

Ionising Radiation Safety Management

IMPLEMENTATION

Aim

To prescribe the responsibilities and actions required for the safe management of radiation on university premises and/or during University related activities to ensure the university meets the requirements of the Health, Safety and Wellbeing (HSW) Policy, [Radiation Protection and Control Act 2021](#), [Radiation Protection and Control Regulations 2022](#) and the relevant sections of the [Work Health and Safety Act 2012 \(SA\)](#).

This procedure should be read in conjunction with the [Plant/Equipment Safety Management Procedure](#), and [the University Radiation Management Plan](#).

1 Objectives

- 1.1 To ensure that the risks of radiation activities, are identified, assessed and the appropriate control measures are in place to prevent an injury and minimise exposure.
- 1.2 To ensure that:
 - all radiation related incidents and safety issues are investigated and reported to the governing body (South Australian Environment Protection Authority "EPA") where required
 - control measures have been reviewed before the activity is conducted again
 - corrective action(s) have been implemented where required to prevent a recurrence.
- 1.3 To ensure that radiation sources are secure against unauthorised use which may result in misuse and harm to people and/or the environment.
- 1.4 To ensure that the radiation protection principles (refer to definitions) are considered when undertaking any activity involving radiation.

2 Scope and application

2.1 Inclusions

This procedure applies to:

- all persons taking part in any University activity that involves ionising radiation in teaching and research activities
- University premises where radiation is used
- University ionising radiation apparatus and University radioactive sources (sealed and unsealed).

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2 Scope and application (continued)

2.2 Exclusions

This procedure does not apply to:

- Non-ionising radiation
 - ultraviolet refer to [Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation \(2006\) ARPANSA](#) and [Australian Standard 2243.5](#)
 - radio frequency field refer to [Radiation Protection Standard for Limiting Exposure to Radiofrequency Fields—100kHz to 300 GHz \(2021\) ARPANSA](#) and [Australian Standard 2243.5](#)
 - [lasers](#)
 - Other non-ionising radiation sources (ultrasonic, sound, electric & magnetic fields (EMF), extremely low frequency (ELF), infrared, visible light) refer to [Australian Standard 2243.5](#).
- all radionuclides which are classified as at an exempt activity according to table I.3 (naturally occurring radiation) or table I.1 for all other nucleotides) of the [IAEA Safety Standards](#).
- any apparatus or source listed in schedule 4 of the [Radiation Protection and Control Regulations 2022](#) which are exempt from regulation (refer to [Appendix I](#))

2.3 Additional Requirements

- For all activities involving Dentistry and dental apparatus in addition to this procedure you must also refer to [Code of Practice and Safety Guide for Radiation Protection in Dentistry \(2005\) ARPANSA](#).
- All activities using fixed radiation gauges in addition to this procedure you must also refer to [Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges \(2007\) ARPANSA](#).
- All activities using radiation for industrial radiography, in addition to this procedure you must also refer to [Code of Radiation Protection Requirements for Industrial Radiography \(2018\) ARPANSA](#).
- All activities involving medical exposures, in addition to this procedure you must also refer to [Code for Radiation Protection in Medical Exposure \(2019\) ARPANSA](#).
- All activities involving veterinary medicine in clinical, teaching, or research exposures, in addition to this procedure you must also refer to [Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine \(2009\) ARPANSA](#).

