Radiation Safety Manual

Curtin University

2023-11-01

Table of Contents

1 Introduction

1.1 Purpose

The purpose of this manual is to specify radiation-related requirements for all Curtin University sites.

1.2 Scope

This manual covers policies and procedures for radiation safety at Curtin University. It applies to all Curtin University workers (i.e. staff, students, contractors, and visitors) who are required to use radiation materials or equipment, or access areas containing them, within the scope of their duties at Curtin University. It is not an educational course or a set of guidelines in radiation safety, although it does contain some overlap where procedures are affected. To maintain brevity, links to other radiation safety educational material are provided where relevant.

This manual should be used in conjunction with other Curtin documentation and procedures surrounding the management of hazardous materials (including specific area safety management plans, area and task specific risk assessments and standard operating procedures). It has been developed in line with legislation and guidance that were current

at the time of writing. There may be other applicable standards and legislation in addition to those outlined here that may need to be considered. Legislation and guidelines that have come into force since the date of this document need to be considered as well.

2 Responsibilities and contacts

Legislation such as the Radiation Safety Act (Western Australia 1975), Nuclear Non-Proliferation (Safeguards) Act (Commonwealth of Australia 1987), and Work Health and Safety Act (Western Australia 2020) impose restrictions on the acquisition, use, storage, transport, and disposal of non-exempt radioactive substances, nuclear material, high powered lasers, x-ray or neutron emitting apparatus, and UV transilluminators. All such substances and equipment must be registered and most can only be used under the supervision of a suitably qualified individual with an appropriate licence issued by the relevant regulator. All projects at Curtin University that use these substances or equipment must be approved by the University Radiation Safety Committee before work commences.

2.1 Radiation Safety Committee

The Radiation Safety Committee (RSC) provides oversight of the Radiation Safety Officer and administers Curtin's radiation management system. The Committee meets twice every year to consider matters relating to radiation safety at the University. It has the sole power to approve radiation projects that are deemed as *high risk* (e.g. those using high-powered lasers; those where there may be potential to exceed statutory radiation exposure limits).

Curtin Radiation Safety Committee Members

Name	Email	Role
Arie van Riessen	A.VanRiessen@curtin.edu.au	Chair
Curtise Ng	Curtise.Ng@curtin.edu.au	Deputy Chair
Adrian Paxman	A.Paxman@curtin.edu.au	Member
Jennifer Wang	Jennifer.Wang@curtin.edu.au	Member
Kristy Noakes	kristy.noakes@curtin.edu.au	Member
Ross Graham	Ross.Graham@curtin.edu.au	Member
Tim Finney	tim.finney@curtin.edu.au	Radiation Safety Officer

2.2 University Radiation Safety Officer

The Radiation Safety Officer (RSO) coordinates radiation activities at Curtin University to ensure compliance with the Radiation Safety Act 1975 and other legislation. The RSO is responsible for instituting and maintaining a system of radiation safety at Curtin University and is monitored by the University Radiation Safety Committee, comprising members from across the University. The University RSO can offer assistance and advice on all matters related to radiation safety including registration and licensing requirements.

Tim Finney
Curtin Health and Safety Department
Phone: 9266 1708, 0434 208 534
Email: rso@curtin.edu.au

2.3 Radiation Safety Supervisors

The responsibility for the implementation of the system at a local level rests with the Heads of Schools or Area Managers. Each workplace is responsible for enforcing the procedures and for ensuring that workers (i.e. staff, students, contractors, and visitors) have the necessary information, instruction, training and supervision before commencing radiation work.

A Head of School or Area Manager may nominate a Radiation Safety Supervisor (RSS) to act on their behalf in matters related to radiation safety in their area. While the University Radiation Safety Officer (RSO) carries out the majority of the work related to radiation safety at the University, each RSS forms an integral component of the radiation safety system by overseeing all radiation work in their area. Specifically the RSS will:

- Liaise with the University RSO regarding changes or issues related to radiation safety within their area.
- Advise local workers on the University requirements and processes related to radiation safety.
- Maintain local radiation related documentation.

Workers who are planning to conduct radiation related work, or have questions about radiation safety, should in the first instance contact their local RSS.

