RP COP010 – Accounting Procedures for Unsealed Radioactive Material

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Document Author:	Colin Farmery
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1. Introduction

If you are using and disposing of unsealed radioactive material within the University, it is expected that you know where it is, or by what route you have disposed of it. This Code of Practice concerns the accounting for unsealed radioactive material that is consumed as part of its use. "Consumed" in this context means acquired from a source of supply, manipulated in some way, and disposed of, or allowed to decay to a defined mass specific activity level. General guidance on source accounting for sealed sources and non-consumed open sources can be found in RP COP005.

2. Legal Requirements

There are two sets of regulations that impose requirements on source accounting: the Environmental Authorisations (Scotland) Regulations 2018 (EASR), regulated by the Scottish Environment Protection Agency (SEPA) and the Ionising Radiations Regulations 2017 (IRR17), regulated by the Health and Safety Executive (HSE).

The EASR is an inclusive regulatory regime and applies to most uses of radioactive substances at the University. Almost all uses of unsealed radioactive material at the University will fall under the regulation of EASR.

There are four tiers of authorisation under EASR. These are shown below; listed from low risk to high risk.

- General Binding Rules (GBRs);
- Notifications;
- Registrations;
- Permits.

All of the different authorisation tiers place record keeping requirements on those holding radioactive substances. For the University's work with unsealed radioactive material, the work falls within the highest tier, Permits. Record keeping requirements for Permit holders are detailed in the EASR "Standard Conditions for radioactive substances" document issued by the SEPA.

A radioactive substance is defined as either radioactive material or radioactive waste. If there is no further use for some radioactive material it automatically becomes radioactive waste. The following gives some examples of uses of radioactive substances at the University and when they might be defines as 'radioactive material' or 'radioactive waste':

Radioactive Material	Radioactive Waste
• New Stock • Experimental samples • Contaminated reusable equipment • Samples kept for future reference/reuse	• Contaminated disposable equipment • Samples kept for decay before transfer/disposal • Waste

It is important to note that under the EASR, the radioactive waste storage period must be as short as reasonably practicable. Storage and disposal must follow Best Practice Means. SEPA recognises that there may be financial justification for accumulating some waste, as it will reduce overall costs of uplift and disposal. However, long-term storage is generally unacceptable.

EASR does not specify any source accounting requirements in detail but under standard condition A.4.1 "*You must make, as soon as reasonably practicable, true, accurate and legible records that ensure and demonstrate compliance with the requirements of your authorisation.*" To comply with the authorisation this requires a record to be made of the following information:

- Details of the sources (This must include means of uniquely identifying the source.);
- Activity (In the case of short half-life sources, this will need to include a reference date for the activity stated.);
- Arrival date;
- Location;
- Disposal date; and
- Disposal route.

The IRR17 and accompanying Approved Code of Practice and Guidance Note are more detailed, but basically contain the same requirements as listed above. The steps taken to comply with the requirements of the EASR will also meet the requirements of the IRR17.

Failure to maintain adequate records can result in a number of actions. It might mean that you are unable to explain where a radioactive source is or went, which would therefore result in the source being defined as missing. This would require notification to the Enforcing Authorities, and would likely result in enforcement action being taken against the University. Since a loss clearly requires a subsequent investigation, time would have to be devoted to the investigation rather than to the research work. Loss of radioactive

material, whether actual or perceived, can give rise to concern to the public, and considerable adverse publicity to the University and your Research Group. Similar actions would occur if you simply failed to keep adequate records - a breach of the law occurs if records are insufficient to identify the matters listed above - there does not necessarily have to be a loss of radioactive material.

It is important to understand that the requirement to adequately record the use and disposal of radioactive material is not confined to large quantities or those quantities that any one researcher believes is harmful. The requirement for adequate record keeping applies to all quantities of radioactive substances which are in-scope of the EASR. Out-of-scope values are available in some cases but don't apply to aqueous-based liquids (i.e. all aqueous based liquids are in-scope of EASR). Specific information on what would fall under out-of-scope or GBR's can be obtained from the University Radiation Protection Adviser.

