Charles Sturt University

# Radiation Management Plan

## Booklet 7 -
## Record keeping and accountability

IN THIS BOOKLET



# 1. Personal radiation monitoring doses

### Radiation Monitoring

Monitoring, where appropriate, includes the measurement of doses received by laboratory workers, external dose rates in the laboratory, amount of radioactive contamination on surfaces and articles in the laboratory, and radioactive contamination in the air and in effluents. The radiation monitoring program must be documented and should be continually reviewed and amended in the light of operational experience.

The type and degree of monitoring required depends on the circumstances and the level of exposure. When assessed doses are well below the dose limits, group or area monitoring strategies may suffice.

Workers in laboratories where radioactive substances or sources of ionising radiation are used shall have ready access to radiation monitoring equipment as specified by the RSC. In particular, at least one appropriate contamination monitor shall be available for every laboratory where unsealed radioactive substances are used. If high activity sources (sealed or unsealed), or irradiating apparatus could give rise to an external radiation hazard, a dose-rate monitor shall be available.

The advice of the RSC shall be obtained:

(i) on the type and characteristics of the radiation and contamination monitors required for unsealed radionuclide work proposed or being carried out; and

(ii) whether a radiation monitor is required, and if so, the appropriate type for work with sealed radionuclide sources or irradiating apparatus.

Further information and advice on the choice of suitable instruments may be obtained from the RSC.

RSC to produce and publicise a list of all monitoring requirements as they relate to equipment. Individual equipment must be displayed the required monitoring relevant in the area adjacent to the equipment in a visible and easily accessible location.

## Personal Monitoring

Individual personal monitoring shall be implemented when required by the regulatory authority or as advised by the RSC.

The type and degree of monitoring required depends on the circumstances and the level of exposure. Any estimate to assess the level of exposure should consider the potential exposure in an unplanned incident situation.

For any worker who regularly works in a Supervised DRA or who enters a Controlled DRA only occasionally, it may be appropriate to assess the occupational exposure based on the results of workplace monitoring or individual monitoring. For any worker who usually works in a Radiation Controlled area, or who occasionally works in a Radiation Controlled area and may receive a significant dose from occupational exposure, individual monitoring must be undertaken. Individual personal monitoring may use any one of, or a combination of, whole body dosimeter, extremity dosimeters, direct reading personal dosimeters, personal air samplers, whole body monitoring, and biological monitoring as appropriate.

The aim of personal monitoring is to ensure that the doses received by the individual are kept within those listed in Appendix 3.1 (see RMP Section 3), and any dose constraints so applied by the institute or the RSC.

Continuous personal monitoring of an external dose should be performed by a dosimetry service accepted by the regulatory body. For controlling individual exposure on a day-to-day basis, or during a particular task, it may be necessary to use supplementary dosimeters of the direct reading type (active dosimeters). If a worker is liable to receive an equivalent dose to the extremities, skin, or lens of the eye that is a sizeable fraction of the relevant dose limit, these tissues and organs should be monitored separately.

Where sudden unexpected increases in exposure might result in a significant dose being received by a worker, provision should be made for the continuous monitoring of the dose rate using an instrument fitted with appropriate audio and/or visual alarms to warn of unacceptable conditions. RSC to indicate where this is required as part of assessment and recommendations of a radiation project submission.

If there is a possibility of exposure to unsealed radioactive substances, the activity concentration in air or intake of radioactivity into the body should be established to be used as an indication of whether there is a potential for a significant individual exposure. If this level is exceeded, the RSC will advise on measurement procedures to be implemented, including additional direct measurements of the individual's internal exposure (for example, thyroid monitoring of persons working with radio-iodine, or urinalysis for persons working with soluble radionuclides).

In cases where individual monitoring of the worker is not feasible, when would this be? the occupational exposure should be assessed on the basis of the results of workplace monitoring and information on the locations and durations of exposure of the worker.