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3 Process: General

Person Responsible		Actions
3.1	Licensed Supervisors	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure you are licensed by the Radiation Protection Branch of the Environment Protection Authority ("EPA") (South Australia) for the work you conduct, including the supervision of unlicensed individuals working with radiation and those practising as dentists and veterinary surgeons. <input type="checkbox"/> Ensure that workers under your supervision are: <ul style="list-style-type: none"> <input type="checkbox"/> licensed (where applicable) and registered with the University in accordance with section 4 of this procedure, <input type="checkbox"/> provided with information, instruction or training as per, section 5 of this procedure, <input type="checkbox"/> monitored in accordance with section 8 of this procedure (for exemptions refer to Appendix I), <input type="checkbox"/> not exposed to greater than 20milliSv in any year by reviewing dose reports and participating in any investigation initiated by Human Resources. <input type="checkbox"/> Ensure that Human Resources is consulted before any work listed in Appendix A is undertaken for the first time. <input type="checkbox"/> Ensure that the activity of conversion (from uranium oxide to uranium hexafluoride) or enrichment (altering the isotopic composition) of uranium does not occur. <input type="checkbox"/> Ensure that all activities in Appendix A are conducted in accordance with the associated codes and listed documents.
3.2	Radiation Workers	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure your work activities do not adversely affect the safety of other staff, students or the public by any action or inaction. <input type="checkbox"/> Ensure you and others are not exposed to more radiation than necessary by using the radiation protection principles and if using radiation for diagnosis or treatment exposure must be justified and authorised. <input type="checkbox"/> Comply with the local rules of the laboratory, store, or clinic.
3.3	Audit and Compliance Manager	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that radiation management is audited in accordance with the licence to possess. <input type="checkbox"/> Ensure that the University Radiation Safety Officer (URSO) is meeting regulatory duties. <input type="checkbox"/> Ensure that an investigation occurs if an individual is likely to receive an exposure of greater than 5milliSievert (mSv) (dose constraint) in any 12-month period (Refer to Appendix H). <input type="checkbox"/> Ensure that the URSO is recognised by the EPA as a Radiation Safety Adviser. <input type="checkbox"/> Ensure the contract services agreement for the URSO is current.
3.4	University Radiation Safety Officer (URSO)	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that the University is complying with the requirements of the Act and Regulations (refer to section 16). <input type="checkbox"/> Advise the University on all aspects of radiation safety. <input type="checkbox"/> Carry out the duties as set out for a Radiation Protection Adviser in Australian Standard 2243.4 (2018) and in the Regulations, and include advice, training, waste management and general supervision of radiation safety in the University.

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4 Process: New Radiation Workers, Changed Radiation Work & Licences

Person Responsible	Actions
4.1 Licensed Supervisors	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that you and staff under your control, record their radiation licence on Staff Services online, and that students provide a copy of the obtained licence to Human Resources. <input type="checkbox"/> Ensure all staff/students under your control working with ionising radiation in a Type C registered premise or an enclosed XRD/XRF are either licensed or supervised by a licensed person. <input type="checkbox"/> Ensure all staff under your control using sealed sources, X-ray analysis (open beam and partly enclosed) or x-ray diagnostic apparatus (plain and fluoro) or working in a Type B registered premise are licensed. <p><u>Note - students using or handling radioactive material are exempt from licensing under Regulation 17(2b) and 18(1b). Refer to Appendix I.</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all work by undergraduates with ionising radiation is conducted under direct supervision of a licensed supervisor (refer to Appendix B). <input type="checkbox"/> Ensure that the quantities of radioactive materials used are kept to a minimum and specific instruction on handling radioactive materials is provided to radiation workers. <input type="checkbox"/> Ensure that students enrolled in tertiary education, where the operation of ionising apparatus is required as a part of the curriculum do not use ionising apparatus unless the work is conducted under continuous supervision of an appropriately licensed supervisor (refer to Appendix B). <input type="checkbox"/> Ensure that Human Resources are advised when a radiation worker leaves the University or no longer uses radiation. <p style="text-align: right;">(continue)</p>

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4 Process: New Radiation Workers, Changed Radiation Work & Licences (continued)