Curtin Radiation Safety Supervisors

Name	Email	Phone	Location
Adrian Paxman	A.Paxman@curtin.edu.au	9266 4316	308 (Pharmacy)
Amy Hickman	amy.hickman@curtin.edu.au	9266 4743	418 (Design and the Built Environment)
Bill Swerlowycz	bill.swerlowycz@curtin.edu.au	9266 7718	206 (Civil Engineering)
Bogale Tadesse	bogale.tadesse@curtin.edu.au	9088 6636	703 (WASM Kalgoorlie)
Curtise Ng	Curtise.Ng@curtin.edu.au	9266 7314	301 (Medical Radiation Science)
Garry Morton	G.Morton@curtin.edu.au	9266 2822	202 (Design and the Built Environment)
Jennifer Wang	jennifer.wang@curtin.edu.au	9266 9187	301 (Physics)

Name	Email	Phone	Location
Julie Lawrence	julie.lawrence@curtin.edu.au	9266 9138	304 (Molecular and Life Sciences)
Kagan Ducker	kagan.ducker@curtin.edu.au	9266 9443	401 (Allied Health)
Mala Senaratna	m.senaratna@exchange.curtin.edu.au	9266 7334	400 (Population Health)
Mia Hillyer	mia.hillyer@curtin.edu.au	9266 9942	311 (Molecular and Life Sciences)
Michael Carson	michael.carson@curtin.edu.au	9266 4973	613 (Earth and Planetary Sciences)
Michael Nesbit	michael.nesbit@curtin.edu.au	9266 2201	305 (Curtin Health Innovation Research Institute)
Peter Chapman	P.Chapman@curtin.edu.au	9266 3425	500 (Chemistry)
Rhys Kennedy	rhys.kennedy@curtin.edu.au		312 (John de Laeter Centre)
Sharon Babaeff	sharon.babaeff@curtin.edu.au	9266 4772	310 (Health Sciences)
Vince Skyrme	vince.skyrme@curtin.edu.au		205 (Mechanical Engineering)
Xiao Hua	Xiao.Hua@curtin.edu.au	9266 5839	205 (Chemical Engineering), 611 (WASM Bentley)

2.4 Licence holder

All projects involving non-exempt radiation sources must be conducted under the supervision of a suitably qualified person with an appropriate WA Government issued licence.

The licensee must ensure that all radiation users have adequate instruction, training, supervision, and information to carry out their duties in a safe manner on a day-to-day basis and that the radiation work is conducted in accordance with their licence conditions and local radiation safe working rules.

2.5 RSS or licensee?

The RSS is appointed by the Head of School to act on their behalf to ensure radiation projects within the area follow University requirements and processes. The radiation licence holder has a licence granted by the Government to work and supervise others on projects involving radiation. The Licensee has legal responsibility for radiation work

carried out under their licence. The roles of RSS and licence holder can be occupied by the same person or by different persons depending on the needs of the area.

2.6 Workers

Workers (i.e. staff, students, contractors, and visitors) who are planning radiation related work, or have questions about radiation safety should in the first instance contact their local RSS. Workers are required to comply with the workplace procedures, to report any accidents or incidents and raise any safety, health or security concerns with the RSS. Each individual is responsible for taking reasonably practicable steps to ensure their own safety when working with radiation.

Roles, responsibilities and authorities related to radiation management.

Role	Responsibility under Work Health and Safety Legislation	Responsibility under Radiation Safety Legislation	Authority
University Radiation Safety Committee		To provide advice to the University regarding radiation safety and to inform, guide and monitor the University Radiation Safety Officer	Advisory
University Radiation Safety Officer		To institute and maintain a system of radiation safety at the University consistent with the requirements under the Radiation Safety Act 1975 and other legislative requirements	Approves and authorises use of radioactive materials, radiation equipment and electronic products (as defined by the Act) at the University.
Heads of Schools/Area Managers	To implement and maintain an effective health and safety system within the School or Area that is consistent with the Work Health and Safety Act 2020 and other legislative requirements.		Allocate responsibility for health and safety management and delegation of authority to Radiation Safety Supervisor for aspects related to radiation.