The RSC have established the following actions that are to be taken when the dose reported for a personal radiation monitor exceeds certain dose constraints:

| Monitoring Period | | | Action to be taken |
|---|---|---|---|
| **Monthly** | **Quarterly (3 monthly)** | **Semi-Annual (6 monthly)** | |
| - | 0.5 mSv to 1.5 mSv | 0.5 mSv to 3 mSv | **Low Dose - When dose exceeds 0.5 mSv as notified by dosimetry monitoring company:**<br>The Radiation Monitoring Unit will immediately inform the wearer in writing and investigate the circumstances concerning the receipt or possible receipt of the dose. An incident report is optional in the first instance, but required for any subsequent notifications for a wearer. The report on the investigation must be placed on file in the Faculty and incident reports provided to the RSC.<br>This must be entered into Protecht to document and record the results of the investigation. |
| 0.5 mSv to 1.5 mSv | 1.5 mSv to 4.8 mSv | 3 mSv to 9.6 mSv | **Warning Dose - When dose exceeds 30% of the legal dose limit:**<br>The Radiation Monitoring Unit will inform the wearer in writing within 5 days, and investigate the circumstances concerning the receipt or possible receipt of the dose. The wearer must be asked to submit an incident report form via the CSU Health and Safety Portal (Protecht) This must be entered into Protecht to document the exposure and record the results of the investigation which must be completed by the supervisor or program administrator.<br>A report must be submitted to the RSC and placed on file in the Faculty. |
| > 1.5 mSv | > 4.8 mSv | > 9.6 mSv | **Exceeded Dose Limit - When dose exceeds the legal dose limit:**<br>The Radiation Monitoring Unit will immediately inform the wearer and RSC in writing and investigate the circumstances concerning the receipt or possible receipt of the dose. The wearer must submit an incident report form via the CSU Health and Safety Portal (Protecht) immediately upon becoming aware. A report must be submitted to the RSC immediately and placed on file in the Faculty.<br>The RSC will advise the Deputy Vice Chancellor (Research, Development and Industry) of the exceeded dose and investigation report as soon as the Committee is made aware.<br>A member of the RSC will complete an investigation and lodge with the RSC.<br>The dosimetry monitoring company must report these doses *directly* to the Radiation Control Section of the EPA, and the University will be required to provide a report of the investigation conducted within seven (7) working days after notice of result. |

- *The dosimetry monitoring company highlights doses of 0.5 mSv or higher, regardless of wear period.*
- *These numbers have been set by the RSC and are based on laboratory averages, the industry standard 30% notification threshold and the internal rule set by the NSW EPA that recommends organisations set their action and investigation levels below what the regulatory authority would work at, to ensure the health and safety of employees and other persons for which they have a duty of care. For further advice or information, please refer to ICRP 103 and the IAEA General Safety Requirements Part 3, or contact the EPA.*

# 2. Inventory of regulated material

### Background

The Radiation Management Licence (RML) holder (the Vice Chancellor, delegated to the Radiation Safety Committee (RSC)) has the sole responsibility for the purchase of all radioactive substances, uranyl salts, sealed source devices, and ionising equipment.

The Radiation Management Licence (RML) holder (the Vice Chancellor, delegated to the RSC) has the sole responsibility for the storage and disposal of all radioactive substances, uranyl salts, sealed source devises, and ionising equipment.

### No holder of a user license can:

- purchase, acquire by borrowing or trading or changing ownership of radiation (radioactive substance, sealed source devices, and ionising equipment)
- organise, form, or control any storage facility for radiation
- dispose of radiation (radioactive substance, sealed source devises, and ionising equipment.

### Acquisition Procedure

This procedure also applies to acquisition by borrowing. Applications to acquire radioactive substances, irradiating apparatus, radioactive nuclides, or uranyl salts must be sent to the Radiation Safety Committee for approval prior to purchase or loan. A Purchase Requisition must not be lodged until an approval number has been issued by the Radiation Safety Committee. The form will contain:

- user licence details
- the RSC approval number
- name of the substance and amount, or equipment to be purchased
- the supplier details
- import licence number (if applicable)
- information about storage and disposal

Security management plan:

The appropriate forms are available from the Forms and Resources page of the RSC Website:

### Storage Procedure

- The RML holder (or delegate) will be responsible for approving, keeping, and maintaining a record of all forms of storage for radiation including rooms, cupboards, and fridges.
- The Work Health and Safety (WHS) unit in cooperation with the RSC will organise, inspect, approve, and ensure the integrity of storage facilities.  What parameters are required to be met? Is there a standard? Is this in conjunction with Facilities Management?
- RSC to provide WHS with an inventory of the storage facility  to enable an inspection to be conducted at a minimum interval of every 6 months.  users must also complete a 6 monthly return self-inspection.  WHS to audit inspections.
- Refer to RMP Section 18 in regard to radioactive waste storage.

Access to such storage unit/s will be restricted and be a part of the initial RSC approval process. Any subsequent changes to access requirements will require an amendment to the RSC approval, with the local management maintaining a copy of this RSC amendment.

