9 Storage, Accounting and Leak Testing of Radioactive Material

Scope

1. This Chapter covers the legal and MOD requirements for the safe storage, accounting and leak testing of radioactive material.

Statutory Requirements

2. In addition to the general requirements of the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, the following specific legislation applies directly or is applied indirectly through parallel arrangements designed to achieve equivalent standards:

a. Ionising Radiations Regulations 2017 (IRR17) (apply directly);

b. Environmental Permitting (England and Wales) Regulations 2016 (EPR16) (as amended) (parallel arrangements);

c. Environmental Authorisations (Scotland) Regulations 2018 (EASR18) (parallel arrangements):

d. Radioactive Substances Act 1993 (Northern Ireland) (RSA93) (as amended) (apply directly)

e. Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR2019) (apply directly);

f. High activity Sealed Radioactive Sources and Orphan Sources Regulations 2005 (HASS) (Northern Ireland only) (apply directly)

Duties

3. Duties as detailed in Chapter 39 apply. In addition, the following duties also apply

Risk Assessment

4. Where work involves ionising radiation there is a requirement to ensure that the risk assessment considers radiological as well as non-radiological hazards. The requirement for a radiation risk assessment, (which must be made before a new activity involving work with ionising radiation begins) complements this risk assessment. The form of these risks assessments and the actions to be taken arising from them are detailed in Chapter 2.

Requirements for Radioactive Material in Storage

5. Radioactive materials when not in use, being moved or transported, must, so far as is reasonably practicable, be kept in a suitable radioactive store. Any store allocated to radioactive materials shall, as far as possible, be reserved for the materials, containers and handling tools and kept clear of other items, in particular flammable or explosive materials. Advice on the storage of radioactive materials is to be sought from the RPA.

Local fire authorities are to be kept informed of the location and radioactive content of all radioactive material storage areas, so that fire plans for buildings can be completed correctly.

6. Items are to be stored in a suitable receptacle to ensure effective restriction of exposure, physical security and prevention of dispersal of radioactive material. Aspects to be considered include shielding to ensure that the dose rate on the external surface of the receptacle is less than 2 mSv / hr, the ability of the receptacle to withstand damage from normal use or foreseeable misuse, and fire resistance. If an item containing radioactive material cannot be stored in a suitable receptacle, equivalent protection and containment is to be provided.

7. Radioactive materials and their containers are to be clearly labelled as radioactive, and, whenever practicable, individually numbered.

Requirements for Radioactive Material Stores

8. Dedicated buildings used as permanent radioactive stores are to:

a. provide sufficient shielding or use controls such that persons outside of the store will not receive a dose exceeding 1 mSv in a year. The risk assessment for the storage of radioactive materials will indicate likely radiation doses to persons external to the store. In practice this will normally be achieved by ensuring that the radiation dose rate at any point on the outside walls of the building is less than 2.5 µSv / hr. For new facilities the dose rate is not to exceed 1 µSv / hr unless advised otherwise by the Radiation Protection Adviser;

b. be constructed of fire-resistant materials;

c. provide protection against the weather;

d. be provided with adequate ventilation (e.g. an air extraction system exhausting to the open air) to prevent accumulations of gases and vapours or of any accidentally dispersed radioactive substance. This is particularly an issue for the storage of large quantities of GTLDs or items containing radium-226; in these cases, advice of the RPA is to be sought; and

e. provide adequate security – refer to Chapter 3 (paragraph 48.3).

9. The RPA is to be consulted on the need to designate the store as a controlled or supervised area in accordance with Chapter 4.

10. Suitable warning notices incorporating the radiation warning trefoil symbol as shown at Annex B, with the name or designation and telephone number of the RPS / WPS and details of the radiation hazard, are to be prominently displayed in appropriate languages at each entrance to a store. Signs stating the contents of a source store and the risks arising from such sources are normally to be posted at the entrance. Units and establishments are responsible for procuring sufficient stocks of suitable signs, either obtained from commercial sources or manufactured locally.

