Procedure: Radiation safety

Purpose

This procedure describes how the Australian National University (the University) establishes, implements and maintains best practice and compliance with radiation legislation and the University's Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) licence conditions with respect to radiation safety. This procedure meets the compliance requirements of the *Work Health and Safety Act 2011 (*Cth*),* the *Work Health and Safety Regulations 2011 (*Cth*)* and ARPANS Act, 1998. This procedure is based on the requirements listed in the University's ARPANSA Licence conditions and is linked to the University's Work Health and Safety and Radiation safety policies and is one of the Safe Work Procedures within the WHS Management System.

Definitions

An **Authorised Person** refers to a person who is permitted to work with and has been trained and evaluated as competent to use radioactive sources or radiation apparatus by the designated Radiation Safety Officer (RSO) of a local area of the University (also see Radiation Worker).

Controlled Apparatus refers to any of the following (see ARPANSA webpage), an apparatus:

- that produces ionising radiation when energised or that would, if assembled or repaired, be capable of producing ionising radiation when energised; or
- that produces ionising radiation because it contains radioactive material; or
- prescribed by the regulations that produces harmful non-ionizing radiation when energised.

Controlled Material refers to any natural or artificial material which emits ionising radiation spontaneously.

Coordinating Radiation and Laser Safety Officer (CRSO/ CLSO) refers to a staff member appointed by a local area to assist in the coordination of radiation safety within their local area. They coordinate regulatory reporting with the Work Environment Group.

Dose is a generic term which means absorbed dose, equivalent dose or effective dose, depending on context. It is an amount related to an individual's exposure.

Emergency Procedures are basic plans, established in advance, stating what action to take in an emergency. These are used to minimise the consequences of an incident, such as injuries or damage to property or the environment.

Equipment maintenance refers to performance or adjustments or procedures specified by the product manufacturer that are performed by internal University personnel (e.g. an operator) to assure intended performance or safety.

Equipment service refers to performance of adjustments or procedures that are performed by external personnel (e.g. field service rep) that affect any aspect of the product's performance or safety.

Exposure refers to the circumstances of being exposed to radiation. Different types of exposure include:

* Occupational exposure (e.g. Ultra Violet light, Laboratory)
* Medical exposure (e.g. Computed Tomography (CT) scans, medicines) and
* Public (non-work related exposure)

Hazard is a source or a situation with a potential for harm in terms of human injury or ill-health, damage to property, damage to environment, or a combination of these.

Ionisation is the process in which an electron is given enough energy to break away from an atom resulting in the formation of two charged particles or ions. Ionisation results in the release of enough energy to cause chemical changes by breaking chemical bonds, which may cause damage to living tissue.

Ionising radiation for the purpose of radiation protection, radiation capable of producing ion pairs in biological material(s).

Local area refers to a College, Research School or Service Division of the University.

Licence refers to a source licence or a facility licence issued by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to the University with the Vice Chancellor named as the licence holder.

Laser operator refers to a person who has completed safety training and has been trained, evaluated, deemed competent and authorised by their supervisor to use the relevant controlled laser/s. Authorisation can alternatively be given by the designated Laser Safety Officer (LSO) of a local area of the University.

Laser Safety Officer (LSO) refers to a person(s) at the University who possesses the necessary skill, training, experience and qualifications to effectively manage the radiation protection program for their designated local area. See Duties and Responsibilities of the LSO in the Radiation safety policy.

Non-Ionising Radiation is any electromagnetic radiation of a wavelength greater than 100 nm in air or vacuum (for example, optical radiation from lasers, infrared, ultraviolet, visible light, microwaves, and radiofrequency waves).

Occupational exposure is the exposure of a person, which occurs in the course of the person's work.

Packaging is the assembly of components necessary to enclose the radioactive contents completely.

Precautionary Principle is defined by the World Health Organisation (WHO) as a risk management concept that provides a flexible approach to identifying and managing possible adverse consequences to human health, even when it has not been established that the activity or exposure is harmful.

Radiation includes ionising radiation (alpha, beta, gamma, x-rays, and neutrons) and non-ionising radiation (infrared, visible light, ultraviolet, microwaves, radiofrequency waves, and magnetic fields).

Radiation Dealing in relation to a controlled apparatus or controlled material means any of the following:

* Possess, or have control of, the apparatus or material
* Use or operate the apparatus, or use the material
* Storage of controlled apparatus and/or material or
* Disposal of the apparatus or material

Radioactive substance is a substance that spontaneously emits ionising radiation as a consequence of radioactive decay.

Radioactive contamination is the presence of a radioactive substance(s) in a material or in a place where it is undesirable or could be harmful.

Radiological incident refers to an unexpected deviation from normal conditions leading to an actual, or potential, abnormal situation that may cause excessive exposure, irradiation or contamination of persons or contamination of the work environment.

Radiation monitor is a device that measures radiation in terms of an exposure assessment (e.g. microsievert per hour).

Radiation detector is a device that detects radiation (e.g. displays counts per second).

Radiation Safety Officer (RSO) refers to a person(s) at the University who possesses the necessary skill, training, experience and qualifications to effectively manage the radiation protection program for their designated local area. See Duties and Responsibilities of the RSO in the Radiation Safety Policy.

Radiation work (unless explicitly stated otherwise) refers to any activity involving interaction with controlled apparatus/material (see above) including but not limited to acquisition, operation, maintenance and disposal.

Radiation worker is anyone who carries out radiation related work at/for the University. A worker includes staff, volunteers, contractors, students and visitors at the University. An authorised radiation worker or authorised person refers to a person who has met the minimum requirements of a radiation worker (as detailed in Table 6 below) and has been granted access to specific locations.

Risk refers to the potential for injury or harm and is the combination of likelihood and severity of the injury.

Risk Management refers to coordinated activities to direct and control an organisation's risks.

Sealed Source refers to controlled material permanently contained in a capsule, or closely bound in a solid form, which is strong enough to be leak tight for the intended use of the controlled material and any foreseeable abnormal events likely to affect the controlled material.

Security in relation to controlled material or apparatus is the prevention of, detection of, and response to, criminal or intentional unauthorised acts involving or directed at radioactive material, associated facilities, or associated activities.

Sievert (Sv) is the Scientific International (SI) unit for both equivalent dose and effective dose. Terms used in this procedure include millisievert (mSv) and microsievert (μSv).

Unsealed source is a radioactive source in which the radioactive material is neither permanently sealed in a capsule nor closely bonded and in solid form.

Ultraviolet (UV) is the ultraviolet part of the electromagnetic spectrum.

WHS refers to Work Health and Safety.