3. Accounting Procedure: Paper-based system

3.1 General

NB: The paper-based system is being phased out in many areas in favour of the electronic recording system, RETAIN. If you currently use a paper-based system but haven't yet moved online, contact your RPS or the RPU @ radiation@ed.ac.uk

Radioactive stock will normally come from a supplier, and fractions are commonly drawn off by a number of researchers. The "stock" could however be a discrete quantity of material used by one researcher in one experiment, or material made by the research group themselves, or acquired from another group within or outwith the University. In order to achieve adequate accounting for all these various options the University uses standard pro-forma record sheets, known as "Usage and Disposal Sheets". The format has been agreed by the University's Radiation Protection Committee, and must not be altered without its consent.

A number of Usage and Disposal sheets have been created by the Radiation Protection Unit for use by researchers. The format of these should not be altered. A table showing the different types and intended uses is given below:

Usage & Disposal Sheet type	Intended Use
Type 1 – Uncorrected Decay	Intended for use by research groups whose experiments do not require quantification of activities, or who are not using short half-life radioisotopes.

Type 2 – Decay Corrected	Intended for research groups who are using short half-life radioisotopes and whose experiments do require activity quantification.
Type 3 – Veterinary Scintigraphy	Is intended to be used only to record the consumption and disposal of technetium-99m used in the Royal (Dick) School of Veterinary Medicine for diagnostic scintigraphy.
Type 4 – Treatment of Feline Hyperthyroidism / carcinoma	Is intended to be used to record only the use and disposal of iodine-131 used in the Royal (Dick) School of Veterinary Medicine for the treatment of feline hyperthyroidism.
Type 5 – F18 dispensing at Clinical Research Imaging Centre (CRIC)	Is intended for recording the use of fluorine-18 in patient diagnosis and ancillary work in the PET Centre in the UoE's Queen's Medical Research Institute building at Little France.
Type 6 – Veterinary Positron Emission Tomography	Is intended to be used only to record the consumption and disposal of fluorine-18 used in the Royal (Dick) School of Veterinary Medicine for positron emission tomography.

A copy of the most commonly used Usage and Disposal sheet, the Type 1 - Uncorrected Decay version, is attached to this Guidance Note. The other versions can be found at: http://www.ed.ac.uk/schools-departments/health-safety/radiation-protection/tools-forms/forms-and-checklists.

One sheet must be used for each item of radioactive stock. Each individual researcher who uses radioactive stock (whether in whole or a fraction of) must enter the amount of stock they are using at the time it is used. In the case of the Type 2 form, the activity, after correction for decay, must be entered. In the case of the Type 1 form, a correction for decay will be done in aggregate by the nominated person at the end of the month; the individual researcher can enter the activity used as a fraction of the original activity value, without correction. The Usage and Disposal Sheets should be kept in the research laboratory where radioactive material is being used. Where the material is dispensed in one laboratory but used in another, then the Sheets should be kept in the laboratory most convenient for completion. For most people this would probably be the laboratory used for the disposal of the radioactive material. Whichever approach is used, the Sheets should be kept in a file that is clearly labelled and readily accessible. They should not be left stuck to various bits of laboratory equipment.

As an initial step, all stock is assigned a unique identification number. The method of assigning the code varies in between groups, and could be the stores staff, a Radiation Protection Supervisor, or other person given that responsibility. Whatever way is used should be specified in the Local Rules. This unique number is recorded on the Usage and Disposal Sheet. When fractions are taken from the stock, it must be possible for all subsequent experimental material, however long after the fraction was removed, to be traced back to the relevant Usage and Disposal Sheet. One technique would be to label the experimental material with, inter alia, the unique identification number. However, this might not be reasonably practicable due to the physical size of the sample container. In this case it might be possible to label the rack or box holding the sample container(s), provided that it was being used only for those samples. Another technique would be to use a form, kept at the point of storage, which can relate the identification used on the sample container to the I.D. number of the relevant Usage and Disposal Sheet. This of course still relies on experimental material being identified in some way, either individually or as a batch.

Where stock material for a number of different research groups is kept and dispensed in one laboratory for use in several others, and the Usage and Disposal Sheets are not kept in the stock laboratory, there may be a problem in identifying which laboratory contains the relevant sheet for a particular stock item. This can be simply resolved by writing on the stock pot or including with the identification number the name of the research group.

Once the material is no longer required, it becomes waste. Waste radioactive material will be disposed of by one or more of the following routes:

- discharge to the drains/sewer (if aqueous based);
- release to the atmosphere;
- placement in a designated laboratory waste bin for either:
    - transfer and incineration by the University's waste contractor;

      OR
    - disposal via normal refuse; strict conditions (the Permit you are working under must have contain standard condition G for this disposal route to be viable).