Role	Responsibility under Work Health and Safety Legislation	Responsibility under Radiation Safety Legislation	Authority
Radiation Safety Supervisors	Delegation from Head of School or Area to ensure workers within the School or Area are familiar with University policies and procedures necessary to undertake work specifically related to radiation.		Advisory
Radiation Licence Holders		Ensure all users working under their licence have sufficient information, instruction, training and supervision to carry out their duties in a safe manner on a day-to-day basis and that the radiation work is conducted in accordance with their licence conditions and local radiation safe working rules.	Authorises individuals to use specific radiation materials or equipment associated with their licence.
Project Chief Investigators	To undertake effective health and safety measures to ensure compliance with the requirements set out by the Head of School/Area or the Radiation Safety Supervisor.	To undertake effective management measures to ensure compliance with the requirements of the University Radiation Safety Officer/Committee and the Radiation licence holder.	
Individual Workers/Students	To comply with all procedures and report any accidents or incidents and raise any safety,	To comply with the conditions of the radiation licence under which they are working	

Role	Responsibility under Work Health and Safety Legislation	Responsibility under Radiation Safety Legislation	Authority
	health or security concerns. Take reasonably practicable steps to ensure their own safety	and the relevant safe working rules.	

3 Radiation projects

3.1 Project approval

You must have approval from the University Radiation Safety Officer or Committee before starting any work involving radiation sources. If your Supervisor already has approval to cover your work, they can apply for an amendment to add your name to their project. If not, you must start a new application.

To apply, please contact the Radiation Safety Officer and ask for a Curtin Radiation Project application form. Projects that meet all the necessary requirements will be given approval for one year, but may be extended indefinitely subject to annual reporting and submission of amendment requests when details of the project change.

Note for students: The Chief Investigator of your project is your supervisor. Please add yourself as co-investigator. If you are a staff member but submitting as a student make sure you use your student credentials.

The University Radiation Safety Officer (RSO) will classify your application as either Low-Risk or High-Risk. Low-Risk applications will be processed by the University RSO, whereas High-Risk applications will be assessed by the Radiation Safety Committee.

The application will be reviewed by the:

- Chief investigator for the project
- Radiation licence holder(s) for the substances or equipment
- Local RSS (or, if this role is vacant, the Head of School).

3.2 Obtaining a licence

All radiation substances and equipment must be used under the supervision of a radiation licence holder. To obtain a licence it is necessary to:

- Pass an appropriate course accredited by the WA Regulatory body, the Radiological Council. (The latest list of courses can be obtained from the Radiological Council courses webpage).

- Fill in the appropriate licence application form. (Download from the Radiological Council licence webpage).
- Contact the University RSO to request a letter of support for your application (necessary for first time applicants only).
- Send the application to the Radiological Council together with payment.

The licences can be obtained for one or three years and the Radiological Council will send out a renewal notice directly to the licence holder just before their licence expires. If work is to continue the licence holder must renew their licence and submit a copy of their new licence to the RSO. Please contact the University RSO for assistance or further advice.

3.3 Quantities requiring a licence

Quantities of radioactive materials below the limits in the following table do not require a radioactive substances licence. However, the University is still required to register the substances, so a project application as described above will be required.

Radionuclides requiring a licence

Radionuclide	Quantity (MBq)
Ra-226	0.0004
Sr-90	0.004
Co-60, I-125, I-131	0.04
Ca-45, Cl-36, Cs-137, Fe-59, Mn-54, Na-22, Ni-63, P-32, Ru-103, Y-90, Zn-65	0.4
C-14, Fe-55, S-35, Tc-99m, Th (natural), Tl-201, U (natural)	4
H-3, Cr-51	40

3.4 Training for unlicensed users

Other persons working under the supervision of a licence holder must have a level of training appropriate to the work they are conducting. This training can be one of the WA Regulator accredited courses or an equivalent level qualification. The licence holder must retain documentary evidence of the training of each user under his/her supervision.

It is not necessary for anyone to have a licence to cover projects involving quantities of radioactive substances below an exempt limit, lasers with power below class 3B, and exempt levels of UV, infrared, microwaves, radiofrequencies, magnetic fields, infrasound or ultrasound. If the equipment is used in accordance with the manufacturer's instructions then it is sufficient to ensure users read the safe working procedures and risk assessments for the apparatus and undergo training on its use. The supervisor must retain documentary evidence of the training of each user under their supervision.

4 Facility requirements

Laboratories containing non-exempt radioactive substances or radiation producing equipment must comply with the legislative requirements for their respective uses. The requirements can, in some cases, be quite extensive and may depend upon the work that is to be conducted. As such, advice should be sought from the University RSO **prior** to the establishment of any new facility. A brief overview of the legal requirements common to many facilities is given below.