Person Responsible		Actions
4.2	Audit and Compliance Manager (or delegate)	<ul style="list-style-type: none"> <input type="checkbox"/> Assess completed Worker Registration Forms to determine the requirements of licensing and personal monitoring for each person and communicate the outcome to the radiation worker and licensed supervisor. <input type="checkbox"/> Ensure once a quarter Landauer participant list for the veterinary nurses and surgeons is obtained and records are updated and filed in the central records management system. <input type="checkbox"/> Ensure once a year all dentistry students and staff details are updated and filed in the central records management system. <input type="checkbox"/> Ensure completed Worker Registration Forms are filed in the central records management system. <input type="checkbox"/> Maintain records of radiation workers, including isotope activities, exposure levels and incidents relating to radiation.
4.3	University Radiation Safety Officer (URSO)	<ul style="list-style-type: none"> <input type="checkbox"/> Where requested, aid applicants to prepare for a licence exam.
4.4	Radiation Worker	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that a Worker Registration Form is submitted to Human Resources before using radiation for the first time at the University or is you are a currently registered worker who is using new/changed radiation sources (excluding veterinarians, veterinary nurses, veterinary students, dental students and casual dental teaching staff who will be identified through other University systems). <p><u>If advised by Human Resources that a licence is required:</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Ensure that radiation work (see definitions) is not commenced until the appropriate licence is obtained. Note that if you have an interstate licence you will need to inform HSW and the EPA (as South Australia has mutual recognition within Australia (refer to Appendix I)). However if you have an overseas licence you will be required to reapply (and sit an exam) to obtain a South Australian licence from the EPA. <input type="checkbox"/> Complete the relevant licence application (Application for a licence to use or handle a radioactive substance (section 23) or Application for a licence to operate ionising radiation apparatus (section 24)) <input type="checkbox"/> Arrange a time with the EPA to sit the exam (within 4 months of the application being submitted to the EPA). Note that the University Radiation Safety Officer can also aid in preparing for the exam if required. <input type="checkbox"/> Ensure that you and staff/students under your control, record your radiation licence on Staff Services online or provide a copy of the obtained licence to Human Resources (students). <input type="checkbox"/> Comply with the conditions of the licence (refer to the second side of your EPA licence).

5 Process: Training/Induction

Person Responsible	Actions
5.1 Licensed Supervisors	<ul style="list-style-type: none"> □ Ensure that you are trained and licensed for all activities under your control. □ Ensure that all radiation workers working under your licence are provided with suitable supervision, information, instruction and training and instruction and training records are maintained (hard copy or electronic) (Refer to Appendix B).
5.2 Radiation Worker	<ul style="list-style-type: none"> □ Undertake and record local area induction and training on local procedures and activities before working with radiation. (Refer to Appendix B).

6 Process: Hazard Management

Person Responsible	Actions
6.1 Licensed Supervisors	<ul style="list-style-type: none"> □ Ensure that activities involving radiation are risk assessed prior to being undertaken in accordance with the Hazard Management Procedure, and that Radiation protection principles are applied (refer to Appendix C). □ Ensure that a Radiation Plan is produced if your work includes a density/moisture gauge (refer to Appendix C). □ Ensure that staff and students undertaking the work are aware of the required controls identified in the risk assessment and ensure that these are being implemented. □ Ensure that all monitoring devices e.g. Geiger counter, identified in the risk assessment are used by the radiation worker under your supervision. □ Ensure that any new or altered work procedures identified during the hazard management process are communicated to the relevant radiation workers under your supervision. □ Ensure that any changes to the radioactive materials being used (e.g. radionuclides, sealed sources disposal/purchases) are communicated to Human Resources.
6.2 Radiation Worker	<ul style="list-style-type: none"> □ Ensure there is a completed risk assessment for all radiation tasks you undertake in accordance with the Hazard Management Procedure. □ Implement the controls required by the risk assessment. □ Follow local area rules, procedures, and instructions from Licensed Supervisors. □ For information regarding working with radiation and potential impacts on fertility and pregnancy please refer to FAQs Reproductive Toxicity.