11. If only a small number of minor sources are held, it is not necessary for a dedicated building to be provided as a store. Such items can be stored in a suitably demarcated lockable metal cabinet within a general store. The cabinet is to be treated as the dedicated

source store; thus the storage requirements listed above will also normally apply to the cabinet. Advice is to be sought from the RPA as to the type of cabinet that is appropriate.

12. Very large and bulky items (such as thoriated engines) or items in temporary storage / transit not stored in a dedicated building are to be stored in dedicated areas of storage buildings that are clearly demarcated. All such items are to be kept in their transit boxes where practicable. All relevant storage requirements will apply to the dedicated storage area. Advice is to be sought from the RPA on the storage requirements.

13. Stores specifically allocated for storing radioactive materials are only to contain radioactive materials, their containers, associated handling tools and shielding materials. No other materials are to be kept within the store.

14. No corrosive, flammable or explosive substances are to be taken into or stored in any building used as a radioactive store.

15. No beverages, foodstuffs, or associated items (e.g. cutlery) are to be taken into or stored in any radioactive store. Radiation sensitive materials, such as radiographic film or personal dosemeters, are not to be stored in the vicinity of radioactive materials.

16. With the exception of High Activity Sealed Sources (HASS) (see paragraph 17), keeping portable sources in a vehicle overnight is only acceptable if it is not reasonably practicable to provide or make use of a proper store and if the vehicle is locked and kept in a secure place, such as a locked compound. HASS sources must not be kept in a vehicle overnight under any circumstances.

High Activity Sealed Radioactive Sources and Orphan Sources Requirements

17. In addition to the MOD accounting arrangements set out in this Chapter, high activity sealed sources are to be accounted for on a HASS Record Form (see Chapter 3) and are to be identified separately on the Annual Holdings Return as advised by Dstl. RPA advice must be sought before acquiring a high activity sealed source.

Radiation (Emergency Preparedness and Public Information) Regulations 2019

18. Where a premises holds large quantities of radioactive material, in excess of the values stated in schedule 1 of REPPIR2019, the employer (e.g. CO / HoE) of that premises is to make or ensure REPPIR2019 is complied with.

Accounting for Radioactive Material

19. All radioactive materials including sealed sources, unsealed radioactive substances, articles containing radioactive materials and radioactive waste are to be accounted for. Appropriate records of all radioactive material holdings are to be kept and made available for inspection.

20. Where radioactive materials are fitted to aircraft, a radioactive source list stating the inventory of those items is to be included with the aircraft documentation (MOD Form 701); this is especially important when an aircraft is under maintenance at, or visiting, another unit or establishment. The responsibility for producing and maintaining the source list lies

with the parent air station. This source list is to accompany the aircraft documentation and is to be made available to the local RSO.

Accounting for Radioactive Material on HM Ships during Refit

21. Where practicable, ships going into refit should return as many radioactive items to Naval stores or remove them to a suitable lay-apart or other store. Where this is not possible, refit authorities and Fleet Maintenance Units with personnel working in areas containing radioactive material are to be supplied with a list of all radioactive items and information on their associated hazards. Local orders must ensure the safety of refit authority personnel during their work in compartments which contain installed sources. All radioactive material is to be mustered and accounted for prior to and on completion of maintenance / repair.

Internal Transfers of Radioactive Material

22. Accounting arrangements should record any internal transfer of items containing radioactive material on-site. Details of the items being transferred should be provided such that the recipient is:

a. willing and able to accept the item(s);

b. able to ensure adequate storage arrangements are in place; and

c. able to correctly account for the items on a source list.

23. Instructions for internal movements of radioactive material are provided in Chapter 10.

Radioactive Material Source Lists and Musters

24. All radioactive items are to be entered onto a radioactive source list kept by the unit or establishment holding the items. An example of a radioactive source list is shown in Annex A. However, where all the information required for a radioactive source list is already held or can easily be adapted within other records and can be readily presented to inspecting officers, then a separate radioactive source list need not be raised. This source list need not be a hard copy document; it can be in an electronic format. If an electronic form is used, a copy of the source list is to be saved periodically either electronically or as a paper copy so that the changes in the source list over time are recorded.