Note: An approval for each project will continue to be required even when many projects utilise the same facility.

4.1 Requirements for radioisotope facilities

All laboratories using radioactive materials must be approved for use by the WA State Government Regulator prior to any work being conducted. The Regulator will require the RSO to submit architectural, plumbing and ventilation plans for the laboratory so as to make an assessment of the laboratory's suitability for radioactive materials work. Architectural, plumbing or ventilation changes can be time consuming and costly. As such, it would be prudent to make arrangements with the RSO for approval well in advance of the commencement of work in case the Regulator does not initially provide approval.

The NORM Management Guidelines must be followed if NORM is being used or stored.

4.2 Requirements for laser facilities

Laser facility requirements are detailed in the Radiation Safety (General) Regulations 1983. The regulations incorporate aspects of the relevant Australian Standard (AS/NZS 2211.1:2004). As with other radiation laboratories it would be prudent to allow time prior to the commencement of work to ensure these requirements are met. In some cases it may take months to arrange for the laboratory to have the appropriate security and safety systems in place. For more information see the Laser Safety Guidelines.

4.3 Requirements for x-ray or neutron generator facilities

Rooms containing irradiating apparatus, whether for analysis or diagnostic purposes, may require walls, doors, and windows to have appropriate shielding. The plans for this facility will then need to be sent by the RSO to the WA State Government Regulator for approval prior to the commencement of work. In addition, the room in which the apparatus is located and the surrounding area may be required to undergo a 3 month long radiation survey at commencement of operations, or at any other times as specified by the WA State Government Regulator, to confirm radiation levels are below the legislated limits.

Each room or area containing the apparatus must have a sign at the entrance stating that x-ray or neutron generators are in that room or area. If the apparatus is not an enclosed unit, the room must have a red illuminated sign at the entrance (orange lights supplied with the unit are also acceptable) which must be activated when the instrument is energised. The light must be a 'fail safe' light that de-energises the instrument if the light fails, or there

must be another clear and unambiguous method of determining whether the light has failed.

An enclosed unit is defined as one that is constructed so that the primary beam is completely contained within permanent barriers requiring tools to gain access, or is interlocked so that if a barrier is removed the instrument is de-energised and cannot be operated without replacing all barriers.

Partly enclosed units should still have partial barriers and interlocks to minimise the possibility of inadvertent exposure, and the instrument should be situated such that if the shutter is opened while an entrance to the enclosure is uncovered or barriers are incomplete, the resultant primary beam must be directed away from areas that may be occupied. These instruments must also be sited in a separate room or cubicle in which there are no other radiation sources.

5 Monitoring

The objective of radiation monitoring is to ensure that existing safety procedures are effective for keeping radiation exposure as low as reasonably achievable (ALARA).

5.1 Personal radiation monitoring

Personal radiation monitoring badges are required for users of ionizing radiation (radioactive substances, x-ray machines, neutron generators). Workers who use ionising radiation will need to apply for a personal radiation monitoring badge. These badges are issued on a monthly or quarterly basis and monitor exposures from incidental and scattered radiation. (Badges are not appropriate for low energy beta emitters such as H-3 or S-35.)

- Wear the badge at chest level or as directed by the dosimeter placement icon on the badge. If a lead apron is used in an x-ray area, the badge should be worn under the apron.
- Wear only the badge assigned to you. Don't share badges.
- Place the badge in a low background radiation area when not being worn, preferably where the control badge is stored. (Consider using a badge board.)
- Don't deliberately expose the badge to radiation.

In addition, personnel using irradiating apparatus that is not enclosed are required to wear wrist or finger dosimeters when using the equipment.

To obtain a badge contact your local RSS. When the badge arrives you can collect it from your RSS or nominated badge coordinator.

5.2 Biological monitoring

Biological monitoring is required for users routinely handling radionuclides with activities exceeding the following limits.

Radionuclide	Activity (MBq)
I-125	0.1
C-14, S-35	5
H-3	120

Urinalysis is required for users of H-3, C-14 or S-35. Thyroid analysis is required for I-125. The frequency of monitoring will be determined by the University Radiation Safety Officer (RSO) for different categories of workers and submitted to the WA Radiological Council for approval. Further information can be obtained from the University RSO.

5.3 Wipe testing

Wipe testing is required for users of low energy beta emitting unsealed radioactive substances or contamination testing in radioisotope areas with high levels of background radiation.