Further information on disposal routes is given in RP CoP009 "*The Management and Disposal of Radioactive Waste*"

The activity disposed of to each of these routes must be entered into the appropriate Usage and Disposal Sheet. It must be completed at the same time as the action to which it relates; it is not acceptable to record that radioactive material has been disposed of before the actual disposal takes place. "Disposal" in this context means either discharge to the designated laboratory sink, release to the atmosphere, or placement in the designated laboratory waste bin(s). For the Type 1 form, the activity disposed of can be reported without correction for decay. For the Type 2 form, the activity values

must be corrected for decay, although it is worth bearing in mind that high degrees of accuracy are not required in this respect. This sheet is not intended for recording waste accumulation or aggregate values of stock or disposals, which is done on a separate record by nominated persons at the end of each month. Note that samples left around the laboratory are deemed to be still in use, since they cannot have been recorded as disposed of. Bearing in mind the legal imposition of defining three-month-old radioactive material as waste unless proved otherwise (see "Legal Requirements" above), this means that keeping any radioactive material for this length of time must be justifiable.

In order to be able to complete the disposal section, it is imperative that a reasonable estimate of the fraction of activity being discharged by each route is made. Guidance on a suitable protocol for estimating these fractions can be found in Radiation Protection Code of Practice RP CoP004.

3.2 Reuse or Transfer

Sometimes all or part of some stock is manipulated physically or chemically and then re-used as new stock, rather than being disposed of. Material might also be transferred to other persons outside your research group. If it is to be used as new stock within the research group, then a new Identity Code must be allocated to the material, and a new Usage and Disposal Sheet started. The new ID Code must be reported on both the new Usage and Disposal Sheet and in the section entitled "Reuse/Transfer" of the existing sheet, to allow the audit trial to be continuous. If the material is being transferred to someone outside the research group, then they must start a new Usage and Disposal Sheet. In this case the name of the Research Group or Organisation to whom the material is transferred must be entered in the "Reuse/Transfer" section.

3.3 Completion of the Usage and Disposal Sheet

Additional, specific notes can be found on the back of or accompanying each Usage and Disposal Sheet. These should be read before first using a sheet.

3.4 Closure

When all the useful stock material has been used, all disposals have been made, new stock created and/or material transferred outside the research group, each sheet can be shown to be finished by ticking the box at the bottom. The name of the person ticking the box should be printed so that it is legible. If a researcher wishes to keep hold of some samples for a long time, it may be worth transferring the information to a Radioactive Closed-Source Record (see Radiation Protection Code of Practice RP CoP005) so that the Usage and Disposal Sheet can be finished. In this case an annotation should be made in the Reuse/Transfer section. Each completed Sheet must be kept for at least five years after the date of the last entry in case it is required by the enforcing authority.

4. Accounting Procedure – RETAIN

4.1 RETAIN Summary

RETAIN is an online system developed by IS and the Health and Safety Department. It is intended to be used by those using unsealed radioactive material at the University of Edinburgh and replaces the paper Usage and Disposal sheets. RETAIN is being rolled out systematically across the University so not all areas will be familiar with the system yet. Please speak with your RPS if you are unsure which accounting system to use.

Details of RETAIN can be found at the RPU webpage: https://www.edweb.ed.ac.uk/health-safety/radiation-protection/radiation-protection-management/retain.