**Documentation**

The Application to Acquire Radioactive Substances and Application to Acquire Irradiating Apparatus forms are available from the Forms and Resources page of the RSC Website:

# 3. Testing where required and quality assurance program

### Radiation Management Licence Holder

In accordance with the ARPANSA Medical Code of Practice (RPS14), the Chief Executive (in NSW this is the Radiation Management Licence (RML) holder or the delegate) must ensure that a comprehensive equipment Quality Assurance program is established, performed, maintained, and regularly reviewed at any site where radiation-producing equipment or radioactive sources are used.

The RML holder may delegate to the manager of Work Health and Safety the process and record keeping for the QA program. Additionally, this delegation may include that the process is conducted, maintained, and regularly reviewed in the future, but not the responsibility for a QA program.

The Chief Executive must also ensure that the results of each Quality Assurance program and their outcomes are clearly documented.

The Chief Executive must, following any repair, maintenance, or modification of radiation-producing equipment, or equipment containing radioactive source(s), that could impact radiation safety, ensure that:

(a) the operation of the equipment is re-assessed so that the radiation safety of patients, staff and the public is maintained; and

(b) a radiation survey is carried out by a medical physicist. Who is this person, are they staff or an external contractor/service provider?)

### The Radiation Safety Committee or Medical Physicist

The RSC or medical physicist must undertake or oversee the calibration and quality assurance program and carry out any radiation surveys that are required. An NSW EPA approved consulting radiation expert (CRE) are accredited to assess ionising radiation apparatus. See NSW EPA guidance for individuals qualified and accredited to assess ionising radiation apparatus or fixed radiation gauges.

### The Radiographer, Radiation Therapist, or Nuclear Medicine Technologist

The radiographer, radiation therapist, or nuclear medicine technologist must undertake the calibration and quality assurance program according to the protocols approved by the RSC or medical physicist. Include results and checks as part of 6 monthly inspection.

### Radiology Quality Assurance

#### a. Acceptance Testing

At installation, a series of acceptance tests should be performed to define the acceptable range of parameters that will be monitored in the subsequent constancy tests. The compliance tests necessary for equipment registration will form part of the acceptance tests.

#### b. Constancy Testing

Constancy tests designed to assess the subsequent performance of the equipment, image quality, and patient dose should be performed at regular intervals. The following table of testing frequencies has been recommended by the ACPSEM (Recommendations for a technical quality control program for diagnostic X-ray equipment, 2008)

**Category of Equipment**

**Recommended Interval Between Tests**

- Mammographic, CT, and fluoroscopic X-ray apparatus (Fixed or mobile) …… 6-12 months
- General radiographic x-ray apparatus (including dental OPG and cephalometric) …… 12 months. (max 24 months)
- CR/DR image receptors and other image processing systems …… 12 months
- Dental (intra-oral) and DEXA …… 36 months

The frequency of inspection recommended for the different classes of equipment is seen as a compromise between the potential for injury to individual patients undergoing imaging-based procedures, the inherent reliability of different modalities, and the cost and inconvenience of testing. The RANZCR, in its Standards of Practice for Diagnostic and Interventional Radiology, Version 9, require the following minimum equipment quality control:

"8-2-2 BMD Equipment Quality Control
Practices performing BMD must comply with the quality control requirements of the Accreditation Guidelines for Bone Densitometry, published by the ANZBMS."

This requires, at time of installation, machine calibration and testing by supplier.

- accuracy and precision evaluation:
  - in vitro: short-term precision
  - in vivo: short-term precision
- calibration and quality control according to manufacturer's specifications. The QC phantom shall be scanned at least twice weekly (and preferably daily) using the same scanning parameters. This phantom is not the daily calibration phantom, but is an anthropomorphic (or quasi-anthropomorphic) phantom recommended by (or at least acceptable to) the manufacturer.

"9-1-1 CT Performance Testing (2008)
The practice shall undertake all quality control requirements as determined by the manufacturer including maintenance and calibration."

"9-3-4-2 CT Dose (2008)
The practice maintains and regularly reviews CT scanning protocols which are optimised to limit patient radiation exposure.

Where the CT unit being used is capable of displaying DLP or CTDI figures, the practice shall review CT patient dosimetry for specific common scan protocols, and shall document the typical dose length product for the specified protocols."

"10-3-2-1 General X-Ray Image Review - Plain Film (2008)
The practice shall ensure that X-Ray repeats are monitored and reviewed in adherence to the ALARA Principle."

