoidable.

Scintillation Fluids – Used scintillation vials are not to be decanted of their contents before disposal. The used vials should be stored in a plastic bucket of no more than 15 litres. This is to reduce the risk of manual handling problems, and to minimise the time required dealing with used scintillation vials. The bucket should be labelled indicating the contain hazard and have a lid that will seal the bucket. DO NOT OVERFILL these buckets: the lid must properly close and seal the container.

Once the bucket is filled, the principal investigator or subject coordinator of the project will organise for the qualified and authorised Faculty staff member to measure the activity, and determine the disposal or storage procedure to be followed.

Where possible, containers should be stored within a secondary container or bunded area.

Waste Material Destined for the University Radioactive Store

(Conditioning/packaging of radioactive waste for long term storage)

The University will adhere to the principles associated with Annex E of the Safety Guide, entitled Predisposal Management of Radioactive Wastes (RPS 16) for management of medical and laboratory radioactive waste (Appendix 18.2). This will be done in consultation with the RSC.

Disposal procedures

User licence personnel shall follow the following steps:

(a) If a waste container is full, it is the appropriate time for the waste to be processed by the University, or a project is completed (whichever the sooner), then the generator of the waste will contact the CSU RSC to approve or confirm procedures for waste storage or disposal.

(b) The generator of the waste will complete all necessary disposal and transfer forms.

(c) For items that are determined to be placed in the University central Radioactive Waste Store, the CSU RSC will determine the procedure for transfer to the University central Radioactive Store.

NOTE:

The type of waste generated can take the following forms:

- airborne wastes such as radioactive gases, vapours, or particulate material;
- liquid radioactive wastes: These include animal excretia and aqueous solutions of radionuclides or suspensions of radioactive material in water or water-miscible liquid(s). Another category of liquid wastes is that of organic solvents which, because they are flammable or toxic, usually require special methods of disposal such as incineration in an approved incinerator (currently no Environmental Permit or Licence has been issued to a waste facility for such purposes);
- solid wastes include liquid in solid containers, sealed sources and rubbish. Sealed sources are generally in the form in which they were originally purchased; whilst rubbish includes contaminated packing materials, laboratory glassware, pipette tips, plastic vials and trays, paper tissues, used syringes, etc; and
- radioactive animal carcasses (from research activities) need special consideration. Carcasses of small animals such as mice and rats, and excised organs of larger animals, will need to be kept frozen until such time as the carcass and the associated radioactive contamination is deemed acceptable for disposal. The nature and quantity of radioactivity involved should be taken into account in selecting the appropriate option. Larger animals contaminated with radioactive materials are definitely a major problem. Please contact the WHS Unit and the University RSC while in the planning stages for this work.

Minimisation, Segregation and Disposal

The effective management of low and intermediate level waste depends on knowledge of the waste characteristics and the contained radioactivity. The volume of radioactive waste should be kept to a minimum and should be categorised according to its method of disposal at as early a stage as possible. Non-radioactive waste and very low level waste (that is, below the exemption levels set by the regulatory authority) should be kept separate from waste that needs to be disposed of as radioactive waste. This waste should be monitored by the RSC to confirm its status before being removed from a controlled area. It is useful to segregate radioactive waste on the basis of half-life in order to facilitate appropriate storage and disposal. For example, waste can be segregated into short-lived and long-lived radionuclide bins. The bins should be well shielded and the content disposed of when the activity drops to a sufficiently low level such that it is indistinguishable from background radiation when measured with an area radiation monitor. Care must be taken to remove or deface any indications that the disposed waste is radioactive.

If possible, sealed sources (see Section 16 - Safety with Sealed Sources) should be returned to the supplier when no longer required. Prior to purchasing a sealed source, purchase contracts should

include the provision that the manufacturer will accept return of the source at the end of its useful life.

Requirements for an Approved Radiation Waste Store

The radiation level in any store or storage area or any accessible region outside the store or storage area must not exceed the dose limits in Schedule 2 of the Protection from Harmful Radiation Regulation 2013 (2023). The accepted limits are:

- If only occupationally exposed persons have access to the area of the storage, then the dose rate at 5cm from the surface of the storage unit must be at or below 5□Sv/hr.
- If any person who is not an occupationally exposed worker has access to the near vicinity of the storage, then the dose rate at 5cm from the surface of the storage unit must be at or below 0.5□Sv/hr.

All storage facilities must meet the appropriate requirements of the legislation and ARPANSA RPS11. Sealed sources and premises that are registered under the Radiation Management Licence must meet the conditions of their registration, in addition to the requirements of this procedure.

Radiation Safety Committee

The Radiation Safety Committee (acting as the delegate of the RML holder) must:

- ensure that logbook, labels and records of transfer documentation are correct;
- ensure that the package(s) are verified in terms of dose rate (activity and specific activity); and
- sign off that the records pertaining to all of the radioactive waste are correct and up-to-date.