7 Process: Area, Apparatus and Source Monitoring

Person Responsible	Actions
7.1 Licensed Supervisors	<ul style="list-style-type: none"> □ Ensure that monitoring for contamination of laboratories, leakage of sealed sources or monitoring and safety checks for X-ray analysis units are carried out in accordance with Appendix C. □ Ensure that actions are taken to eliminate or reduce contamination if detected (Appendix C and Appendix G). □ Ensure that any leakage of radiation is reported to Human Resources.
7.2 University Radiation Safety Officer	<ul style="list-style-type: none"> □ Conduct 12 monthly wipe-testing of sealed radioactive sources and maintain records of testing. □ Conduct an investigation in consultation with the licensed supervisor and Human Resources where an abnormal result is found and record the outcome of the investigation findings in the University's records management system.

8 Process: Personal Monitoring

Person Responsible	Actions
8.1 Licensed Supervisors	<ul style="list-style-type: none"> □ Return all dosimeters, including the control, to the monitoring provider or Human Resources at end of each monitoring period. □ Ensure that all radiation workers under your control know the rules regarding wearing and storage of a dosimeter (Appendix D). □ Participate in any investigation conducted by Human Resources if a radiation worker under your supervision is identified as possibly achieving a 5milliSv (dose constraint) in a 12-month period. □ Ensure that radiation workers under your control modify radiation work once it is identified that the 5milliSv dose may be reached in a 12-month period. □ Ensure that radiation workers under your control cease radiation work for the next 12 months once it is identified that their 12 monthly dose has, or is likely to have, reached 20milliSv.
8.2 Audit and Compliance Manager (or delegate)	<ul style="list-style-type: none"> □ Distribute new dosimeters to the school. □ Monitor the dose reports to ensure that no radiation worker exceeds 5milliSv (dose constraint) per year. □ Distribute dose reports from the monitoring provider to the Licensed Supervisor. □ Ensure that HSW Advisory team completes an investigation once it is identified that 5milliSv dose may be reached in a 12-month period (refer to Appendix H). □ Ensure that a radiation worker is informed to modify radiation work (and the supervisor is notified) once it is identified that 5milliSv dose has, or is likely to have been, reached in a 12-month period. □ Maintain a record of all personal monitoring exposures and cumulative dose reports (in the University's records management system) for each radiation worker.

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8 Process: Personal Monitoring (continued)

Person Responsible	Actions
8.3 University Radiation Safety Officer (URSO)	<ul style="list-style-type: none"> □ Conduct an investigation (where required) in consultation with Human Resources, once HR determines that 5milliSv dose may be achieved in a 12-month period (if requested by the University) (refer to Appendix H).
8.4 Radiation Worker	<ul style="list-style-type: none"> □ Ensure that you wear your dosimeter at all times when using radiation. □ Only wear the dosimeters allocated to you. □ Ensure that you follow the requirements regarding correct wearing and storage of dosimeters (Appendix D). □ Participate in any investigation conducted by Human Resources if you are identified as achieving a 5milliSv dose (dose constraint) in a 12-month period. □ Ensure that you modify radiation work once it is identified that the 5milliSv dose has or is likely to be reached in a 12-month period. □ Ensure that you cease radiation work (for the next 12 months) once it is identified that the 20milliSv dose has or is likely to be achieved in a 12-month period.

9 Process: Registering premises, sealed sources, apparatus and the licences to possess

Person Responsible	Actions
9.1 Licensed Supervisors	<ul style="list-style-type: none"> □ Ensure that any premises in which unsealed substances are handled or stored (exemption for ore refer to Appendix I), any sealed radioactive sources, and any ionising radiation apparatus are registered with the EPA. □ Ensure premises meet requirements and sealed sources and apparatus are managed according to Appendix E. □ Ensure conditions of registration for premises, sealed sources and apparatus are complied with (listed on reverse of EPA registration document). □ Complete and submit applications for registration of apparatus, sealed sources or premises in which unsealed sources will be handled or stored to EPA (supplying a copy of the application and any associated documentation to Human Resources). Forms are as follows: <ul style="list-style-type: none"> □ Apparatus: Application to register an ionising radiation apparatus (form 27) - new apparatus and transfer of ownership. □ Sealed sources: Application to register a sealed radioactive source (form 26) - new sources and transfer of ownership. □ Premises: Application to register premises in which unsealed radioactive substances are handled or kept (form 25). □ When advised by the EPA, organise compliance testing for the apparatus. □ Place a copy of the registration conditions for the premises or the equipment at the entrance to the laboratory. □ Inform Human Resources within 10 days if the location of an already registered ionising radiation apparatus or sealed source changes.