4.2 General

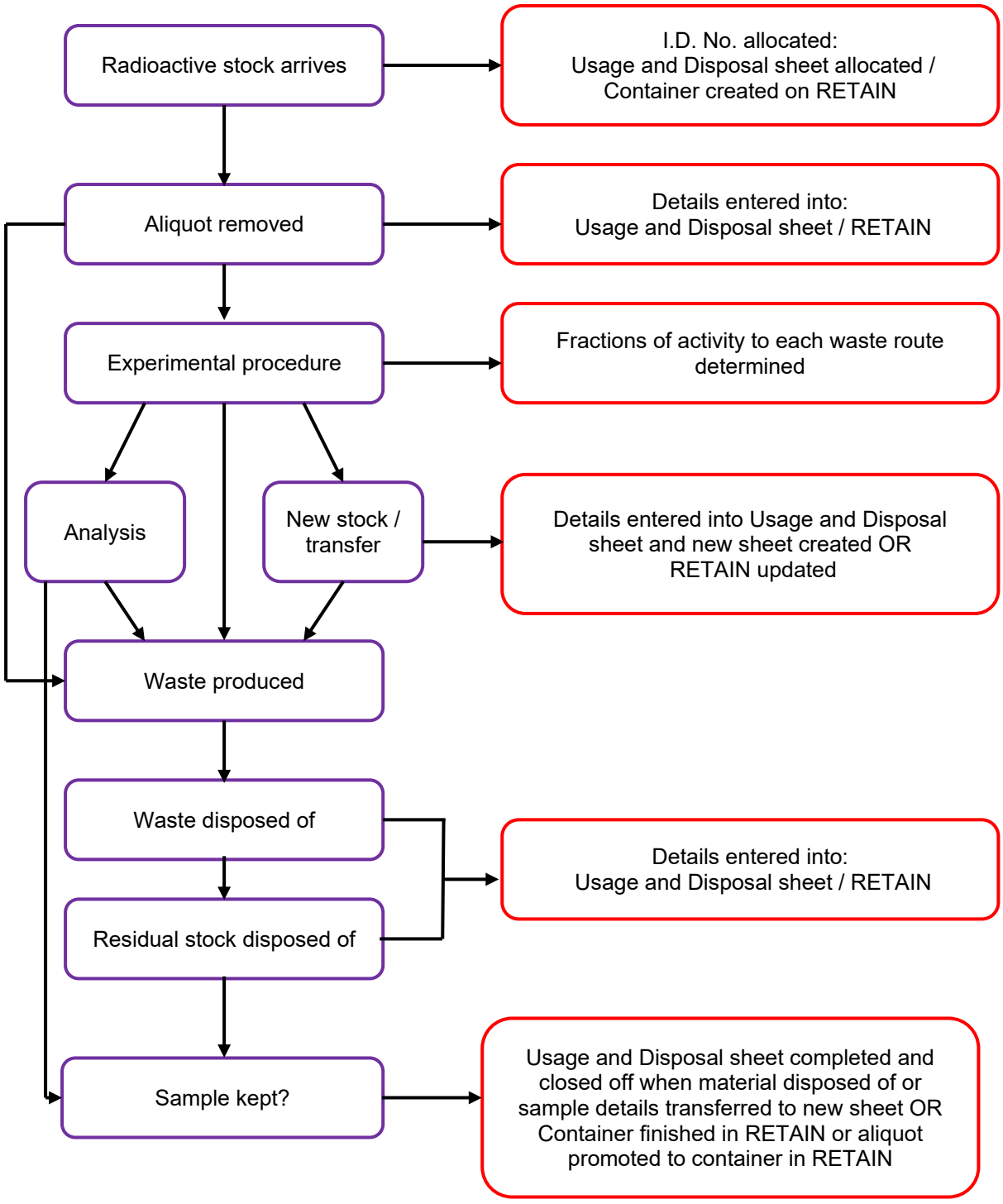
RETAIN should be used to record all the steps listed in section 3 of this Code of Practice. The major differences are:

- You will not need to keep a paper record trail when using RETAIN as all details are stored in RETAIN and are accessible by anyone who had permissions to log in
- You are required to take RETAIN training before using the system, details of the training can be found on the RPU Training Webpage
- RETAIN automatically decay-corrects so the onus for this no longer falls on the user

RETAIN is able to follow the life cycle of a source and the training will demonstrate how to complete these steps.

5. Summary

A flow chart outlining the accounting procedure is show below:



For advice on any of the above topics please contact the Radiation Protection Unit, radiation@ed.ac.uk.

UNIVERSITY OF EDINBURGH

RADIOACTIVE MATERIAL USAGE AND DISPOSAL SHEET

TYPE 1: UNCORRECTED DECAY

NAME OF GROUP: _____ ISOTOPE: _____ LOCATION OF STOCK: _____

ACTIVITY ON ENTRY TO STOCK: _____ MBq DATE OF ENTRY TO STOCK: _____ IDENTITY CODE: _____

CHEMICAL COMPOSITION: _____ ACTIVITY CONCENTRATION: _____ MBq/ml SUPPLIER: _____

a	DATE	NAME	USE (MBq)		DISPOSAL (MBq)					REUSE / TRANSFER	
b	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
c			Activity removed	Activity remaining	Aqueous to drains	Solid to Incineration	Normal Refuse	Liquid for incineration	Gaseous to atmosphere	As new stock/ transfer (MBq)	New ID Code /to whom?
d	**Brought Forward / Initial Activity:**										
e											
f	**Carried Forward:**										

Tick box when all this stock has been used and disposed of or reused and recorded elsewhere: ☐ Name of person ticking box: ……..……..