"10-3-2-2 CR/DR Performance Testing (2008)
The practice shall maintain a Quality Assurance (QA) program specifically designed to assess the performance of its CR/DR equipment. The practice shall as a minimum follow the manufacturer's recommended QA program.

An acceptable QA program must, as a minimum:

- keep in the vicinity of the equipment and maintain dose output records (to commence from acceptance testing) and reviewing dose optimisation at least 6 (six) monthly ensuring that any general increase in dosage levels is identified and examined, and where required corrected; and
- conduct analysis of repeats and recording findings and corrective and/or preventive action taken.

“10-4-1 Radiation Safety - Fluoroscopic Examinations (2008)
A log must be maintained of screening times and (where the fluoroscopy equipment is capable of this) dose for all fluoroscopic examinations.
Corrective action shall be taken as necessary to minimise patient exposure.

“13-2-2 Diagnostic Mammography Quality Control for Film Screen Mammography Units (2008)
There must be documented procedures for quality control checks as specified in the ACPSEM Standard for Facility Quality Control Procedures” (Craig AR et al., Recommendations for a mammography quality assurance program, Appendix 1, Aust Phys Eng Sci Med, 2001, 24:107-131).

“13-2-3 Diagnostic Mammography Annual Equipment Testing (2008)
Mammography equipment must be tested annually in accordance with the ACPSEM Standards for Mammography System Performance and Medical Physics Testing” (Craig AR et al., Recommendations for a mammography quality assurance program, Appendix 2, Aust Phys Eng Sci Med, 2001, 24:107-131).

“13-2-4 Diagnostic Mammography Annual Equipment Testing - CR/DR Mammography Equipment (2008)

Computed radiography (CR) and full field digital (DR) mammography equipment shall be tested in accordance with the manufacturer’s guidelines, and the RANZCR Mammography Quality Assurance Program (CR/DR).”

“13-6-1 Mammography Radiation Dose Limit (2008)
The practice must not exceed the Mammography Radiation Dose Limit requirements of the RANZCR Mammography Quality Assurance Program.

The average glandular dose as determined by the dosimeter must not exceed 2 mGy (200 mrad) per view, using the RMI-156 phantom or another of equivalent constitution.”

### Calibration, Acceptance and Tests of Nuclear Medicine Equipment

Nuclear Medicine Quality Assurance programs focus on image quality, radiopharmaceutical quality, and patient dose optimisation. The basic elements consist of:

- equipment acceptance testing;
- equipment constancy testing;
- radiopharmaceutical quality testing;
- record keeping;
- patient activity surveys; and
- keeping records of equipment unscheduled downtime and the reason for the failure.

### Acceptance Testing of Nuclear Medicine Equipment

At initial installation, the nuclear medicine equipment (e.g. radionuclide dose calibrators, gamma cameras, PET cameras, autogamma counters, laser film imagers) need to undergo acceptance testing to ensure that the equipment performance complies with the manufacturer’s specifications, and also to establish a baseline against which future equipment performance can be evaluated. The results of the acceptance testing will need to be documented and available for inspection by the relevant regulatory authority.

Any radionuclide sources used in performing accuracy checks of radionuclide dose calibrators will need to have a calibration traceable to a national or international standard.

## Repair and Maintenance of the Nuclear Medicine Equipment

Nuclear Medicine equipment must only be repaired/maintained by qualified service engineers who possess a current radiation licence covering the use of radioactive substances for quality assurance purposes.

Following calibration or repair (prior to clinical use), equipment performance must be assessed to demonstrate that it is at a level which equals or is better than that expected for routine performance of clinical work. This judgement would be made by comparison of the equipment performance to baseline or recent quality control assessments.

### 1. NUCLEAR MEDICINE QUALITY ASSURANCE, INCLUDING RADIOPHARMACEUTICAL QA

Local QA programs should clearly define the:

- types of constancy tests;
- frequency of tests;
- tolerance of each parameter being monitored; and
- procedure for staff to follow when tolerance is exceeded.

The results of constancy testing need to be reviewed as a matter of routine and any anomalous results reported immediately to the Responsible Person, usually the RSC staff.

Tests designed to assess the performance of the equipment must be conducted, taking into account:

- the likelihood of an equipment failure or a measured parameter falling outside an acceptable tolerance range; and
- the consequences that follow when such an event occurs.