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9 Process: Registering premises, sealed sources, apparatus and the licences to possess (continued)

Person Responsible		Actions
9.2	Audit and Compliance Manager or delegate	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all premises, apparatus and sealed sources are registered with the EPA. <input type="checkbox"/> Advise the EPA within 14 days if the location of an already registered ionising radiation apparatus changes. <input type="checkbox"/> Confirm with Schools which premises and apparatus require registration renewal and ensure that registration is renewed before the expiry date. <input type="checkbox"/> Ensure that the EPA have the correct details of all current sealed sources, premises and ionising apparatus. <input type="checkbox"/> Ensure that annual audits are conducted as per the requirements of the EPA licence to possess radiation. <input type="checkbox"/> Ensure that the Radiation Management Plan is submitted to the EPA by 31 August annually. <input type="checkbox"/> Maintain a register of all the University's sealed sources and apparatus (including those used as "waste storage"). <input type="checkbox"/> Provide a copy of the EPA registration for premises and apparatus to the relevant Schools/Branches. <input type="checkbox"/> Ensure that the University complies with the conditions of the permit to possess nuclear material from The Australian Safeguards and Non-proliferation Office annually.
9.3	University Radiation Safety Officer (URSO)	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all new radiation premises are inspected to determine if requirements are being met and provide advice to the applicant if necessary.

10 Process: Management of Facilities, Storage, Transportation and Record-Keeping

Person Responsible		Actions
10.1	Licensed Supervisors	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all radiation activities are managed in accordance with Appendix E. <input type="checkbox"/> Ensure all staff/students comply with the conditions of registration detailed on the relevant EPA registration document.
10.2	Radiation Worker	<ul style="list-style-type: none"> <input type="checkbox"/> Comply with requirements of Appendix E and the conditions of registration detailed on the relevant EPA registration document.
10.3	Audit and Compliance Manager or delegate	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all relevant documents received centrally under this procedure are kept in the central records management system.

11 Process: Irradiation of people for research purposes

Person Responsible		Actions
11.1	Licensed Supervisors	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all use of radiation in research on themselves or another person is conducted and authorised by the Human Ethics Committee in accordance with Part 6 of the Regulation and the following Codes: <ul style="list-style-type: none"> • Code for Radiation Protection in Medical Exposure (2019) ARPANSA • Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005) ARPANSA • Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA <input type="checkbox"/> Ensure that the Human Ethics Committee is provided with an independent medical physicist report (contact Human Resources to coordinate this activity). <input type="checkbox"/> Ensure that procedures in place using the principles of justification and optimisation outlined in Regulation 105.

12 Process: Management of Facilities, Storage, Transportation and Record-Keeping

Person Responsible		Actions
12.1	Licensed Supervisors	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all radiation activities are managed in accordance with Appendix E. <input type="checkbox"/> Ensure all staff/students comply with the conditions of registration detailed on the relevant EPA registration document.
12.2	Radiation Worker	<ul style="list-style-type: none"> <input type="checkbox"/> Comply with requirements of Appendix E and the conditions of registration detailed on the relevant EPA registration document.
12.3	Manager Goods receiving store	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that access to packages which contain radioactive materials is restricted to authorised persons.
12.4	Audit and Compliance Manager or delegate	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all relevant documents received centrally under this procedure are kept in the central records management system.