Areas using unsealed radioisotopes are required to conduct monthly wipe tests of all radioisotope laboratories:

- Label containers (press-seal plastic bags or screw-top vials) with wipe test locations (e.g. “phone”, “Bench A”, “Centrifuge knob”).
- Use an alcohol swab, moistened glass fibre filter disk or similar.
- Wipe tests of bench and sink areas to be over an area of 100 cm2 (i.e. wipe a square area measuring approx. 10 cm x 10 cm). If not possible to wipe an area of 100 cm2 (e.g. when wiping phones, knobs, handles) then do what you can.
- Wiping of bench and sink areas is done as a series of wipes evenly covering the area once. When wiping uneven surfaces, ensure that the surface is wiped once only.
- Transfer to the appropriate labelled container.

The type of counting depends on the isotopes used. Liquid scintillation counting is required for low energy beta emitters (e.g. H-3, C-14) and will have to be done by an external analytical lab. Gamma counting can be done by a gamma spectrometer at Curtin. Counting results should be submitted to the local RSS and the University RSO.

5.4 Radiation surveys

Periodic radiation surveys are required for users of radioactive substances and x-ray equipment. Users of beta and gamma emitting radionuclides should survey their area before and after any procedure involving radionuclides to ensure no contamination is present. A thin window Geiger-Muller monitor (betas and gammas) or scintillation monitor (gammas) is normally used. Any contamination should be dealt with immediately.

Users of partially enclosed x-ray units should perform a radiation survey on a monthly basis to check for radiation leakage from the machine. For totally enclosed x-ray units the radiation survey should occur quarterly. The dose at any accessible point 5 cm from the surface must not exceed 25 μGy per hour whilst the instrument is operating at maximum power. The University RSO must be notified immediately if the leakage dose exceeds the

threshold. The survey report must be submitted to the RSO at the time of the annual review of the radiation project.

Users of medical x-ray equipment should conduct radiation surveys in accordance with the requirements of the Radiological Council and manufacturers of the instruments. While these requirements may vary, in-house leakage tests should be conducted at least annually. If leakage tests for these instruments prove impracticable, advice should be sought from the University RSO regarding alternative arrangements.

6 Radiation source lifecycle

Radiation sources need to be tracked through their entire life-cycle of acquisition, use, storage, movement, and disposal.

6.1 Research initiation guide

Completing the Research Initiation Guide will help you to identify and obtain the permissions required before starting work. It will also inform you about safe handling and how to protect yourself and others from the impacts of your research.

6.2 Notification

Curtin's registration under the Radiation Safety Act stipulates that prior written notice must be given of material changes to:

- type, form, maximum activity, purpose of radioactive substances
- structure, ventilation or drainage of laboratories housing radioactive substances
- number, type, purpose of irradiating apparatus
- change of location of irradiating apparatus
- structural changes that may compromise radiation safety of laboratories housing irradiating apparatus.

The University Radiation Safety Officer (RSO) and local RSS must be informed of such changes. A corresponding radiation project application or amendment must be submitted as well.

6.3 Acquisition

A radiation project application or amendment must be submitted **before** acquisition of any non-exempt radiation source. Some facilities may require modifications to satisfy statutory requirements associated with use and storage of the radiation sources they are meant to contain.

For repeat orders of radioactive materials already covered by an existing project it is only necessary to inform the local RSS to ensure activity limits for the location are not exceeded.

If ordering radioactive materials from overseas it is necessary to obtain an import permit from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). Failure to obtain a permit will result in the shipment being held by Customs. The relevant form should be completed and submitted to ARPANSA, sending a copy to the RSO. Payment is to be made by the School ordering the materials.

Natural materials such as rocks or ores may contain radioactive material. Most of these materials have activity levels below exemption limits and therefore are not classified as radioactive. However, some contain significant concentrations of radioactive material so appropriate controls must be in place when acquiring and storing them. Please see the NORM Management Guidelines for more information.

6.4 Storage

Storage locations and containers must be clearly marked with a radiation trefoil symbol. Decanted radioactive substances must be labelled with isotope, activity, date, and composition.

6.5 Movement

Records detailing the movement of radiation sources must be kept and regularly updated. Records must provide details of the substances (e.g. isotope, activity) or equipment (e.g. energy, wavelength, power), supplier, arrival date, use details, disposal method, disposal date, and other pertinent information. Signed receipts and documentation should be obtained where possible.