25. Radioactive source lists are to be kept up to date by an appropriate person on behalf of the CO / HoE of the unit or establishment. This is usually the RPS / WPS for each storage area.

26. A review of the total holdings of each nuclide at the establishments is to be undertaken to ensure they do not exceed those detailed on the establishment's relevant environment agency notification (if held) or trigger the requirements for REPPIR (see Chapter 3).

27. The location of each source or article containing a radioactive substance must always be known. For static sources, the source list record at Annex A is adequate. For sources which can be used in a variety of locations, a source movement log is to be kept and for sources issued out to individuals, an issue log is to be maintained.

28. Musters are to be conducted at a frequency appropriate to the movement of a source, its security of stowage and its potential for becoming damaged. The frequency of muster is to be decided by the unit or establishment, although advice can be sought from the RPA. The interval between musters must not exceed one month unless otherwise advised by the RPA. A record of the muster taking place is to be retained for at least two years. Typical muster frequencies are listed below:

a. for portable sources such as radiography sources and mobile check sources, at the end of each working day; and

b. for installed or static sources, monthly and following maintenance or repair that could have affected the source.

29. An annual check is advisable to ensure that the accounting record is a true record. This can be conveniently linked to the requirement to provide Dstl with an Annual Holdings Return as detailed in Chapter 3. Any radioactive materials identified at this stage as being no longer required are to be transferred or disposed of through an appropriate transfer / disposal route. A record of the annual audit is to be kept by the unit or establishment.

30. Records of non-radioactive items contaminated with radioactive materials and radioactive waste are to be kept for each unit and establishment in a radioactive substances list. The record is to contain the following information:

a. name and address of authority holding the source;

b. place where the source is normally kept;

c. date of receipt and origin of the source;

d. nature of radionuclide and estimated activity, or dose rate at known distance from radioactive material and date of estimation or measurement;

e. nature of container;

f. details of tests undertaken to demonstrate that the exterior of the container, and surrounding areas are not contaminated;

g. date and details of removal of part of the source; and

h. date and details of final disposal.

Leak Tests

31. It is to be ensured that any article containing or embodying a radioactive substance is tested for leakage, unless it is inappropriate to do so; the RPA will be able to provide advice on leak testing requirements and methods. The purpose of a leak test is to show that the mechanisms for preventing dispersal of radioactive substances are functioning as intended. The risk assessment (see Chapter 2) is to identify potential ways in which containment could be lost and the likelihood of those scenarios occurring. The test method chosen, and the frequency of testing is to be capable of detecting leakage of radioactivity before a radiation risk arises. Annex C provides guidance on the method for carrying out leak tests on a number of common items. The interval between leak tests will not normally exceed two years and in some cases, leakage testing might be required more frequently, for example when a sealed source is going to be retained beyond the recommended

working life for the source capsule by the supplier or manufacturer, or when it is used in an aggressive or corrosive environment. A suitable record of the leak test is required is to include the following:

a. the identification of the source or article which is the subject of the test;

b. the date of the test;

c. the reason for the test;

d. the methods of test, including, when the source or article has not been tested directly, a statement of what part of the device was tested and a statement as to whether this is likely to detect any leaking material. The method will include a statement of the pass / fail criteria;

e. numerical results of the test;

f. the result of the test (pass / fail);

g. any action taken if the source failed the test; and

h. the name and signature of the person carrying out the test.

32. The current Dstl leak test certificate fulfils the requirement of a suitable record of a leak test. The record of the leak test is to accompany the associated radioactive source if this source is transferred to another establishment. A copy is to be kept by the transferring establishment.

33. The Dangerous Goods Manual contains guidance on the transport of smears from units in the UK. Units outside the UK must send smears through established channels and not via the local postal system.