13 Process: Disposal

Person Responsible		Actions
13.1	Licensed Supervisor	<ul style="list-style-type: none"> □ Ensure sealed and unsealed radioactive material and apparatus are disposed of in accordance with Appendix F. □ Provide details of expected unsealed radiation purchases/waste disposal to Human Resources as requested (for the annual Waste Management Plan for Approval to Dispose of Unsealed Radioactive Substances). □ Ensure that only approved disposal of unsealed substances is conducted (contact Human Resources if unapproved disposal is required and an amendment to the Waste Management Plan can be sought from the EPA (Environment Protection Authority). □ Ensure a record of radionuclides bought and sent for disposal is kept. □ Ensure that disposal records are kept for all radioactive waste leaving the laboratory.
13.2	University Radiation Safety Officer (URSO)	<ul style="list-style-type: none"> □ Submit annual Waste Management Plan for Approval to Dispose of Unsealed Radioactive Substances to the EPA by 31st August annually.
13.3	Audit and Compliance Manager or delegate	<ul style="list-style-type: none"> □ Send relevant details of the approval to dispose of unsealed radioactive substances plan to licensed supervisors.

14 Process: Decommissioning and Decontamination of Laboratories, Sealed Sources and Apparatus

Person Responsible		Actions
14.1	Licensed Supervisor (or where no longer employed by the University the Head of School/Branch)	<ul style="list-style-type: none"> □ Ensure that where registered premises, sealed sources or apparatus are no longer required that Human Resources is notified to assist with the decommissioning process.
14.2	University Radiation Safety Officer (URSO) or Human Resources (as the URSO delegate).	<p>Decommissioning Apparatus</p> <ul style="list-style-type: none"> □ Disable equipment so that equipment is no longer functional and cannot be reconnected. □ Advise users on the management of remaining hazards and final disposal of equipment (consider sending to metal recycling). □ Inform the EPA of decommissioning within 14 days. <p>Decommissioning Sealed Sources</p> <ul style="list-style-type: none"> □ Decommission equipment and transfer the source to long term storage or make alternative arrangements as required. □ Advise user if the remainder of equipment can be disposed of. <p style="text-align: right;">(continue)</p>

14 Process: Decommissioning and Decontamination of Laboratories, Sealed Sources and Apparatus
(continued)

Person Responsible	Actions
14.2 University Radiation Safety Officer (URSO) or Human Resources (as the URSO delegate). (Continued)	Decommissioning Registered Premises <ul style="list-style-type: none"> <input type="checkbox"/> Conduct an inspection, with a special focus on identifying any residual radioactive materials and remove any signage present. <input type="checkbox"/> Conduct a survey and wipe test of surfaces, sinks and any other appropriate areas in the registered premise. Photograph the areas surveyed and wipe tested and mark out on a map of the area. <input type="checkbox"/> Submit a declaration, along with all relevant documentation, confirming the areas absence of radioactivity, to the EPA (with a copy to Human Resources).

15 Process: Sale or Relocation of X-ray Apparatus, Sealed or Unsealed Sources

Person Responsible	Actions
15.1 Licensed Supervisor	<ul style="list-style-type: none"> <input type="checkbox"/> If a sealed source or X-ray apparatus is going to be sold or gifted, advise Human Resources in advance. <input type="checkbox"/> Submit Notification of Sale, Installation or Relocation of X-ray apparatus form to Human Resources within 10 days of sale or disposal of an X-ray apparatus. <input type="checkbox"/> Submit Notification sale/install of registrable device or registrable sealed radioactive source to Human Resources within 5 days of sale of a sealed source.
15.2 Audit and Compliance Manager or delegate	<ul style="list-style-type: none"> <input type="checkbox"/> Review for completeness and submit the Notification form to the EPA within 14 days of sale or disposal of an X-ray apparatus. <input type="checkbox"/> Advise the EPA within 7 days of the sale/gifting of a sealed source. <input type="checkbox"/> Retain records for all sales/disposal/gifting of apparatus and sealed sources within the central record management system.