### 2. GAMMA CAMERAS

Suggested Gamma Camera tests and frequencies are outlined in the document “Minimum Quality Control Requirements for Nuclear Medicine Equipment,” prepared by the Technical Standards Committee of the Australian and New Zealand Society of Nuclear Medicine (ANZSNM) and available at: http://www.anzsnm.org.au/nmofs/1585311305/Minimum_QC_Tests_5_7.pdf

3.6.2. PET Equipment

For PET equipment, the Technical Standards Committee of the Australian and New Zealand Society of Nuclear Medicine (ANZSNM) have produced the document “Requirements for PET Accreditation (Instrumentation & Radiation Safety)” which outlines minimum performance parameters for the PET scanner in an accredited PET facility measured using NEMA NU2-2001 protocols. This is available at: http://www.anzsnm.org.au/nmofs/1117150996/TSC_PETaccred_4_May07.pdf

Current required performance parameters are as follows:

| Parameter | Specification |
|---|---|
| Transverse resolution at 1 cm radius | □□6.5 mm |
| Axial resolution at 1 cm radius | □□6.0 mm |
| Transverse (tangential) resolution at 10 cm radius | □□8 mm |
| Axial resolution at 10 cm radius | □□8 mm |
| System sensitivity | □□4.0 cps/kBq |
| Peak noise equivalent count rate (NECpeak) at activity concentrations of □10 kBq/ml | □□30 kcps |
| Maximum count rate error over the central 80% of axial FOV (after dead time correction) at or below NECpeak | □□10% |

### Testing of Dose Calibrators

For dose calibrators, the following tests should be conducted at the frequency indicated below, and to the indicated tolerance:

a. background:
   at least once each work day prior to the first assay of patient dosages or whenever contamination of the dose calibrator is suspected;
b. constancy:
   at least once each work day prior to the first assay of patient dosages (±10 per cent);
c. linearity:
   at installation and at least annually thereafter, and after repair or movement (±10 per cent);
d. accuracy:
   at installation and at least annually thereafter, and after repair or movement (±10 per cent); and
e. geometry independence:
   at installation and after repair or movement (±10 per cent).

Recommended testing frequencies for dose calibrator quality control procedures are as follows:

| **Quality Control Procedure** | **Testing Frequency** |
|---|---|
| Constancy | Daily |
| Linearity | Annually |
| Accuracy | Annually |
| Geometry independence | At calibrator acceptance and then for any change in sample geometry |

Repair, replacement, or arithmetic correction will need to be conducted if the dose calibrator falls outside the indicated tolerances.

Details of procedures that may be used to meet these test requirements are provided in Annex F of ARPANSA's Radiation Protection Series No. 14.2 Safety Guide Radiation Protection in Nuclear Medicine.

### Testing Radiopharmaceutical Quality

The *in vivo* behaviour of a radiopharmaceutical is dependent upon its quality, which includes high standards of radionuclidic, radiochemical, and chemical purity. The specifications and quality control testing for most of the currently used radiopharmaceuticals are given in the British Pharmacopoeia (BP) or other suitable Pharmacopoeia (e.g. USP). There should be written local procedures detailing all aspects of quality control testing that should be considered before the radiopharmaceutical is administered to the patient.

**Technetium-99m Generator**

A molybdenum-99 breakthrough measurement needs to be performed on all elutions from each technetium-99m generator and the following records kept of all generator elutions:

(a) dose calibrator setting where the isotope is manually dialled;
(b) reading of long-lived reference source;
(c) time of elution;
(d) volume of eluate;
(e) technetium- 99m activity;
(f) molybdenum-99 activity; and
(g) radionuclidic purity.

BP specification for molybdenum-99 impurity in sodium pertechnetate eluate is 0.1% or a limit of 1 MBq of molybdenum-99 per GBq of technetium-99m at the time of administration. If this level is exceeded, then the technetium-99m solution has failed quality control and is not to be used in the preparation of radiopharmaceuticals for patient use (Note: The US pharmacopoeia limit of 0.15 MBq Mo-99 per GBq Tc-99m is also commonly used).

Aluminium ion breakthrough should also be checked on any eluate used to prepare products that are adversely affected by the presence of aluminium.

**Technetium-99m cold kits.**

All technetium-99m cold kits should be reconstituted in accordance with the manufacturer's instructions. The (internal) written procedures detailing the method for reconstitution should also state the quality control testing that is to be carried out on each particular product. The procedure should therefore include any appropriate radiochemical purity testing to be performed on the reconstituted kit prior to patient administration.