Incidents, Occurrences and Accidents

34. If a radioactive source is lost or stolen or, if any radioactive substances on the source list or inventory cannot be accounted for, the RPA and TLB Safety Authority are to be informed initially. In addition, MOD, HSE, EA / SEPA / NIEA and the police may also need to be informed. Damage to a source or accidental spillages or release of radioactive material may also require notification to the RPA, MOD, HSE and EA / SEPA / NIEA. The procedures to be followed after a suspected or real loss or incident are detailed in Chapter 14.

Annual Holdings Returns

35. To enable MOD to apply equivalent arrangements to those set out under EPR16/EASR18/RSA93, Dstl maintains a database of radioactive material holdings for all units and establishments. In order to ensure that this database is accurately maintained, units and establishments are to complete an Annual Holdings Return. The following item details are required:

a. radioactive items - their NATO Stock Number, nuclide, activity and quantity;

b. High Voltage equipment capable of producing X-rays (Greater than 5 kV) – make, model, serial number and quantity;

c. Non–Ionising Equipment (radars, lasers) – NATO Stock Number, wavelength, laser classification and quantity;

d. Radiation Monitoring Instruments – NATO Stock Number and quantity;

e. Radioactive Waste, Discharges and Transfers – NATO Stock Number, type and quantity;

f. Chief Environment and Safety Officers or equivalents are to remind their units, by 1 February each year, of the requirement to complete the return by 31 March;

g. on receipt of the Annual Holdings Return, Dstl will check the data, verify any changes with the unit or establishment and update the database;

h. although the need for a permit (Notification or Approval) should have been assessed at the time of procurement or disposal commencing in April of each year, the data will be reviewed by Dstl against the requirements of EPR16 / EASR18 / RSA93. An assessment will be made on whether a new Notification, or a change in Notification status, is to be made to the appropriate Regulatory Authority for the unit or establishment and is thus liable for an annual subsistence charge;

i. Dstl will review source holdings to determine if any high activity sealed sources are held by the unit or establishment as these will become subject to special requirements. The RPA will provide advice on these special requirements but the responsibility for making an application for HASS will remain with the respective CO / HOE; and

j. Dstl will submit the updated information direct to the appropriate Regulatory Authority on behalf of the CO / HoE. The appropriate fee is to be paid by the TLB. Dstl will act as agent and will ensure that any correspondence is copied to the unit or establishment.

Records

36. Radioactive source lists, records of leak tests and lists of unsealed radioactive substances are to be retained by the unit or establishment indefinitely following disposal of the item. However, if the item is transferred to another MOD establishment, the period is 2 years (from the transfer date) for radioactive source lists, records of leak test and lists of unsealed radioactive substances. Source lists from ships that have been decommissioned and establishments that have closed are to be archived in accordance with the requirements of JSP 392 Part 1, Chapter 3.

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ANNEX A
TO JSP 392
CHAPTER 9

Example Radioactive Source List and Muster Sheet

NSN (or other ref.)	Description	Isotope	Activity (Bq)	Serial No/ Quantity	Location	Date received/ removed		Transfer/ disposed to	Date next leak test due (if required)*	Custodian

Date	Signed	Date	Signed	Date	Signed	Date	Signed	Date	Signed	Date	Signed

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Radioactive Material Storage Signs

Figure 1 GTLS Storage Sign

Radioactive Materials (GTLSs) are stored within this Cupboard

Workplace Supervisor

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Telephone.....

Figure 2 Radioactive material storage area sign

Workplace Supervisor

……

Telephone……

Figure 3 Radioactive material storage cupboard sign

Radioactive Materials are stored within this Cupboard

Workplace Supervisor

……

Telephone……

Procedures for Leak Testing Radioactive Sources

DSTL RPA Body

Institute of Naval Medicine
Alverstoke
Gosport
Hampshire PO12 2DL

Tel: +44(0)23 92 768130 / 9 3806 8130
Fax: +44(0)23 92 768150 / 9 3806 8150
Email: LHPINM@dstl.gov.uk

Equipment

This document
*Filter papers (NATO Stock Number 6640-99-220-3090)
Ziploc resealable plastic bags (NATO Stock Number 8105-99-224-6148)
Disposable gloves
Cardboard
Tape
Padded envelope
Radiochemistry Laboratory Sample Request Form - CBRD_RD_FORM_WI 005 v2

References

JSP 392 – Management of Radiation Protection in Defence
Ionising Radiations Regulations 2017 (IRR17)

Upon submitting the leak test filter paper to DSTL for analysis, a certificate will be returned to the RSO containing the results. The certificate should be filed in an appropriate place, for example with the radioactive source list. The leak test frequency of these items is every two years with the exception of SICS Mk 10 NHA where the requirement is for an annual leak test.