Worker is defined as anyone who carries out work for the University. A worker includes staff, volunteers, contractor, students and visitors at the University.

Procedure

Scope

1. The University has developed this procedure to ensure implementation of the radiation policy. This includes complying with legislation, licence conditions and relevant standards. The procedure lays out a framework to ensure workers receive the appropriate training to perform their duties.

Legislative requirements

2. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) issued the University a Source Licence (S0027) and three Facilities Licences (F0073, F0074 and F0075) to hold ionising and non-ionising radiation apparatus and/or material and conduct research and teaching. Refer to the Radiation Safety policy for additional information.

3. The University's Nuclear Safety procedure addresses dealings regulated under the *Nuclear Safeguards and Non-Proliferation (Safeguards) Act, 1987 (Cth).*

Managing risk

4. The University uses a risk-based approach to minimise risks when working with, storing, handling, transporting and disposing of radioactive materials and apparatus associated with the University's research and teaching.

5. Managing radiation risk involves conducting an assessment to:

- establish the context associated with radiation use
- identify the hazards (source of risk)
- assess the risks associated with those hazard
- control the risks and
- review the process for effectiveness and compliance

Table 1: Risk Management Principles and the Australian Standards/New Zealand Standards (AS/NZS ISO 31000: 2009)

Stage	Description
1	Establish the Context: Consider the scope and nature of work within a laboratory when working with radioactive substances or apparatus.
2	Identify the Hazards (source of risk): Hazard (risk) identification is covered in detail in the University's safety courses.
3	Assess the risks associated with the hazards: Assess both real and potential exposures.

4	Control the risks: Provide suitable measures to reduce identified risks to As Low as Reasonably Achievable (ALARA). The plan for controlling workplace radiation exposure in the workplace is based on a hierarchy of controls, including: avoidance or elimination of source; substitution fora less hazardous source; * isolation of radiation sources through shielding, containment and remote-handling techniques * engineering controls to reduce radiation levels * administrative controls, including safe work practices, work methods that make use of time, distance and shielding to reduce exposure, training, safety signage, intakes of radioactive materials in the workplace * Personal Protective Equipment (PPE), where other means of controlling exposure are not practicable or sufficient Note: Risk control is usually implemented through a combination of controls, rather than just one.
5	Review the process: Regular reviews are a requirement of the *Regulations*. Also, consider whether new processes and techniques are available. If an incident (or near miss) occurs, incorporate recommendations and improvements into the protocols.

6. Radiation workers working with Non-Ionising Radiation apply the Precautionary Principle. The Principle of Optimisation of Protection is used to minimise exposure and ensure that legal dose limits are not exceeded.

Responsibilities

7. To ensure that the University's obligations are met, the Radiation safety policy and the Nuclear Security procedure state the responsibilities of the people working with radiation apparatus and/or materials. To ensure that workers can meet these responsibilities, this procedure provide duties (listed below) that the relevant worker performs.

Supervisor and research leaders

8. Supervisors and research leaders are accountable to the Dean/Director and have the following duties:

- document proposed radiation work and research
- conduct only justified (documented) research and dealings (i.e. there is a net benefit to the researcher or the community, considering social, economic and other relevant factors)
- work with the relevant RSO/LSO to develop, document and implement a plan to manage the safety of all aspects of the proposed activity (research and dealings)
- comply with the University's 'new-work' approval process (refer to paragraph 25)
- conduct hazard (risk) assessments. Where there are high or extreme risks (after implementing controls), contact the relevant RSO/LSO before proceeding
- ensure that hazards are effectively managed such that individual exposures are below ARPANSA exposure limits and kept to the lowest level achievable, consistent with best practice
- ensure that all necessary training (records kept) and supervision is provided to all radiation workers
- provide proper resources (e.g. work area, safety devices and PPE)
- communicate with, local RSO and LSO
- report any incidents, exposures or hazards via the Workplace safety incident and hazard reporting tool and
- report any Workplace Health and Safety (WHS) concerns or matters within their jurisdiction to the local RSO/LSO

Radiation workers

9. All radiation workers are required to meet the responsibilities stated in the Radiation safety policy and Nuclear Safety Procedure, in addition, other responsibilities are described in this procedure (refer paragraph10-25) for specific cases as applicable. The following apply to all radiation workers:

- do not operate equipment or enter a facility if not authorised
- ensure that training obligations are met before work commences
- are familiar with emergency plans

* comply with all relevant safe work procedures, risk assessments, operation restrictions and work practices
* identify and raise (with supervisor, RSO/LSO or HSR) any concerns or changes that impact on workplace safety or the risk assessment and
* ensure that equipment, safety controls and PPE are functional and not damaged

Pregnant Radiation Workers

10. Females working with radiation notify their supervisor (or the RSO/LSO or Work Environment Group) as soon as they suspect they are pregnant. Once the pregnancy is confirmed, the supervisor actively seeks to further control exposure and provide information to the radiation worker on the risks to the embryo or foetus when the parent is working with radiation. When a radiation worker is no longer able to continue working with radiation, the supervisor (in consultation with the RSO) provides suitable alternative tasks.

11. Where a pregnant radiation worker continues to work with ionising radiation, a more stringent dose limit must be applied to the embryo or foetus. The dose limit for a pregnant radiation worker is 1 mSv a year during pregnancy.

12. These conditions also apply to breastfeeding radiation workers.

13. Radiation monitoring badges are worn at the level of the waist by a pregnant radiation worker or the chest by a breast-feeding radiation worker. Refer to ARPANSA Radiation Protection Series - 1.

Workers with a medical condition or implants

14. Workers with a medical condition or a medical implant that may be affected by exposure to radiation (e.g. a heart pacemaker in a magnetic field) discuss this with their supervisor, the RSO or the Work Environment Group (WEG). Supervisors and managers of the local area provide suitable alternative tasks where the worker is no longer able to work with radiation for health reasons. For further information, contact the WEG (whs@anu.edu.au).

University workers at external organisations

15. Workers planning to work with radiation at external organisations are to document the type of radiation they are working with and have their ANU supervisor and relevant RSO/LSO approve the work.

16. Where the external organisation provides the radiation monitoring, the RSO (in consultation with the WEG) considers how to combine external results with the University dose results.

17. University radiation workers comply with the external organisation's induction and training requirements.

Non-radiation workers

18. Any personnel who have not met the requirements of a radiation worker are directly supervised by an appropriately trained and authorised University radiation worker at all times when dealing with a controlled apparatus or material.

Visiting radiation workers at the University

19. All visiting radiation workers including honorary appointees, summer students and non-ANU contractors work with an ANU supervisor while they are working on ANU projects, on ANU grounds or in ANU buildings. Before any work starts, the supervisor approves the work and work conditions.