GUIDANCE NOTES FOR THE COMPLETION OF THE USAGE AND DISPOSAL SHEET

General

This Usage and Disposal Sheet is used to record the consumption of open radioactive material. It excludes closed sources and open radioactive material that is not consumed during use. This sheet allows us to determine the activity held by the Research Group at any one time and to record what amount of what isotope was disposed by which route. Further information on Usage and Disposal Sheets can be found in Radiation Protection Code of Practice RP CoP010. All persons who use stock radioactive material must complete this form, and it must be completed at the same time as the action to which it relates. It is not acceptable to record that radioactive material has been disposed of before the actual disposal takes place. “Disposal” in this context means either discharge to the designated laboratory sink, release to the atmosphere, or placement in the designated laboratory waste bin(s). There must be a Usage and Disposal Sheet for each item of radioactive stock.

Notes to the table

NAME OF GROUP – This is the name of the Research Group.

IDENTITY CODE – This is the code that will uniquely identify the particular container of stock material. It may be allocated either by the person completing this section of the form, a storeman, the RPS, or anyone else having this responsibility as identified in the Local Rules. All material removed from this stock must be labelled in such a way as to be able to trace it back to the relevant stock container and this record sheet.

CHEMICAL COMPOSITION – This need only to be a short form description of the material, eg. methionine, dCTP, D-Fructose.

ACTIVITY CONCENTRATION – In the case of liquids, state the activity per unit volume, expressed in units of MBq ml^{-1}.

COLUMN 1 – This is the date of removal of an aliquot from the stock and, if occurring on the same day, the date of disposal. If the disposal is not on the same day, then the disposal operation must be entered on a separate line.

COLUMN 3 – This is the activity removed in MBq, **not the volume**. Report the activity before decay correction, i.e. the activity of the aliquot as if it had been removed on the day of entry to the stock. Correction for decay for record purposes will be made at the end of each month on the Unsealed Radioactive Material Monthly Returns.

COLUMN 4 – This is the running total in MBq, so that the activity remaining in the stock container, without correction for decay, can be seen.

COLUMNS 5 TO 9 – This is the activity, in MBq, of the material being disposed. Report the activity before decay correction, i.e. the activity of the waste as if it had been disposed of on the day of entry to the stock. Correction for decay for record purposes will be made, where appropriate, at the end of each month on the Unsealed Radioactive Material Monthly Returns. Information on how to estimate the relative fractions of waste activity can be found in Radiation Protection Code of Practice RP CoP004. Items in Columns 5, 6, 8 & 9 refer to disposals made under the EASR Permit. Column 7 refers to solid radioactive material disposed of to normal refuse. Details of the activity limits and other conditions for disposal via normal refuse can be found in RP CoP009. Column 9 refers to the disposal of gaseous waste for which there is limits in EASR Permit. The adventitious loss of exempt gaseous waste does not need to be recorded.

COLUMNS 10 AND 11 – These columns are for use if material, rather than being disposed of, is either re-used as new stock or transferred to other persons outside your research group. If it is to be used as new stock, then a new Identity Code must be allocated to the material, and a new Usage and Disposal Sheet started. The new ID Code must be reported on both the new Usage and Disposal Sheet and in column 11 of this sheet, to allow the audit trail to be continuous. If the material is being transferred to someone outside your research group, then they must start a new Usage and Disposal Sheet. The name of the Research Group or Organisation to whom the material is transferred must be entered in column 11.

ROWS d and f – If more than one sheet is required for a stock item, the value of activity remaining in column 4 should be carried over to the new sheet using columns d and f, without correction for decay. The page number should be completed.

Completion

When all the stock material has either been used and disposed of, or become new stock and recorded on a new Usage & Disposal Sheet, the box at the bottom of the sheet must be ticked and the name of the person doing so written in - please print. The sheet must be kept for at least five years after the date of the last entry in case it is required by the enforcing authority.