**Use, Maintenance and Calibration of Radiation Measuring Instruments**

Proper radiation survey meters must be used for each radiation survey required by this Plan. A survey meter is considered proper if it:

(a) has sufficient measurement range to measure ambient dose equivalent rates at least throughout the ranges of 0.5 □Sv hr-1, or its equivalent, to 1 mSv hr-1 (2 mSv hr-1 for radiotherapy use) or its equivalent from the radioactive sources used;

(b) continues to indicate, either visibly or audibly, when radiation levels exceed the maximum reading in any measurement range; and

(c) indicates the measured quantity with a measurement uncertainty not greater than ± 25% inclusive of uncertainty due to response variation with energy over the range of energies of the radiation to be measured.

Radiation survey meters used for the purposes of completing the above must have an operational and calibration check performed:

(a) prior to initial use;

(b) at intervals not exceeding 12 months; and

(c) following damage or repairs.

## Veterinary Radiology Quality Assurance

**Quality Assurance Program**

A quality assurance (QA) program approved by a CRE should be instituted and maintained. The program should ensure that consistent, optimum-quality images are produced so that the exposure of operator, staff, and the general public to radiation satisfies the 'as low as reasonably achievable' principle.

QA procedures should be standardised and documented in a QA manual.

## Ongoing Testing

The QA program should include checks and test measurements on all parts of the imaging system, as indicated in NSW Guideline 6 Part 4 and in ARPANSA RPS 17, at appropriate time intervals not exceeding one year.

# 4. What to do with regulated material when it is no longer required

### Storage Procedure

- The RML holder (or delegate) will be responsible for approving, keeping, and maintaining a record of all forms of storage for radiation including rooms, cupboards, and fridges.
- The Work Health and Safety (WHS) unit, in cooperation with the RSC, will organise, inspect, approve, and ensure the integrity of storage facilities.
- WHS will ensure an inventory is conducted at a minimum interval of every 6 months of the storage facility. Inventory does this mean a count of equipment? Is there a list? Labs could complete a 6 monthly check and submit to the RSC that can then be collated into a whole of CSU list of equipment. This can be audited by WHS periodically,
- Refer to RMP Section 18 in regard to radioactive waste storage.
- Access to such storage unit/s will be restricted and be a part of the initial RSC approval process. Any subsequent changes to access requirements will require an amendment to the RSC approval with the local management maintaining a copy of this RSC amendment.

### Background

This document describes appropriate methods for the storage and eventual disposal of waste radioactive material. Legislation requires that the Radiation Management Licence Holder is the responsible person for this waste from the time of acquisition, and this responsibility cannot be delegated. However, the Principal Investigator 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 the following:

- 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 Regulation 2013, 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, 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 Radiation Control Regulation 2003.

  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 Protection from Harmful Radiation Regulation 2013.

## Responsibilities

### 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 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;
- be disposed by the responsible 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 anyone who generates radioactive waste records 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.

### Central Store Manager

The person responsible for the central store will ensure:

- that the storage area or facility complies with legislation; and
- a logbook of stored radiation material is available and kept in the storage area or facility.

### Radiation Management Licence Holder

Radiation Management Licence Holder must ensure that:

- all radioactive waste is stored or disposed of in accordance with the current legislation;
- all dealings with radioactive waste storage or procedures are kept in a written form (could be electronic) and documents stored for at least 5 years and destroyed only if permission is gained from the Director-General of the EPA; and
- a store or storage area for radioactive sources within the premises is constructed of durable materials, is lockable and secure.

**NOTE:**

Requirements for an approved radiation waste store or storage area

The radiation level in any store or storage area or any accessible surface on the outside the store or storage area must not exceed the dose limits in Schedule 5 of the Protection from Harmful Radiation Regulation, the dose constraint for the general public detailed in NSW Guideline 7 and be in accordance with the concepts as detailed in ARPANSA RPS16 Predisposal Waste Management. The accepted conservative limits, based on these concepts, as being:

- if only occupationally exposed persons have access to the area of the storage then the dose rate at 5cm from the outside surface of the storage unit must be at or below 5□Sv/h.
- 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 outside surface of the storage unit must be at or below 0.5□Sv/h.

### 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.

# 5. Storage of records

## Background

This procedure will list the legally mandated recordkeeping requirements with regard to radiation safety.

The storage of records, including records of staff occupational exposure:

- All records referred to in points 2.1 (i-ix, xiii, xv and xvii) must be kept until such time as the Director-General of the EPA gives consent to dispose of them.
- All other records listed in 2.1 not identified above must be kept at the site of the registered device, apparatus, or premises for a period of 6 years after the event requiring documentation. Once a project is completed the records are to be archived centrally, accessible by the RSC and the RML.