20. Workers meet (or exceed) all the set University radiation standards. They are aware of:

* their roles and responsibilities and how they may influence safety
* the University and local area standards for working with radiation and
* issues relating to age, pregnancy and medical implants

21. Workers meet the local RSO/LSO and discuss the work with them.

22. Any worker working in or visiting a radiation area undertake the local area induction before commencing work.

Table 2: Local induction processes for new radiation workers or visitors

When the duration of work at the ANU is expected to be:	**Then** the following is mandatory
Less than 20 days Includes radiation workers visiting from other organisations, honorary appointees, summer students and non-ANU contractors.	A local area workplace radiation induction. Full local area induction. Any additional local area requirements for e.g. supervision
More than 20 days	A local area workplace radiation induction.

	Full local area induction. Successful completion of ANU radiation safety course. An additional local area requirements.

23. If there is potential for new radiation workers or visitors to receive a radiation dose, the supervisor ensures that a Personal Dose-Monitoring Badge is issued after completion of the local area induction process.

Trade contractors, workshop and maintenance workers

24. When seeking access to hazardous and restricted locations, trade contractors, workshop and maintenance workers (including equipment technicians):

* adhere to the Control of access to restricted locations procedure
* obtain prior approval from the laboratory or area supervisor, or in their absence, the RSO/LSO and
* in an emergency consult with RSO, facility manager or head of the research group and gain approval for access if they need urgent access. This also applies to after-hours access

Facilities & Services supervisors of trade contractors

25. Facilities and Services supervisors ensure that prior approval and access has been granted by the laboratory/facility manager and RSO/LSO (or WHS officer) before allowing access to contractors.

New work approval

26. The local RSO, LSO and WEG help decide which approval level is correct for any new work. Approval for new work involving radiation may occur through:

* local area assessment or
* Radiation Safety Advisory Group (RSAG) assessment or
* ARPANSA approval or
* the Australian Safeguards and Non Proliferation Office (ASNO) notification

Local area assessment

27. A local area assessment is suitable when a new activity/project is conducted using a radioactive isotope or controlled apparatus currently in use within the local area and arrangements are in place to correctly transfer expertise with the isotope, procedure or apparatus to the new work location. The material or apparatus are listed in the local area's ARPANSA inventory.

28. The process outlined in Table 3 applies.

Table 3: University local area new-work approval process

Step	Who	Action
1	Activity leader in consultation with supervisor or research leader:	Conduct a risk assessment as per the WHS Hazard management procedure. Develop a radiation safety management plan: For ionising radiation use, the ionising radiation apparatus application form; or ionising radiation isotope application form For non-ionising radiation also use, the Laser application form and the Non-ionising radiation equipment application form.
2	Supervisor or research leader	Develop safe-work procedure to ensure compliance with relevant codes of practice and the licence conditions, based on * the results of the risk assessment * ARPANSA documents Radiation Protection Series and Radiation Health Series and * Australian Standards.

3	Supervisor or research leader	Send the completed risk assessment and radiation safety management plan including safe-work procedure to the Coordinating RSO (CRSO) or Coordinating LSO (CLSO) for approval. CRSO or CLSO validates that the control measures are in place (via inspection as necessary) and provides feedback as needed. **Note:** The CRSO or CLSO is required to provide the local WHS Committee with details of the new experiment.
4	CRSO or CLSO	CRSO or CLSO sends complete documentation to WEG for information.
5	Local area	After all measures are in place and approval is given, the activity commenced.

RSAG assessment

29. A RSAG assessment is suitable when there is:

- a new protocol that uses existing material or apparatus
- a new radiation producing apparatus
- a new sealed source
- a new unsealed source not currently listed in the school's inventory
- an unsealed source of a radioisotope that exceeds the cumulative activity for that radioisotope shown on the inventory
- an unsealed source of a radioisotope of different physical form (i.e. solid, liquid, gas) than shown on the inventory for that radioisotope
- an unsealed source of a radioisotope that is to be used differently than shown on the inventory for that radioisotope (i.e. the risks are significantly different)
- transfer of radioactive material into long-term storage or

* some other situations as determined by the WEG or RSOs/LSOs

30. The following RSAG new-work approval process applies.

Table 4: RSAG new-work approval process

Stage	Who	Description
1	Researcher or Group Leader	Completes the correct application form: New radiation work application form; and one of the following: * Ionising radiation apparatus application form * Ionising radiation isotope application form * Non-ionising radiation equipment application form or * Laser application form Sends the completed forms to the Local RSO/LSO.
2	Local RSO/LSO	Checks the forms for completeness and sends the completed forms to the Coordinating RSO for comments.
3	CRSO/CLSO	The CRSO/CLSO adds any comments and sends the completed forms to the WEG whs@anu.edu.au .
4	WEG	Checks the forms, adds any further comments required and sends the forms to

		the RSAG.
5	RSAG	Considers the application and returns the forms to WEG with decision for distribution.
6	WEG	Records the assessment and returns the RSAG approved application to the Researcher or Group Leader and the CRSO/LSO.
7	Local area	After all measures are in place and approval given, the activity commences.

ARPANSA approval

31. ARPANSA assessment and approval is required for:

- a new radiation dealing that involves radiation apparatus or materials not currently listed in the University inventory (ARPANSA Workbook)
- changes that significantly influence the safety of a radiation area or process (according to section 63 of the ARPANS Regulations)
- disposal or transfer of ARPANSA controlled radiation apparatus; and
- disposal or transfer of controlled ionising radiation sources

Table 5: ARPANSA new-work approval process

Stage	Who	Description
1	Researcher or Group Leader	**If**: it is a new radiation dealing; **Then:** complete the process as for a New-Work Approval application to the Radiation Safety Advisory Group. **If**: it is a transfer of a controlled source or apparatus between Commonwealth agencies;

		Then: complete the ARPANSA source transfer notice (http://www.arpansa.gov.au/Regulation/RegulatoryForms.cfm#2) **If**: it is a movement to a State organisation; **Then:** complete an ARPANSA disposal or transfer request form (http://www.arpansa.gov.au/Regulation/RegulatoryForms.cfm#2) **If**: it is a disposal of a controlled source or apparatus (i.e. the material is leaving the Commonwealth's control) **Then:** complete the ARPANSA disposal request form (http://www.arpansa.gov.au/Regulation/RegulatoryForms.cfm#2) Send the completed forms to the local RSO/LSO.
2	Local RSO/LSO	Checks the form for completeness and sends the completed form(s) to the CRSO/CLSO for comments.
3	CRSO/CLSO	Adds comments, if required, and sends the completed forms to WEG whs@anu.edu.au
4	WEG	Checks the forms and helps the CRSO/CLSO complete the appropriate ARPANSA application/forms and sends the completed form to ARPANSA for approval.
5	ARPANSA	Assesses the application and returns it to the WEG for action.
6	WEG	Notifies local area of the ARPANSA decision.

