

19. DISPOSAL OF RADIOACTIVE WASTE

19.1.1 Contents:

Aim	19.2.1
Introduction	19.3.1
Policy	19.4.1
Implementation	19.5.1
Disposal of different types of radioactive waste	19.6.1
Record keeping	19.7.1
Storage of radioactive waste	19.8.1
Further information	19.9.1

19.2.1 Aim: To describe radioactive waste disposal arrangements for University buildings on the Edinburgh bioQuarter site and ensure that radioactive waste arisings are properly managed.

19.2.2 Procedures for managing other (non-radioactive) forms of waste are dealt with in detail in Section 18 of this Manual.

19.3.1 Introduction: It is a statutory duty for the University to ensure that radioactive waste is segregated from other waste streams. The University will be penalised for failing to segregate and properly manage radioactive waste, and waste management contractors may be put at risk if they are inadvertently put in the position of handling radioactive waste that has been incorrectly bagged and labelled.

19.4.1 Policy: The disposal of radioactive waste is controlled by The Radioactive Substances Act 1993, which is administered by the Scottish Environment Protection Agency (SEPA). Premises used for the keeping and use of radioactive materials *must* have a Certificate of Registration from SEPA and all such materials may only be disposed of according to a Certificate of Authorisation issued by SEPA. Separate certificates are issued for sealed (closed) sources and unsealed (open) sources. Copies of Certificates of Registration and Authorisation for University premises on the Edinburgh bioQuarter campus are displayed in public areas of the building to which they apply. Records are also kept of the acquisition and disposal of radioactive materials.

19.4.2 All people generating and handling radioactive waste arisings within University buildings on the Edinburgh bioQuarter site *must* conform to the segregation and management strategies described in this Section.

19.5.1 Implementation: The following areas of University buildings on the Edinburgh bioQuarter campus have been specially designated for receipt and temporary storage of solid radioactive waste:

- GU420 (Ground floor, Chancellor's Building) – Clinical and radioactive waste;
- E 0.19 (QMRI) – Radioactive waste only; and
- G1.07 (CRM) – Clinical and radioactive waste

19.5.2 The approved methods for the disposal of radioactive waste are described below and are summarised in the accompanying Table. It is critically important that every individual radiation worker co-operates by ensuring that all disposals comply with the Certificates of Authorisation and with the procedures set down in this Section. Details of the arrangements for waste storage and disposal in each department can be found in Departmental Local Rules.

19.5.3 Solid waste is consigned in fifty or thirty litre bins; these have lids which can be securely attached once the bin has been filled. The bin will provide shielding for beta-emitters H-3, C-14, P-33, S-35, Cl-36 and Ca-45 and approximately 50% attenuation for P-32. Additional shielding is required for gamma-emitting isotopes.

19.6.1 Disposal of Different Types of Waste: The following paragraphs describe procedures and protocols for disposal of:

- Sealed sources;
- Unsealed sources;
- Solid (non-combustible) waste;
- Solid (very low activity) waste;
- Liquid (water miscible) waste;
- Liquid (flammable or water immiscible) waste;
- Gaseous waste; and
- Other forms of waste.

19.6.2 *Sealed Sources:* Whenever possible, a used sealed source should be disposed of by return to the supplier or manufacturer. When a sealed source is no longer required, the University's Radiation Protection Adviser (URPA) should be consulted and advice obtained regarding its safe disposal.

19.6.3 *Unsealed Sources:* Most radioactive waste arises from the use of unsealed sources, and may be disposed of in the form of solid, liquid or gaseous waste. The Certificate of Authorisation for each department will set out the approved means of disposal and also the allowed limits (usually the activity of each nuclide that may be disposed of per month).

19.6.4 *Solid (Non-Combustible) Waste:* This waste is segregated from other waste in laboratories and accumulated in large wheeled bins in one of the waste stores referred to at Paragraph 19.5.1 for collection at intervals of three months for disposal at an authorised landfill site. Bins must be safe to handle, and so *must not* be over-filled, and bags *must not* contain wet material or unprotected sharps. Waste that does not comply with the requirements will be rejected and returned to laboratories.