## Responsibilities

### Technical Support Unit

The Technical Support Unit will ensure that the following records are kept and maintained for Schools, Centres, and Facilities that use radiation, but have no authority or responsibility in terms of the

Radiation Management Licence – this is ultimately the responsibility of the RML holder and/or their delegate.

The Technical Support Unit must ensure that the records marked with an asterisk (*) are maintained centrally for the University and that they are required to provide a current copy of these records to the RSC every 3-6 months (or sooner in some cases). See the Institutional Responsibilities section of the RSC Annual Plan for further details and reporting deadlines each year.

The process will be to forward an electronic copy of the inventory to RadiationSafety@csu.edu.au and ohs@csu.edu.au and indicate clearly in that copy that it has not been changed since the last submission or that it has been changed and highlight the changes.

Required records are as follows:

(i) Radiation Accident/Incident Reports (NOTE: See RMP Section 19 in regard to notifications as some incidents need to be reported as soon as they occur or notification is received) *
(ii) Register of User Licences *
(iii) Register of Student Exemptions *
(iv) Register of Personal Monitoring *
(v) Inventory of Unsealed Sources *
(vi) Inventory of Sealed Sources *
(vii) Register of Facilities and Equipment (laboratories, radiation stores, etc.) *
(viii) Inventory of X-ray equipment (all equipment that has an X-ray tube or X-ray capability) * (NOTE: This can be combined into the Register of Facilities and Equipment)
(ix) Register of Radioactive Waste *
(x) Register of Portable and Non-portable radiation monitors and detectors *
(xi) Register of Monitor and Detector repairs and calibrations *
(xii) Record of use of facilities (including all irradiating apparatus)
(xiii) Register of Facilities Inspections *
(xiv) Record of Contamination and Area Monitoring
(xv) Register of Ionising Equipment Repairs, Calibrations and Certifications (NOTE: A record of all certifications is also to be kept in a central location by/available to the RSC)
(xvi) Register of Clinical Equipment QA tests
(xvii) Register of Projects and Teaching involving Radiation including Approval Numbers (NOTE: This is maintained by the RSC)

### Radiation User Licence Holders

Radiation User Licence holders are to keep and maintain all records regarding the usage, storage, waste, equipment maintenance, purchase, disposal, and monitoring of radiation or radiation equipment associated with their project. They should be in accordance with the above list.

## Record Keeping

### Record of Radiation Accident and Incidents

It is a legal requirement that there is a central (company/institute) record of all accidents and incidents that involve radiation. This is maintained by the WHS section of CSU, with all reports lodged via the SCRIM system. Records need to be provided to and maintained at both at the Facility/School and the RSC. The legal minimum to be recorded is as follows:

(a) particulars of the accident or incident, including where it occurred and the period during which there may have been uncontrolled emission;

(b) names of any persons witnessing the event, or who may have been exposed;
(c) an estimate of any potential exposure doses;
(d) details of any medical examinations;
(e) particulars of the area over which any radiation may have been dispersed;
(f) the time at which the accident/incident was reported;
(g) the probable cause of the accident;
(h) particulars of the subsequent investigation/s; and
(i) the steps taken to minimise reoccurrence of a similar accident.

At the local level (School, facility, etc.) points (a), (b), (e), (f), and (g) are to be recorded.

### Register of User Licences

This register is to contain the following details:

(a) Name of the Licensee;
(b) Licence Number;
(c) Active/Expired/Terminated;
(d) Date of Expiry;
(e) Licence details; and
(f) Radiation Safety Training Details.

### Register of Exemptions

This register is to contain the following details:

(a) Date of Issue of Exemption and period of time for which it applies;
(b) Name of Exempted Person/s;
(c) Student details (Full student name/cohort, Course, Approved project number, etc.);
(d) Location of use of radiation;
(e) Radiation details;
(f) Name and licence number of User Licensee who is granting exemption and has the legal authority to do so
(g) Name and licence number of radiation supervisor who has the authority to supervise
(h) Copy of the written exemption for each person

### Register of Personal Monitoring

Personal monitoring records for each person issued with a dosimeter must be kept and maintained:

(a) the full name, sex, and date of birth of the occupationally exposed person,
(b) the current home address of the occupationally exposed person or, if the person is no longer employed by the employer, the person's last known home address,
(c) the date of commencement of employment (and, if applicable, the date of cessation of employment) as an occupationally exposed person,
(d) the kind of work performed by the occupationally exposed person,
(e) details of the types of ionising radiation to which the occupationally exposed person may have been exposed in the course of employment with the employer, including information about radioactive substances in unsealed form (if any) to which the occupationally exposed person may have been exposed,
(f) details of any radiation accidents in which the person has been involved or by which the person may have been affected,

(g) details of the personal monitoring device worn by the occupationally exposed person, and

(h) the results of monitoring the levels of radiation exposure of the occupationally exposed person, which will include date, type(s) of radiation, badge result, lifetime result and 5 year rolling average.