32. Changes that significantly influence the safety of a radiation area or process include

Section 63 of the ARPANS Regulations requires ANU to seek the CEO's approval to make certain changes that will have significant implications for safety.

If a change has significant implications for safety, the ANU must seek approval to do either of the following:

* change anything described in the application for the licence or
* modify the controlled source, apparatus or facility described in the licence

Examples of such changes include: the alterations of processes; introduction or removal of equipment; modifications to structures systems or components; changes in the way processes are undertaken and resourcing of a source or facility.

33. If researcher(s) are in doubt contact the local area RSO/LSO for clarification.

ASNO Notification

34. ASNO notification is required when:

* new experiments involve a nuclear source purchase or
* disposal occurs in accordance with the University permit and the Nuclear safety procedure

35. Any proposed new nuclear material is discussed with University's the ASNO liaison officer (contact: whs@anu.edu.au).

New radiation laboratory designs

36. Any new (wet chemistry) radiation laboratories comply with AS/NZS 2982 Laboratory design and construction and AS/NZS 2243.4 Safety in laboratories: ionising radiation.

37. Radiation measured outside laboratories housing radiation apparatus or radioactive material are below the public exposure limits set by ARPANSA.

Note: Contact Work Environment Group (WEG) on whs@anu.edu.au for advice.

Existing laboratory compliance

38. The following audit checklists are used to assess an area's compliance with the current Australian Standards on laboratory safety:

* ionising radiation apparatus/material
* non-ionising radiation
* lasers or
* laser system or equipment

39. The checklists are used if there are proposed changes in existing laboratories. RSO/LSO use these checklists as part of their audit program.

40. Discuss any deficiencies with the local RSO/ LSO and local management. If there is a dispute, contact WEG on whs@anu.edu.au for advice.

Training, qualifications and experience

41. Activities with safety implications are conducted under the control of qualified, experienced and authorised personnel, and under approved written protocols. Table 6 lists minimum training, qualifications, and experience.

Table 6: Training, qualifications and experience requirements

Worker	**Education,** Qualifications or Training	**Related Experience**	**Authorisation**
New workers who are working with radiation.	Worker is not able to work in radiation area at the University until they have successfully completed the Radiation Safety Course and are deemed competent in the laboratory procedures. Depending on role, immediate supervisor completes Pre-employment work environment report (PEWER) form	Special circumstances are considered due to past experience but exam must be passed and competence demonstrated.	RSO/LSO authorise work with radiation according to demonstrated level of training/skills required. Electronic Security Pass to specific area/lab issued by local RSO/LSO.
Undergraduate Student	Year 12, training/ Studying	None, requires direct supervision from a competent and	Supervisor

		authorised worker	
Equipment maintenance officer/ technician	Relevant technical qualifications, University Radiation Safety Course (highly recommended)	Relevant technical expertise and understanding of the hazards associated with the equipment and acknowledgement of the University's procedures.	Supervisor, RSO
Radiation worker, Controlled laser user, PhD and honours students	Local area induction course, University Radiation (operator laser safety) Safety Course, on the job training in techniques and processes	Minimal experience, but needs supervision until demonstrated proficiency and authorised for unsupervised work (understands theory, and for isotope work conducts a dry run of the experiment)	Supervisor
Supervisor	Local area induction course, PhD, University Radiation Safety Course, University WHS for managers, Laser Safety Officer Course (level 2)	More than one year practical experience	Dean/Director
Deputy Radiation Safety Officer, Laser	Local area induction course, University Radiation Safety	More than one year practical experience. The	Business/ Laboratory Manager, RSO

Safety Officer	Course, Laser Safety Officer Course (level 2)	deputy RSO/LSO may occupy the role of RSO/LSO for up to six months to cover absences of the incumbent RSO/LSO.	
Radiation Safety Officer, Laser Safety Officer	Local area Induction course, University Radiation Safety Course and encouraged to attend an external radiation safety course. Laser Safety Officer Course (level 2)	Three years minimum in radiation safety, with practical experience	Dean/Director
Coordinating Radiation Safety Officer, Laser Safety officer	Local area induction course and University safety courses (ionising machines, lasers and radiation safety Training). A coordinating RSO/ LSO may also be a RSO/LSO or a user of radiation. Laser safety officer course (level 2) plus experience.	Three years minimum in radiation safety, with practical experience. A coordinating RSO/ LSO is able to network with the other area RSOs and attend the University's RSAG. They are responsible to the Dean/Director to maintain the area's ARPANSA inventory.	Dean/Director

Acceptable alternative training

42. External courses or other institutional courses are recognised as a substitute for the University safety courses by agreement with the local area RSO/LSO, WEG or University RSAG. New workers with external training are encouraged to complete the University Radiation or Laser Safety course(s).

Re-training

43. Workers relying solely on the University radiation safety courses refresh their training every five years. All radiation-trained personnel revisit the University safety site regularly, or upon notification of changes or additions to information on the web sites.

Ionising radiation

Handling radioactive materials at the University

Ionising radiation store requirements

44. Stores for radioactive substances comply with the following:

- ensure the store is secure and restricted to authorised personnel only
- ensure only radioactive substances are stored there
- keep a register (for waste stores) or a Chemical Inventory (for radiation stores) that is readily accessible to authorised workers only
- appoint a person to be responsible for the store housekeeping
- display a radiation warning sign at the entrance(s) to the store
- place containers of radioactive substances on spillage trays
- ensure the store has enough light to read the labels and good ventilation (natural or mechanical)
- display emergency contact details and
- store packages and containers to prevent physical damage, reduce the effects of the chemical properties, contain spills or leaks; and separate packages from incompatible materials (packages will not need to be opened once placed in the store)

45. The RSO assesses and records minimum and maximum radiation dose rates at least annually.

Note. Radiation levels are measured outside the entrance of the store and on any major path or public area next to the store.

Storage of radioactive substances

46. All radioactive substances must be stored in appropriate storage containers. Radioactive substances are stored separately from non-radioactive substances. The storage containers are appropriately shielded and:

- strong
- durable
- made of compatible material
- kept closed and
- labelled clearly and appropriately with radioactive isotope information

47. Unsealed radioactive residues at tracer levels are stored in glass vessels with correct polyethylene or rubber stoppers.