Procedure

1. Regulation 27(3) of Ref. B requires that suitable leak tests are carried out to detect leakage from radioactive sources. There are many equipment items in service with the UK Armed Forces that require such testing.

2. The Radiation Safety Officer of each Ship, Unit or Establishment is to ensure that such items are correctly leak tested.

3. Prior to taking a sample, a Ziploc plastic bag from the supplied kit should be marked with the following information:

   a. the date of taking the sample;

b. the name of the Ship, Unit or establishment;

c. the type of equipment being sampled e.g. “CAM # 4”;

d. the radiation source employed by the equipment e.g. “nickel-63”;

e. a unique identifying feature from the equipment e.g. serial number; and

4. Disposable gloves should be worn when taking the following sample.

5. The leak test sample should be taken by wiping the area immediately surrounding a radioactive source with a small circular “filter” paper from the supplied pack. The purpose of this is to collect any potential escaping radioactive material. It is important to observe the following discipline:

a. do not write on the filter paper;

b. do not bend or tear the filter paper;

c. do not moisten the filter paper with water or any other solvent; and

d. do not apply tape to or staple through the filter paper

6. The paper should be placed in the Ziploc bag which was marked in step 3. This bag should then be sealed.

7. Once all items have been tested and samples obtained, all sealed bags should be placed together between two pieces of card to keep them flat. They should then be placed into the supplied pre-addressed envelope supplied in the pack.

8. The “DSTL Radiochemistry Sample Analysis Request” supplied with this document should be completed with all relevant information and placed in the same envelope. The envelope should then be mailed to DSTL.

Leak Test Procedures for Specific Equipment

CAM and MCAD

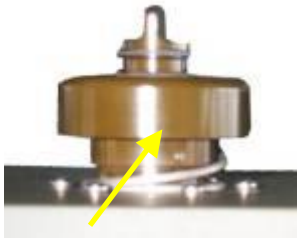
a. wear disposable gloves;

b. do not moisten the filter paper, this could affect the function of the CAM / MCAD;

c. when examining CAM, remove the black nozzle assembly from the front of the CAM;

d. wipe the filter paper around the white air exhaust ports at the base of the air intake nozzle, and inside the black nozzle;

e. with MCAD, use one dry filter paper to wipe both of the areas described below;



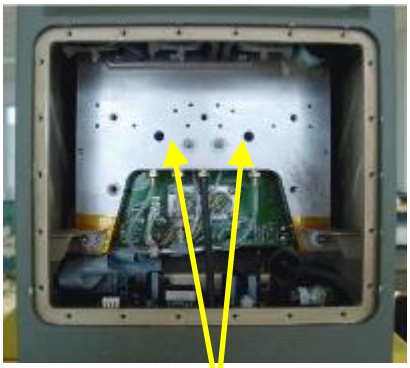
Wipe the inlet port under the rain cap assembly

Wipe the MCAD exhaust port

f. in addition, a supplementary leak test of the air inlet manifold of the MCAD should be undertaken to coincide with sieve pack replacement. One dry sample should be taken.

****Warning: Dangerous substances and fumes**

g. the RTC battery can vent at any time causing the release of dangerous substances and fumes. Suitable precautions must be taken when opening the sieve pack door to prevent contact with these substances or inhalation of the fumes.