### Inventories of Radioactive Sources and Radiation Apparatus

Documented inventories of all radioactive sources, substances, and radiation apparatus must be kept and maintained. The specific requirements for the unsealed and sealed source inventory are:

(a) location and records of transfer of location including date of transfer;

(b) date of receipt;

(c) calibration date;

(d) sealed source ID number;

(e) isotope;

(f) chemical form and concentration;

(g) total activity;

(h) specific activity; and

(i) date completely used or exhausted or disposed.

The specific requirements for the ionising equipment inventory are:

(a) date of receipt;

(b) calibration date and date of certification if clinical;

(c) registration number;

(d) equipment, equipment type, brand, model, serial number;

(e) location; and

(f) date disposed, decommissioned or traded.

**NOTE**:

Equipment can be included in the Register of Facilities and Equipment (see below).

### Register of Facilities and Equipment

All facilities (designated radiation areas, laboratories, radiation stores and radioactive waste stores) once inspected by the University RSC and WHS Unit and certified will be added to the Register of Facilities and Equipment. This record will contain:

(a) type of facility;

(b) date of inspection and certification;

(c) date of annual inspection;

(d) registration number;

(e) location (includes site and room number), and

(f) equipment contained in facility.

### Log of Facility Use

Each facility will have a book recording the use of that facility. The following details (as is relevant) will be recorded for each use:

(a) date;

(b) time;

(c) user(s);

(d) purpose of use;

(e) isotope(s);
(f) contamination and clean-up; and
(g) signature.

### Register of Radioactive Waste

The register is to contain sufficient detail so that the RSC and WHS can ascertain the ability of disposal. The details required are:

(a) location and records of transfer of location including date of transfer;
(b) date of becoming waste;
(c) isotope(s);
(d) concentration and details mixture;
(e) specific activity or total activity;
(f) chemical form (solid or liquid, chemical details); and
(g) signature of user of the material being declared as waste.

### Register of Portable and Non-portable Radiation Monitors and Detectors

Each School, Centre or facility must keep a record of their radiation monitors and detectors. This record will contain the following information:

(a) location and records of transfer of location including date of transfer;
(b) date of purchase; and
(c) instrument type, brand, model and serial number, and if allocated, the asset number.

### Register of Monitor and Detector Repairs and Calibrations

This record could be combined with the previous register and would contain in addition to the above the following details:

(a) location
(b) instrument details
(c) repair details (problem, symptom)
(d) repaired by
(e) calibration details
(f) calibration results
(g) signature

### Register of Facilities Inspections

In addition to the central record of inspections, each School, Centre, or facility is to keep a simple register of inspections that may include:

(a) date of inspection;
(b) type of inspection;
(c) name of the person conducting inspection; and
(d) any necessary actions to be immediately addressed.

### Record of Contamination and Area Monitoring

For radioisotope laboratories and facilities it is a legal requirement that contamination monitoring is conducted on a weekly basis. Area monitoring as is required and is usually expected to be at least once during a procedure. The following details are to be recorded:

(a) location;

(b) date and time;
(c) name of person(s) doing the monitoring;
(d) contamination and area monitoring results;
(e) isotopes used at the time or are being tested for;
(f) decontamination required (Y/N); and
(g) signature of person doing monitoring.

### Register of Ionising Equipment Repairs, Calibrations and Certifications

It is a legal requirement that there is a documented record of all repairs, calibrations, and certifications (where necessary for clinical use and registration). The information required will depend on the equipment, e.g. for clinical equipment as is detailed in NSW Guideline 6.

### Register of Clinical Equipment QA tests

Records required are stipulated by the Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation (ARPANSA 2008) or legislation. This will be a summary of all QA tests that are done for each item of equipment.

### Register of Projects and Teaching Involving Radiation

All work (research and teaching) in a School, Centre or facility that involves radiation must be recorded for local information. The details to be recorded are:

(a) dates of approval period;
(b) RSC approval number;
(c) approved project or teaching details; and
(d) principal investigator.

### Audit

Every 2 years.

## 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;
(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.

## 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