48. Ionising radiation can induce decomposition of water, so vented containers are needed to store aqueous radioactive solutions.

49. Thermally unstable radioactive substances need particular care and are stored in vented containers.

50. Storage containers for beta-emitting isotopes are chosen to reduce bremsstrahlung radiation.

51. During building renovations/demolition, RSO or facility's manager bring to contractors' attention all controlled apparatus' in their respective areas. They also complete the Controlled apparatus identification and local listing form before commencement of their work.

Labelling of storage containers and ionising apparatus

52. All storage containers have a label that correctly identifies the radioactive substance. The label contains the following information:

- name of radio nuclide
- activity level/details
- description of contents
- physical form
- chemical form
- encapsulating material and
- Chemical Management System barcode

See: Appropriate label for storage container

53. Long-lived radioactive material that is no longer required needs special storage containers and labelling. Contact your RSO for further information.

54. All radiation apparatus listed on the University ARPANSA inventory is labelled.

See: Appropriate label for ionising apparatus

Transporting radioactive material

Table 7: Transporting radioactive material

Mode of transport	Packaging Requirements	Approval
Within the University buildings: this includes between the radiation store and laboratory, laboratory to laboratory, laboratory to radiation store	Radioactive material is contained properly. It has primary and secondary containment. It is labelled with a radiation trefoil and substance or material identification and shielded to reduce exposure to an acceptable level (< 10 µSv/hr or <500 counts/s) at 1cm from package.	Supervisor/lab leaders
Between the University buildings	All material is appropriately packaged, labelled and secured. Tertiary containment is required for unsealed sources.	RSOs
By rail, road and waterways	Package complies with Radiation Protection Series C-2- Code for the Safe Transport of Radioactive Material (2019)	RSOs and WEG
By air	Transportation by air complies with the *Civil Aviation Act, 1988* and International Air Transport Association (IATA) requirements. An IATA-certified person packages and provides the documentation for material transported (off campus or) by air.	RSOs and WEG

Transfer of controlled material or controlled apparatus within the University

55. Transfer within the University occurs between areas covered by the ARPANSA licence and only with the approval of the RSOs in both the areas involved. RSOs are responsible for:

- notifying WEG of the transfer on the next ARPANSA quarterly report
- updating the Source Inventory Workbook (SIWB) with the new location of the controlled material or controlled apparatus and
- where control of the source is passed to another budget area, the prefix of the University identifier in the SIWB is to be changed to reflect that change of ownership

Transfer of controlled material or controlled apparatus to another Commonwealth agency

56. Transfer of controlled material or controlled apparatus occurs between the University and other licensed Commonwealth Agencies. The RSO from the area transferring the material completes a Transfer Notice within seven days of the transfer and sends it to the CRSO who sends the form to WEG for submission to ARPANSA.

57. For information on transferring nuclear material within the University or externally, contact WEG at whs@anu.edu.au.

Transfer to a non-Commonwealth agency and disposal of controlled material or controlled apparatus

58. Licence holders receive prior approval from ARPANSA. Transfer of a controlled apparatus or controlled material listed in the SIWB to a non-Commonwealth agency is defined as “Disposal” and requires prior approval from ARPANSA. The RSO/ LSO from the area transferring the material complete a disposal request form and sends it to CRSO/CLSO who sends the form to WEG for submission to ARPANSA.

59. Licence holders ensure that disposal of controlled material or apparatus follows:

- The National Directory for Radiation Protection
- Code for Disposal Facilities for Solid Radioactive Waste
- Code of Practice for the Safe Transport of Radioactive Material or/and
- The Code of Practice for the Security of Radioactive Sources.

Disposal of radioactive waste

60. Radioactive laboratory waste released under a Radiation licence issued by the ACT Radiation Council does not require written approval. Disposal must be done in accordance with the local area Radiation Waste Management Plan.

61. The Radiation Waste Management plan is endorsed by the RSAG and lodged with the WEG. Transfer of low-level radioactive waste from the University to an approved location is done in accordance with the local area transfer processes contained in their Radiation Waste Management Plan. The local RSO is notified before any waste leaving and ensures that the transfer is fully documented.

62. Disposal of radioactive waste material involves one of the following:

* returning it to the manufacturer or supplier for processing
* concentrating and containing it
* storing the material and allowing it to decay or
* diluting the material

63. Every effort is made to minimise the generation of hazardous and radioactive waste. If an experiment is to produce radioactive waste, the researcher must consider how to dispose of any residue, contaminated equipment and waste at the design stage. A protocol or waste disposal route is available (and approved by RSAG) before the work can commence. The local RSO assists.

64. Details for disposing of radioactive waste are located in the Hazardous waste management procedure.

65. For disposing of controlled material or apparatus contact local area RSO/LSO.

66. For disposing of nuclear material consult the Nuclear safety procedure and send the completed form to University ASNO Liaison Officer at whs@anu.edu.au for approval.

Import of radiation sources

67. Under the Customs (Prohibited Imports) Regulations 1956, a permit from ARPANSA is required for the import of radioactive substances into Australia. Refer to the Non-medical import permits page for more details.

68. To apply for a non-medical import permit, complete the appropriate application form:

* Non-medical single shipment - Application for permission to import non-medical radioactive substances - Single shipment permit
* Non-medical 12 month permit - Application for permission to import non-medical radioactive substances - Twelve month permit

69. Submit the completed form with required documents to the local area CRSO.

70. Local area CRSO submits the form to WEG for submission to ARPANSA.

71. WEG notifies the local area CRSO after receiving ARPANSA decision.

Minimum age limits

72. Persons under the age of 16 do not work in a high-hazard or restricted area unless directly supervised, and are not exposed to conditions where that person may be exposed to radiation exceeding the effective dose limit for members of the public.

73. No one under the age of 18 works in a high-hazard or restricted area unless directly supervised. Refer to the: Control of access to hazardous and restricted locations procedure.

Monitoring

Personal Ionising Radiation Monitoring

74. As a minimum safety precaution, radiation workers:

- wear issued radiation-monitoring dosimeters during their radiation work and
- maintain their monitoring dosimeters and keep them clean as advised in the manufacturer's guidelines

See: Personal and area monitoring Supporting Documents for details about dose limits.

75. The following table applies to personal monitoring.

Table 8: Personal monitoring

When a worker ...	**Then …**
Begins work with the University in radiation laboratories, or performs work involving radiation exposure	RSO, supervisor or monitoring agency requests cumulative radiation dose reports or incident reports from past employment or exposure.
Ends their employment with the University	They are entitled to request a copy of their cumulative dose report and their incident report.