Wipe the air inlet ports

SICS Mk.10 NHA

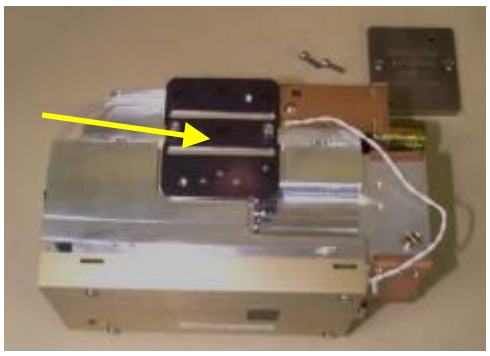
a. the SICS Mk10 NHA requires leak testing every year;

b. wear disposable gloves;

c. do not moisten the filter paper, this could affect the function of the SICS Mk10 NHA; and

d. remove the Sieve Pack Assembly and wipe the outside surface of the sieve pack including the area around the air intake from the Drift Tube Assembly unit.

The sieve pack unit should be pulled forward.



Wipe the area around the sieve pack.

Mk. 13NJ and 1623A Check Sources

Mk. 13NJ

1623A

a. wear disposable gloves;

b. do not moisten the filter paper;

c. each check sources can be leak tested by wiping the closed outer surface of the units; and

d. do not wipe the inner surfaces of the units.

Smoke Detectors

F36 Smoke Detector

F31 Smoke Detector

a. wear disposable gloves;

b. do not moisten the filter paper; this could affect the function of the smoke detector;

c. the smoke detectors can only be practically leak tested by wiping around the unit, especially between the unit and the surrounding fixtures; and

d. take care to be aware of any electrical hazards from power supplies.

TRaME

a. wear disposable gloves;

b. do not moisten filter papers (two will be required);

c. there are two items within the TRaME / Exploranium package that contain caesium-137 sources. These are the base plate and check source, and each should be wiped separately;

d. both items should have their plastic housings checked for damage. If any is found, isolate the item and consult your RPA;

e. the underside of the docking station (left) should be wiped with the first filter paper; and

f. the upper face of the check source (right) should be wiped with the second filter paper.

CBR Division Radiochemistry Sample Request Form

1 The information requested in Sections 1, 2, 3 and 4 must be completed by the originator.
2 CBR Division Radiochemistry facility staff will not submit samples for analysis without full information and a signature from the facility manager, or representative thereof, in the appropriate boxes.
3 Please list all the sample descriptors on page 2 of this form.
4 Please indicate whether you require hard copies of certificates or electronic copies via e-mail;
Hard Copy ☐ Electronic Copy ☐ (Please Provide e-mail address in the box below).

Section 1 – Customer Details

Please send the completed form to	Please Provide Return Details:	
Radiochemistry Facility **Dstl CBR Division** Institute of Naval Medicine Crescent Road, Alverstoke Gosport, Hants, PO12 2DL Tel 023 92768164 Fax 023 92768150 E-mail; RadioChemistry.ESD@dstl.gov.uk	To:	
	Unit Address for return of results/ certificates:	
	Tel:	
	E-mail:	
Person requesting the analysis		
Unit or Company the samples have come from		
Date of submission		
Date the report is required by		
For D		
Dstl Assignment and Item codes		
Project Facility Managers Authorisation Signature*		
Reviewed and Accepted by Facility staff*		

*These two areas needs to be completed when both parties are satisfied with the information provided and that resources are available.

Section 2 – Analysis and Limit of Detection required

To include details of suspected nuclide identity, and required limit of detection [LoD] - This will minimise count times.

Sample Type	Quantity	Nuclides Required	LoD Required	Is the activity of the sample likely to be **greater than background**?
Are any of these samples a possible mixture of pure Beta and Beta/Gamma emitters?				Y/N

Any other relevant information concerning the analysis and further notes

Section 3 – Disposal arrangements (Please tick the appropriate box)

Dustbin if the activity is at Background levels	

Return to Originator after analysis	

Section 4 – Sample Description (Please complete for all the samples. Use a continuation sheet if required)

Sample number	Sample Descriptor i.e. instrument type, serial number, nuclide	Analysis Type Dstl Use
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
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