19.6.5 *Solid Waste for Incineration:* There are no limits imposed by SEPA on the activity of beta and gamma-emitters that can be disposed of by this route. However,

restrictions are imposed by waste management contractors in order that they can meet their own limits of authorisation.

19.6.6 Each bin *must*, therefore, comply with the following activity limits:

Radionuclide	Total Activity per bin (MBq)
Hydrogen-3	5 000
Carbon-14	3 000
Phosphorus-32	10
Phosphorus-33	60
Sulphur-35	30
Iodine-125	10
Iodine-131	10
Any other β/γ	10

If a bin contains a mixture of radionuclides, the total activity in the bin must not exceed the lowest value of the relevant nuclides.

19.6.7 Detailed instructions about the arrangements and the conditions which must be observed are sent along with the appropriate forms to each Radiation Protection Supervisor (RPS) about two weeks in advance of each collection.

19.6.8 *Solid (Very Low Activity) Waste*: A contractor has been contracted to remove very low level activity waste.

19.6.9 Each item for incineration *must* be enclosed in a yellow sack and have attached a yellow label with an attached bar code label bearing the details of nuclide, activity, department, responsible person and date. The labels are obtained from the University's Energy and Environment Office.

19.6.10 Activity limits for each sack are as follows:

Radionuclide	Total Activity (kBq)
Per waste bin (<i>i.e.</i> a volume of 0.1 m ³)	400
Per single article	40

N.B. Radioactive waste must not be mixed.

19.6.11 *Liquid (Water Miscible) Waste*: The Certificate of Authorisation states the maximum activity of liquid radioactive waste which can be disposed of in any calendar month. Disposal is permitted *only* at approved sinks within Controlled or Supervised Radiation Areas. Such sinks *must* be clearly marked with the radiation trefoil. No other sinks may be used for such disposals. A warning symbol should also be attached to the waste trap of the sink to alert maintenance staff to seek the advice of the departmental RPS when repairs are required. Care must be taken to see that drains are clear and that disposals are made with sufficient running water to

ensure thorough dilution. When disposing of high specific activity solutions it may be necessary to add a carrier material first.

19.6.12 The maximum activities permitted per bin of organic liquid waste are as follows:

Radionuclide	Total Activity per bin (MBq)
Hydrogen-3	4 000
Carbon-14	300
Phosphorus-32	10
Phosphorus-33	60
Sulphur-35	30
Iodine-125	10
Iodine-131	10
Any other β/γ	10

19.6.13 *Liquid (Inflammable or Water Immiscible) Waste*: This category refers mainly to the waste from liquid scintillation counting and may present particular problems of handling, storage, transport and disposal. The vapours from toluene are particularly toxic if inhaled in concentrations above 200ppm. Some scintillants may be carcinogenic and there is, of course, a potential fire hazard. To avoid these problems, every effort should be made to use the newer types of bio-degradable liquid scintillators. Protective clothing and gloves *must* be worn when working with waste scintillant, which must be stored with due regard to all of the above hazards.

19.6.14 The following rules for disposal of scintillant waste will be observed:

- Scintillant waste, normally in the form of unopened plastic counting vials containing liquid scintillation samples, should be collected in approved plastic drums. Containers which appear to be damaged or externally contaminated or in a dangerous condition will *not* be uplifted from departments;
- A yellow label for combustible waste *must* be attached to each container giving the full details required: type of waste, nuclide, activity, originating department, *etc*;
- Collection of waste containers can be arranged by request to the University's Radiation Protection Services office. A liquid scintillation waste transfer form should be completed for each waste consignment. The top two copies should be given to the driver when the collection takes place and the third copy kept for department records. Waste is taken to the waste store at King's Buildings to await disposal by incineration; and
- Note that departments will be charged separately for transport to the King's Buildings store and for disposal to a contractor.

19.6.15 *Gaseous Waste*: Certain departments have Certificates of Authorisation that include the disposal of gaseous waste to the atmosphere. Any procedure that leads to the production of radioactive gases, vapours or aerosols *must* be carried out in an authorised fume hood to ensure that any activity is discharged at a safe place well away from any air intake points.

19.6.16 Authorised limits for gaseous waste disposal are generally given as activity concentrations (kBq per cubic metre) which depend on a large dilution in air. Care must, therefore, be taken to ensure that the fume hood is functioning properly.