76. ARPANSA mandates that the annual dose received by radiation workers should not exceed 20 mSv, averaged over five consecutive years, with no more than 50 mSv in any one year. The following protocols in table 9 apply.

Table 9: ANU dose constraints

Where a worker's dose results ...	**Then …**
>80 µSv per month or >250 µSv in a reporting quarter, or >1000 µSv per year	Report the dose results using the University's notification system.
Approach recommended dose limits	Strictly monitor and review the radiation work to ensure the dose remains within set limits.

Area, zone and equipment monitoring

77. WEG conducts personal and area monitoring to identify whether dose exceeds worker dose constraints, or where changes have occurred. Documented (ionising and non-ionising) radiation monitoring results provide information that assists in creating actions that reduce the radiation dosage to personnel. This also includes regularly monitoring equipment for leaks or contamination that could lead to personal exposure.

Environmental Monitoring

78. The release of radioactive material into the environment is strictly regulated and controlled. Contact WEG at whs@anu.edu.au for further information.

79. Radon, a naturally occurring radioactive gas that originates from rock and concrete, permeates into buildings. When the ventilation is poor, radon levels may increase. The WEG can arrange radon monitoring of buildings on request. Consult your RSO or the WEG for further information.

Testing sealed sources

80. The RSO arranges for wipe or smear testing for each sealed sources or its housing at least annually. Testing results are kept in accordance with records management processes.

Record keeping

Local areas

81. Local areas must maintain:

* RSO/LSO contact details

- radioactive waste disposal records
- ACT Radiation Council radiation licences for waste disposal and
- local WHS committee minutes and agendas that discuss radiation issues

RSOs

82. RSOs/LSOs maintain:

- access to the ARPANSA Source Inventory Workbook
- applications for new-work
- safety assessments, reviews and approvals
- personal ionising radiation dose records
- records of ionising radiation doses that workers have received, including details of monitoring results and dose calculation methods. These are to be kept during the working lifetime of the person and afterwards for no less than 30 years after the last dose assessment and at least until the person reaches or would have reached 75 years of age
- area, zone and equipment-monitoring results
- radiation store radiation survey results and dose rates
- radiation apparatus and laboratory design specifications for new or refurbished installations
- local area annual monitor efficiency testing and or calibration results
- medical records of optical examination for persons using class 3B and 4 lasers
- sealed source records comprising of the serial number or other identification of each source
- the physical nature of the source, the radionuclide, its date of receipt and its activity upon receipt; all movements of the source in the University and the date and manner of disposal of the source when it leaves the University

Radiation Laboratory Leaders

83. The Radiation Laboratory Leaders must maintain:

- documentation for new-work and movement
- documentation of internal transfer and/or consumption of unsealed radiation sources and

* safe-operating procedures, protocols and risk assessments (which are reviewed periodically)

Personnel File

84. The following documents are kept on the personnel file of those working with radiation:

* training and qualifications
* relevant radiation experience
* a copy of medical records
* a copy of the final cumulative radiation dose report upon leaving the University (or wearer register identification) and
* a copy of any relevant radiation-incident report(s) and investigation results

WEG

85. WEG must maintains:

* the University ARPANSA Licence
* training attendance records (University safety course details only)
* minutes of RSAG meetings
* WEG member's exposure assessment reports
* centralised environmental monitoring results (e.g. radon)
* incident and investigation reports and
* records of internal audits, ARPANSA inspections and verification of completed corrective actions

Personnel monitoring dose records

86. An individual's exposure report should be available to them on request. Records are available for inspection to the proper authority following request.

87. Records are stored in Historion (radiation dose reporting software) and submitted to Australian National Radiation Dose Register (ANRDR) as per the University Licence condition by WEG.

Security arrangements

88. The University implements ARPANSA security requirements for radioactive sources according to Code of Practice for the Security of Radioactive Sources to decrease the

likelihood of unauthorised access to, or acquisition of, the source by persons with malicious intent.

89. Radiation areas are hazardous locations under the control of access to restricted locations. Except for emergency services personnel in an emergency, only authorised persons may access a radiation area. An authorised person accompanies all visitors or trades persons at all times.

90. An initial security inspection of a radiation area is conducted to ensure that the area also meets the security requirements of AS/NZS 2243.4 Safety in laboratories - Ionising radiation and AS/NZS 2243.5 Safety in laboratories- Non-ionising radiation. Regular area audits also identify any security concerns.

Radioactive sources and apparatus not in use

91. Radioactive sources and apparatus not in use must be secured according to the AS/NZS 2243.4 and AS/NZS 2243.5 to ensure that there is no unauthorised access or operation.

Emergency procedures

Table 10: Emergency Procedures overview

When there is a:	**Then**:
Spillage	Immediately notify immediate supervisor and CRSO; * if safe to do so, notify closest workers first and evacuate the area immediate to the spill Follow the requirements outlined in Laboratory spill management Note: Any serious injury to a person should be treated immediately, taking care to reduce the spread of contamination. Emergency treatment for serious or life-threatening injury takes priority over treatment for contamination.
Fire/ Explosion	Immediately notify immediate supervisor and CRSO;

	Follow the procedures in University's emergency procedures. **Note**: If there is a fire or explosion inform the senior officer of the attending fire brigade of radioactive hazards. **Warning**: Fire and explosion are likely to spread radioactive contamination.
Chemical Incident	Immediately notify immediate supervisor and CRSO; Follow the chemical management procedure.
Biological Incident	Immediately notify immediate supervisor and CRSO; Follow the Biological safety procedure.
Need for First Aid	Immediately notify immediate supervisor, first-aid officer and CRSO; Follow the Provision of first aid services procedure, which describes in detail early First Aid treatment in an emergency.
Need to decontaminate people	Immediately notify immediate supervisor and CRSO; Follow the procedures in Laboratory Spill management, which explains the process to decontaminate. Note: Anyone who has had an accidental intake of radioactive material is referred to the CRSO as soon as possible to determine if there is a need for medical monitoring. Help on this matter is available through the WEG, ACT Radiation Health Section and

	Canberra Hospital.
Flood	Ensure radioactive substances are stored so water damage cannot occur.

Reporting incidents involving radiation

92. Reporting and investigating all incidents, significant exposures and dangerous occurrences helps the University avoid recurrence of the incidents. Table 11 applies to reporting any incident involving ionising radioactive materials or ionising radiation producing apparatus.

93. Protection of the individual(s) takes priority over reporting. Follow the Provision of first aid services and Emergency response procedures.