Transport of radioactive material must be done in accordance with the Transport Code (Commonwealth of Australia 2019). If transporting waste to the Radiation Waste Store then liaise with the University Radiation Safety Officer to arrange a time for handover. Do not leave radioactive waste unattended at any time.

6.6 Disposal

The RSO and local RSS must be informed if there is an intention to relocate, transfer, or dispose of a radiation source. The School disposing of radioactive materials or radiation equipment is responsible for the costs of disposal. The method of disposal is dependent on the type of material or equipment. Some isotopes can be stored until their activities drops below exemption limits through radioactive decay. (Curtin has a Radiation Waste Storage facility that may be used for this purpose.) Please contact the RSO if further information is required.

6.7 Disposal of radiation equipment

Final disposal of any irradiating apparatus or electronic product **must be carried out by a licensed service person** in accordance with the methods below:

X-ray equipment
Either burn out the filament or eliminate the vacuum inside the x-ray tube (break the glass envelope).

Lasers
Sever the power supply cord and remove the critical optical components and the amplifying medium.

Transilluminators
Sever the power supply cord and destroy (break) the UV lights.

Each of these methods is potentially hazardous (due to e.g. electrocution, mercury poisoning, splintered glass injuries from imploding x-ray tubes) so should not be attempted by anyone except someone who is qualified to do the job.

6.8 Disposal of liquid radioactive waste (water soluble)

Exempt quantities of liquid radioactive waste may be disposed of via the sewer system. Such waste must only be disposed of via flushing sinks suitable for the purpose.

Ensure that the activity per flush is below the legal dilution concentration limit for each radionuclide and that the waste complies with the Water Corporation's 'Acceptance criteria for trade waste'.

6.9 Disposal of sealed, solid or liquid (non-soluble) radioactive waste

Waste must be segregated according to the radionuclide and the type of waste. For example:

- Sealed sources
- Biological material (e.g. food, animal carcasses)
- Sharps (e.g. syringes, broken glass)
- Scintillation cocktail from counting tubes
- General laboratory waste (e.g. gloves, paper towels)

Long-lived radionuclides must not exceed the box activity limits tabulated below:

Radionuclide box activity limits

Radionuclide	Activity limit (MBq)
Cl-36	2.2
C-14	3.4
H-3	48

Solid waste must be sealed in a sturdy plastic bag. Liquid waste must be sealed in a screw top bottle or vial before being sealed in a sturdy plastic bag. Any sharps, such as needles or broken glass, must be enclosed in a durable container (e.g. metal tin or plastic sharps container).

The sturdy plastic bag or durable container must be placed in a cardboard box with the words 'Radioactive material' printed clearly on the outside. The box or bag must then be sealed with durable tape.

Label the waste box or bag with a contact name, date, waste source (i.e. building and room number). Specify each radionuclide and its estimated activity in Becquerels (Bq, kBq, or MBq). Do not use other measures such as counts per second or Bq/mL.

7 Control of radiation incidents

In the event of suspected exposure (e.g. through device malfunction, radioactive spill):

- in the case of electrically energised radiation sources (e.g. lasers, x-ray machines, neutron generators, RF generators), switch off the device
- in the case of radioactive spills, set up an exclusion zone of at least five metres around the spill.

For electrically energised radiation sources, radiation production ceases immediately when the device is switched off. Security may be called on ext. 4444 to isolate power to a room containing a device if it is not safe to enter the room to switch off power to the device.

For radioactive materials, there is no way to halt radiation production. However, increasing the distance from the source, reducing exposure time, and increasing shielding are all effective means of reducing radiation dose. (Walking five metres away renders most exposure scenarios harmless.)

7.1 Spill procedure

In the event of a radioactive spill:

- Verbally warn all other persons in the area.
- Ensure anyone with a serious injury receives proper medical attention. The treatment of serious injury must take precedence over decontamination and containment. Inform medical personnel of the nature of the spill if they need to take away anyone with an injury.
- Call for assistance to contain and control the spill. The area can be isolated by calling Security on 9266 4444. Security can also assist in contacting people to help manage the spill (e.g. the Radiation Safety Officer).
- Locate the spill kit.
- Evacuate the immediate area around the spill using absorbent mats and overshoes to create a path away from the spill without spreading contamination.
- Move everyone to a safe area to wait for a decontamination assessment. Don't allow anyone to leave the safe area until they have been assessed by personnel trained in decontamination.
- Mark out the spill area and restrict further unnecessary movement into and through it.