19.6.17 *Other Forms of Waste:* If the need arises to dispose of any radioactive material not covered by the above, the advice of the local RPS and University RPA must be obtained.

19.6.18 From the end of March 2006, the University will be left with three routes for the disposal of solid radioactive waste. Decay to below the levels of the Radioactive Substances (Substances of Low Activity) Exemption Order is an unusual route, and one with limited application. “Dustbin disposal” is limited both by Certificates of Authorisation and the move towards segregation and recycling of ordinary waste. Disposal by incineration is therefore the route now most likely to be used. Changes in arrangements for disposal of solid radioactive waste, effective from the end of March 2006, are outlined at end of this Section.

19.7.1 Record-Keeping: It is a requirement of each Certificate of Authorisation that a record is kept of each disposal of radioactive waste so that all radioactive material acquired can be accounted for. Whenever a disposal is made, it is the responsibility of the person making the disposal to make sure that an entry is made in the relevant waste disposal record.

19.8.1 Storage of Radioactive Waste: If it is necessary to store waste in a building, either to accumulate it for disposal or to allow radioactive decay, this must be done in a manner which is safe, secure and complies with the relevant Certificate of Authorisation.

19.9.1 Further information: The following people and departments may be contacted for specialist advice:

Contact	Location	Telephone
University of Edinburgh’s Radiation Protection Unit	Chambers Street	650 2818
University of Edinburgh’s Health and Safety Services	Chambers Street	650 6695
University of Edinburgh’s Works Division, Estates	Infirmery Street	650 2480
University of Edinburgh’s Transport Section	41 Forrest Road	650 6805

19.9.2 A summary of procedures for disposal for all categories of radioactive waste listed in the following table:

**DISPOSAL OF RADIOACTIVE
WASTE (Summary)**

TYPE OF WASTE	INSTRUCTIONS FOR DISPOSAL	NOTES
SEALED SOURCES	Dispose as specified in Registration Certificate, or contact UofE's Radiation Protection Unit	Avoid accumulation of redundant sources.
SOLID FOR INCINERATION	Store in waste store, decayed for six months where relevant. There are maximum activity limits per bin depending on the isotope and mix (see Section 3.2.1 of UofE's Guidance Note GN0009). Check external surface of bins for dose rate and contamination. Label bins with standard transport label and barcode label, and remove any other labels.	Protect sharp objects, seal liner Complete special form, two copies to RPA, one for department records.
VERY LOW LEVEL (SOLID) WASTE	Store in waste store if decay required. Dispose to normal waste at outside collection points. Maximum activities are 400 kBq/0.1m ³ and 40 kBq/item of β/γ emitters only. Remove any radiation labels.	Register with Estates and Buildings. Yellow label on each item. Complete incinerator records.
LIQUID (WATER – MISCIBLE) WASTE	Dispose at designated (and labelled) sinks and drains only. Monthly activity limits set by Certificates of Authorisation.	Ensure free flow before disposal. Dilute with excess running water and carrier if necessary.
LIQUID WASTE FOR INCINERATION	Vials to be placed unopened in plastic drums. Store in waste store, decayed for six months where relevant. There are maximum activity limits per bin depending on the isotope and mix (see Section 3.2.1 of UofE's Guidance Note GN0009).	Yellow label on each item. Complete transfer form, two copies with waste, one for department records.
GASEOUS	Activity limit set by authorisation certificate. Dispose at authorised (and labelled) fume hoods <i>etc.</i> Rate of discharge must keep activity concentrations below prescribed limits.	Ensure that consideration is given to the risk of producing airborne radioactivity. Fume cupboard operation must be regularly checked.
OTHER FORMS	Consult RPS and/or contact UofE's Radiation Protection Unit	All disposals must be authorised or meet the conditions for appropriate Exemption Orders.
	RECORD ALL DISPOSALS	GET ADVICE IF UNSURE

19.9.3 Detailed information on health and safety aspects of radioactive waste disposal appears on the University's Health and Safety web site (and should be consulted):