Table 11: Incident reporting

Step	Action
1	Immediately, report the incident to the area supervisor and CRSO.
2	Complete an Incident report via the Workplace safety incident and hazard reporting tool.
3	The WEG reports the incident to ARPANSA by phone as soon as soon as practical to-do so and with written notification within 24 hours if it is a notifiable incident. Associate Director, WEG makes the determination.
4	The WEG reports all radiation incidents or near misses to ARPANSA according to the University's licence condition (Quarterly Report).

94. The CRSO and the area supervisor provides initial emergency assistance. Additional assistance in dealing with the emergency can be obtained from:

* the local RSO
* WEG

* University Security
* University Maintenance workers
* Emergency Services personnel or
* ActewAGL (Utility provider) workers at 13 10 93 (24 hours).

Testing, calibration and efficiency checks of radiation monitors and contamination detectors

95. Radiation contamination detectors are those detectors that measure count rate for example counts per second. Those detectors must have their efficiency checked every year and calibrated by NATA accredited organisation at least every five years. The detailed information on calibration and efficiency requirement is outlined in Radiation contamination detectors and monitors.

96. RSOs must annually conduct efficiency checks as outlined in Radiation contamination detectors and monitors in clause 95.

Radiation monitors and special radiation detectors

97. Radiation monitors are those devices that measure radiation in terms of an exposure assessment. That is, they are dose rate meters. They read Sv/hr, mREM/hr etc. A dose rate is calibrated annually by NATA accredited organisation. Efficiency checks must be performed by RSOs annually as well.

98. Special radiation detectors for low energy x-ray detection or neutrons are tested annually or as per manufacturer recommendations Simple operational checks are conducted regularly and before each use for all types of radiation monitors or detectors.

Non-Ionising Radiation-Lasers

99. This procedure is mandated for controlled lasers, which produce ultraviolet, visible or infrared radiation and laser pointers. In general all lasers used within the University are classified in accordance with AS/NZS IEC 60825.1 Safety of laser products Part 1: Equipment classification and requirements (or equivalent) and all use of lasers shall meet the requirements of AS/NZS IEC 60825.14 Safety of laser products Part 14: A user's guide. Refer to ARPANSA Laser radiation basics and AS/NZS IEC 60825.1 Safety of laser products Part 1: Equipment classification and requirements, and AS/NZS IEC 60825.14 Safety of laser products Part 14: A user's guide.

Reporting incidents involving controlled lasers and controlled non-ionising apparatus

100. Reporting and investigating all incidents, significant exposures and dangerous occurrences helps the University avoid repeating incidents. Table 12 applies to reporting any incident involving controlled laser apparatus and controlled non-ionising apparatus.

101. Protection of the individual(s) takes priority over reporting Follow the Provision of First Aid services and Emergency response procedures first.

Table 12: Controlled laser and controlled non-ionising apparatus incident reporting

Step	Action
1	Immediately, report the incident to the area supervisor and local RSO. All laser incidents should be reported locally and investigated.
2	Report the Incident via the Workplace safety incident and hazard reporting tool as per the WHS Incident management procedure.
3	The WEG reports the incident to ARPANSA by phone as soon as soon as practical to-do so and with written notification within 24 hours if it is a notifiable incident.
4	The WEG reports all incidents, near misses involving controlled lasers to ARPANSA according to the University's licence condition (Quarterly Report).

102. The CLSO and the area supervisor provide initial emergency assistance. Additional assistance in responding to the emergency may be needed from:

- The RSO
- WEG
- University Security
- University Maintenance workers or
- Emergency Services personnel

Training

103. All personnel involved with the operation and management of controlled lasers are t appropriately trained, i.e. to a level commensurate with the risk and their role. Training requirements for this procedure are detailed in table 6.

Laser Safety Officers

104. Local laser safety officers are appointed in areas where controlled lasers are housed or operated and are charged with the responsibility of ensuring compliance with the University policy and procedures.

105. A coordinating laser safety officer may be appointed at a University level to provide local LSOs a path to raise complex approvals (see Tables 3, 4 & 5) and specialist advice to the RSAG.

106. All LSOs are aware of their duties and be provided with training commensurate with those duties, see table 6.

Contingency plan for traumatic eye exposure

107. Where class 3B and 4 lasers are used laser radiation safety management plans include a contingency plan for actions to be taken if a traumatic eye injury occurs. If serious eye trauma results in the casualty going into shock and in extreme cases death has occurred, it is treated as a medical emergency. All personnel involved are to be familiar with the plan.

Table 13: Actions in the case of traumatic eye injuries

Step	**Action**
1	Immediately, call ambulance, cover casualty's eye and monitor/treat for shock
2	As soon as possible after casualty is stabilised, report the incident to the area supervisor and CLSO.
3	Report the Incident via the Workplace safety incident and hazard reporting tool as per the WHS Incident management procedure.
4	The WEG will report the incident to ARPANSA by phone as soon as practical to

	do so and with written notification within 24 hours if it is notifiable incident.

108. Once the medical emergency is dealt with, the appropriate incident reporting procedure is followed.

Laser accident/incident investigations

109. Incidents involving lasers are investigated in accordance with the WHS incident management procedure.

Laser Eye Testing

110. Staff involved with class 3B or 4 lasers undergo an ophthalmic screening (before working with lasers) to assess the baseline condition of their eyes. Refer to the Health monitoring procedure for further information on the testing requirement.

111. Routine ophthalmic examinations of employees working with laser equipment have no value as part of a health surveillance program (AS/NZS IEC 60825.14 Safety of laser products, part 14: A User's guide). Only medically advisable ophthalmic exams are carried out, e.g. in the case of an exposure above the Maximum Permissible Exposure (MPE) or a traumatic exposure.

112. Routine eye tests e.g. visual acuity, amsler grid etc. are carried out as part of ongoing eye health program, as a validation of controls or as a precursor to more invasive tests after a suspected exposure.

Pre-Work or pre-purchase planning for laser activities

113. Only justified (documented) research or dealings with controlled lasers are conducted at the University. All laser activity is planned, managed and approved using the processes stated in tables 3, 4 or 5 of this document as appropriate. Laser activity proposal adheres strictly to the hierarchy of control; for example in general approval for an activity is not given for use of a class 4 laser when a lower class could be used.

114. Where practicable the approvals process detailed in tables 3, 4 or 5 is commenced and developed as much as possible before purchase. Before purchasing a laser the supervisor or worker responsible for the activity confirms compliance of the device with the appropriate product safety standard (AS/NZS IEC 60825.1 or equivalent). Compliance is confirmed as soon as possible (as far as reasonably practicable) on delivery before acceptance (taking control of the laser) and upon acceptance entered into the ARPANSA Source Inventory Workbook.