- If you have been trained to do so, commence decontamination of individuals affected by the spill.
- Wait for the arrival of the Radiation Safety Officer for a final decontamination assessment.

7.2 Decontamination

To decontaminate an area after a spill:

- Wear protective clothing (lab coat, gloves, overshoes, safety glasses, P2 mask if volatiles involved).
- Decontaminate individuals first, followed by the general area, followed by individual items of equipment.
- Soak up any liquid contamination from skin and clothing with absorbent pads.
- Make way to wash area, possibly using plastic-backed absorbent pads to make a path to avoid further spread of contamination.
- Using a fresh set of gloves, remove any contaminated clothing.
- Decontaminate skin and eyes by washing or flushing only the contaminated area with water. Gentle scrubbing may be used for persistent contamination, being careful not to break the skin.
- Use a radiation monitor to confirm that contamination has been removed.
- Place pads and other disposables used for decontamination into a sturdy plastic bag then seal it.

7.3 Reportable quantities for radioactive spills

Spills must be reported to the Radiological Council if they involve activities exceeding those tabulated below:

Reportable quantities

Radionuclide	Quantity (MBq)
Ra-226	0.004
Sr-90	0.04
Co-60, I-125, I-131	0.4
Ca-45, Cl-36, Cs-137, Fe-59, Mn-54, Na-22, Ni-63, P-32, Ru-103, Y-90, Zn-65	4
C-14, Fe-55, S-35, Tc-99m, Th (natural), Tl-201, U (natural)	40
H-3, Cr-51	400

8 Other radiation safety information

8.1 Mobile phones

Mobile phones emit radio frequency (RF) electromagnetic radiation. Information on RF and ways to reduce exposure are available on the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) website:

- Mobile phones and health
- Can I reduce my exposure to RF?

8.2 Laser pointers

Laser pointers are useful but can cause harm to people's eyes. In Western Australia, laser pointers of power output greater than 1 mW should not be used or possessed by members of the general public. More information about laser pointers can be found in the University's Laser Safety Guidelines.

9 Additional resources

The following links provide further information on radiation protection:

- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- Health Physics Society
- International Atomic Energy Agency
- IAEA live chart of nuclides
- International Commission on Non-Ionizing Radiation Protection
- International Commission on Radiological Protection
- United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)
- WA Radiological Council

10 Glossary

Licensee
The radiation licence holder has a licence granted by the Government to work and supervise others on projects involving radiation. The Licensee has legal responsibilities for the day-to-day radiation safety aspects of the work carried out under their licence.

NORM
Naturally Occurring Radioactive Material

Radiation source
A source of radiation exposure such as a radioactive substance or a piece of radiation producing equipment

Radioactive substances
Materials with activities exceeding exemption limits listed in the Radiation Safety (General) Regulations (Western Australia 1983)

Radiation producing equipment
Lasers, x-ray machines, neutron generators, UV transilluminators, RF generators, and any other devices that emit radiation when energised and are not exempted under the Radiation Safety Act (Western Australia 1975)

Radiation Safety Committee (RSC)
Provides oversight of the Radiation Safety Officer and administers Curtin's radiation management system

Radiation Safety Officer (RSO)
Coordinates radiation activities at Curtin University to ensure compliance with the Radiation Safety Act 1975 and other legislation.

Radiation Safety Supervisor (RSS)
Appointed by the Head of School to ensure radiation projects within the area follow University requirements and processes.

References

Commonwealth of Australia. 1987. "Nuclear Non-Proliferation (Safeguards) Act." https://www.legislation.gov.au/Details/C2016C00932.

———. 2019. *Code for the Safe Transport of Radioactive Material*. Rev. 1. Radiation Protection Series, C-2. Yallambie: ARPANSA. https://www.arpansa.gov.au/sites/default/files/rps_c-2-2019.pdf.

Western Australia. 1975. "Radiation Safety Act." https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_784_homepage.html.

———. 1983. "Radiation Safety (General) Regulations." https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_1969_homepage.html.

———. 2020. "Work Health and Safety Act." https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_a147282.html.

———. 2022. "Work Health and Safety (General) Regulations." https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_s53267.html.