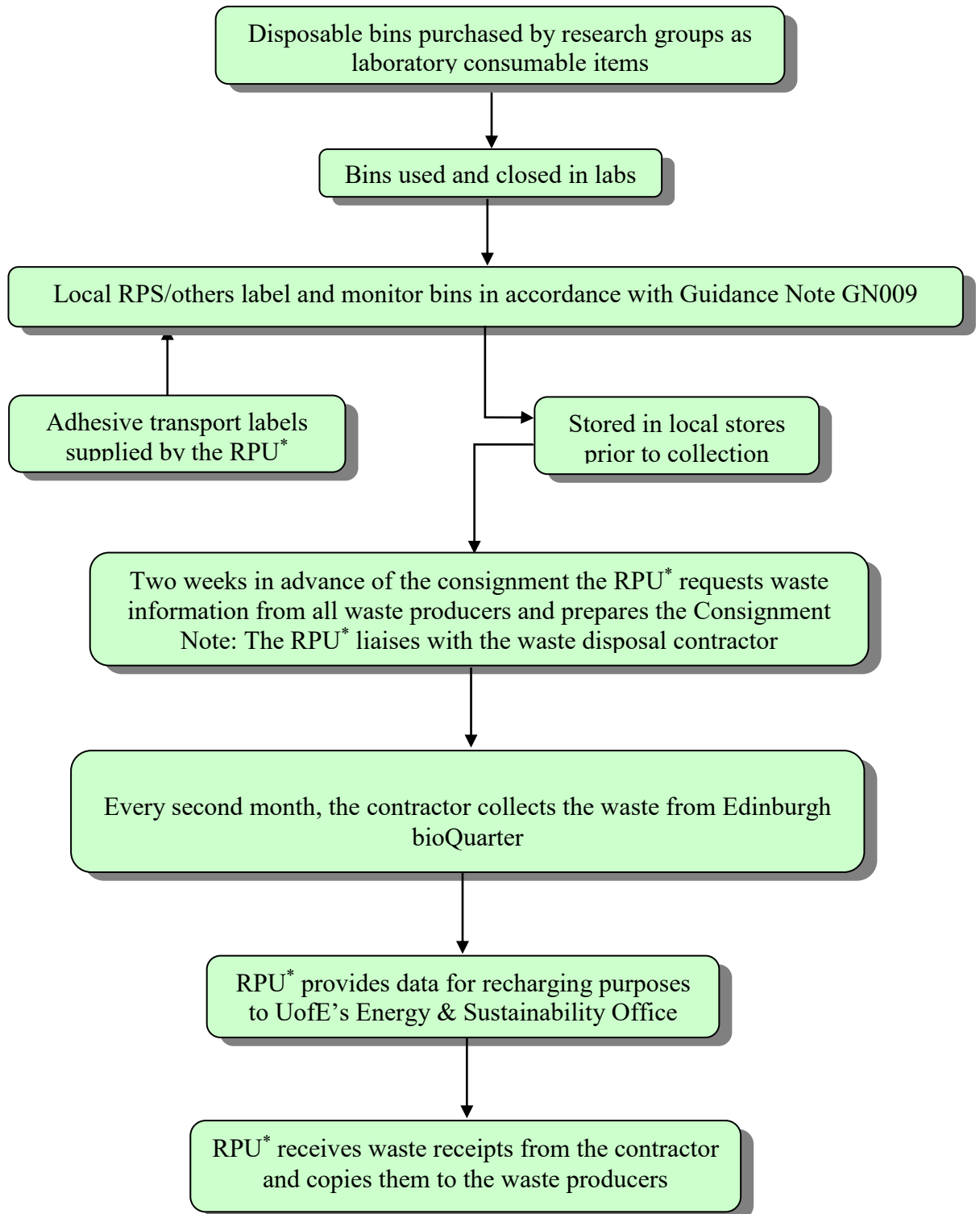
<https://www.ed.ac.uk/health-safety/radiation-protection/codes-of-practice-and-guidance>

together with Guidance Note GN0009 (The disposal of Radioactive Waste), at:

This is currently being rewritten, but guidance can be obtained upon application to the
Radiation Protection Unit

DISPOSAL OF SOLID RADIOACTIVE WASTE BY INCINERATION

The flow chart below describes the new arrangements for the disposal of radioactive waste by incineration.



* RPU = UofE's Radiation Protection Unit

Last reviewed/updated: 17th February, 2022