115. All class 3b or 4 lasers are not commissioned until new-work approval for the activity is obtained and necessary documentation is complete.

Storage and transport of controlled lasers

116. When controlled lasers are not being used they are stored in a decommissioned state, i.e. a state whereby they cannot be simply activated by a passer-by; for example, in a secure room with the keys or power supply physically separated.

117. Unless a controlled apparatus is transferred off the source licence, the licence holder is responsible for its safety at all times. Any time that a controlled laser is transported around or between facilities, a locally recorded safety plan is implemented and the location change recorded in the inventory workbook by WEG.

Short-term variation to approved activities and maintenance

118. Short-term variations to activities that have not been foreseen in the original activity approval are separately approved by the local LSO or coordinating LSO as appropriate. Short-term variations to activities are documented and approved using the new-work approval process.

119. Where possible, regular maintenance activities are considered in the overarching work approval detailed in tables 3, 4 and 5. Laser radiation safety management plans are written in a way that foresees and accounts for maintenance activities and single fault events. However, where this has not occurred maintenance is approved through a short-term variation.

General controls for all lasers

120. All work procedures using lasers are planned, managed and conducted in a way that meets the requirements of this procedure and the requirements of AS/NZS IEC 60825.14 and the AS/NZS IEC 60825.1.

https://www.saiglobal.com/online/Search/Standard*Laser Eyewear*

121. Risks are managed in such a way that eyewear in not required. Where this is not achievable or additional redundancy is required, laser protective eyewear is prescribed. In these cases the supervisor consults with the appropriate LSO who determines the appropriate laser safety eyewear rating. The eyewear performance is specified to reduce the maximum reasonably foreseeable exposure to safe levels and considers eyewear resistance to damage and impacts to user comfort/vision. For more information refer to AS/NZS 1337- Requirements for eye protectors against laser radiation.

122. Where class 4 lasers are being used, laser-protective eyewear are not be considered in isolation of the skin hazard. In such cases, it is appropriate to consider face shields rather than glasses or goggles.

123. Eyewear users check the condition of their eyewear before each use and store to prevent damage from scratching or contact with water or chemicals. Users always read manufacturer's instructions regarding the proper care and use of eyewear.

Safety Associated with Servicing of Lasers

124. In addition to the following requirements, if servicing is not included in the overarching approved safety management plan, it is to be formally approved as a short-term variation to the approved activity; see above.

125. Approved and properly trained personnel must service laser systems in line with licence conditions. The supervisors and/or LSO must ensure that any person who repairs or maintains controlled apparatus has the appropriate qualification and training irrespective of being University staff or contractor.

126. If University staff perform service, a written service process with safe practice information must be documented. All enclosures, interlocks, and safety devices (shutter, etc.) must be replaced and verified as operational before returning the laser to service.

127. The above requirements apply when servicing is conducted off site unless the controlled laser is transferred off the University source licence to another jurisdiction.

Disposal, transfer and destruction

128. ARPANSA approval is required before disposal, transfer or destruction of controlled lasers. All such activities are carried out in accordance with the requirement of this procedure, see table 5.

Laser Pointers

129. Laser pointers are a common tool for many lecturers to highlight or direct a person's attention to a relevant location. A presentation laser pointer is a class I or class II laser product and labelled as such. Class 3 (III) laser pointers are not suitable for presentations and their use is restricted. **DO NOT** purchase laser pointers overseas unless they are clearly labelled and meet the criteria.

130. Handheld, battery-operated lasers that emit laser radiation in excess of 1mW are considered a prohibited weapon under the *ACT Prohibited Weapons Act 1996* and require a police permit. Additionally, a large percentage of "laser pointers" also exceed the ARPANS limit and are therefore a controlled laser (s). The use without approval per this procedure is a breach of the University's license conditions. These dangerous lasers are only used by trained and aware staff with a legitimate reason.

Ultraviolet

131. Ultraviolet (UV) radiation (wavelengths from 200 to 400 nm) may be produced by low pressure gas discharge lamps for germicidal control in biological safety cabinets, or UV curing, reaction vessels and in transilluminators. The Ultraviolet radiation supporting document outlines the precautions required while working with UV sources. Refer to ARPANSA UV radiation Basics, Radiation Protection Series 12: Occupational Exposure to Ultraviolet Radiation and AS 2243.5 Safety in laboratories -Non-ionising radiation - Electromagnetic, sound and ultrasound.

Infra-Red

132. Infra-Red (IR) radiation (wavelengths between 760 nm and 1 mm) may be produced by IR lamps or associated hot materials (such as furnaces). Refer to AS/ NZS IEC 62471- Photo biological safety of lamps and lamp systems

Radio frequency

133. Radio frequency (RF) is the portion of the electromagnetic spectrum with frequencies between 100 kHz and 300 GHz. Sources of RF include microwave ovens, induction heaters, plasma sources, and radio transmitters. Refer to ARPANSA RF radiation basics webpage and Radiation Protection Series S-1-Standard for Limiting Exposure to Radiofrequency Fields – 100 kHz to 300 GHz.

Visible light

134. Visible light is the part of the electromagnetic spectrum between 400nm to about 760 nm. The maximum sensitivity of the human eye occurs at 555nm. Sunlight is the main source of visible light and eyes are at high risk of damage from non-ionising UV radiation.

Other non-ionising radiation

135. For concerns about any non-ionising radiation contact WEG via whs@anu.edu.au for further information and assessment. Refer to ARPANSA and Electromagnetic spectrum.

Note: Non-ionising radiation apparatus producing potentially hazardous exposures are also managed within the University's radiation licence.

Legal and other requirements
Australian Radiation Protection and Nuclear Safety Agency (Cth)- *Radiation Protection Series*

Australian Radiation Protection and Nuclear Safety Agency (Cth)*- Radiation Health Series*
AS/NZS 2243.1- Safety in laboratories - Planning and operational aspects
AS/NZS 2243.4- Safety in laboratories - Ionising radiation
AS/NZS 2243.5- Safety in laboratories - Non-ionizing radiation - Electromagnetic, sound and ultrasound
AS/NZS 2982- Laboratory design and construction
AS/ NZS ISO 31000- Risk Management- principles and guidelines
AS/NZS IEC 60825.1 Safety of laser products, Part 1: Equipment classification and requirements.
AS/NZS IEC 60825.14 Safety of laser products, part 14: A User's guide
AS/NZS 1336 - Recommended practices for occupational eye protection.
AS/ NZS 1337- Requirements for eye protectors against laser radiation.
AS/ NZS IEC 62471- Photo biological Safety of Lamps and Lamp System.

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