16 Process: Emergency Management

Person Responsible		Actions
16.1	Licensed Supervisors	<ul style="list-style-type: none"> □ Ensure that all incidents or safety issues (including using apparatus that is not registered, or person who has used radiation unlicensed, or unsealed sources found in unlicensed premises) are reported in the University HSW reporting system. □ Ensure that areas which are storing radioactive materials and using radiation develop, implement and test contingency plans in accordance with Appendix G. □ Ensure that appropriate spill kits are available for radiation premises and workers are trained in their use. □ Ensure incidents are managed and reported in accordance with Appendix G.
16.2	Radiation Worker	<ul style="list-style-type: none"> □ Report all incidents or safety issues to your licensed supervisor and into the University HSW reporting system.
16.3	Manager Goods receiving store	<ul style="list-style-type: none"> □ Ensure that any leaking, lost, damage or tampered packages are reported immediately to Human Resources and reported in UniSafe.
16.4	University Radiation Safety Officer (URSO)	<ul style="list-style-type: none"> □ Ensure any notifiable radiation incidents are investigated, and where the incident meets the definition in schedule 3 of the Regulations, report to the EPA.
16.5	Audit and Compliance Manager or delegate	<ul style="list-style-type: none"> □ Assist in incident and safety issue investigations, and where the incident meets the definition in schedule 3 of the Regulations, report to the EPA. □ Maintain records of radiation incidents in the central record management system.

17 Performance Measures

Human Resources will use performance measures to assist in identifying areas of success and/or where corrective action is required to meet the objectives and targets of this process.

The level of compliance with the procedure and effectiveness will be determined during the internal audit process.

18 Useful information and resources

18.1	University-related documents and resources <ul style="list-style-type: none"> • HSW Hazard Management Procedure • HSW Plant/Equipment Safety Management Procedure • HSW Laser Safety Procedure (in development) • Reproductive toxicity FAQs • Radiation FAQs
18.2	Related Legislation <ul style="list-style-type: none"> • Radiation Protection Control Act 2021 • Radiation Protection and Control Regulations 2022 • Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards Part 3 (2014) IAEA • Code for the Safe Transport of Radioactive Material (2019) ARPANSA • Code of Practice for Portable Density/Moisture Gauges Containing Radioactive Sources (2004) ARPANSA

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	<ul style="list-style-type: none"> • Code for the Disposal of Radioactive Waste by the User (2018) ARPANSA • Code for Disposal Facilities for Solid Radioactive Waste (2018) ARPANSA • Code of Practice for the Security of Radioactive Sources (2019) ARPANSA • AS 2243.4 2018 Safety in laboratories - Ionising Radiation • AS 2243.5 2024 Safety in laboratories - Non-ionizing radiations - Electromagnetic, sound and ultrasound • Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) • Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 • Code of Compliance for Medical, Veterinary, and Chiropractic X-ray Apparatus 2022 EPA • Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA • Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005) ARPANSA • Code of Compliance for Dental X-ray Apparatus Used for Plain, Panoramic & Cephalometric radiography and Cone-beam Computed Tomography 2022 EPA • Code of Compliance for Facility Design and Shielding 2022 EPA • Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges (2007) ARPANSA • Code for Radiation Protection in Medical Exposure (2019) ARPANSA • Code of Compliance for Facility Design and Shielding 2022 EPA • Radiation Protection Standard for Limiting Exposure to Radiofrequency Fields—100kHz to 300 GHz (2021) ARPANSA • Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005) ARPANSA • Code of Compliance for Radiation Therapy Apparatus 2022 EPA • Code of Radiation Protection Requirements for Industrial Radiography (2018) ARPANSA • Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine (2009) ARPANSA • Statement on enclosed X-ray equipment for special applications (1987) ARPANSA • Code of Practice for Protection against Ionizing Radiation Emitted from X-ray Analysis equipment (1984) ARPANSA • Code of Compliance for medical, veterinary and chiropractic X-ray apparatus 2022 EPA • Cyclic compliance testing of diagnostic X-ray apparatus guidelines 2024 EPA. • Portable XRF apparatus guidelines 2023 EPA
18.3	<p>Useful Web-links</p> <ul style="list-style-type: none"> • Environment Protection Authority, Radiation Protection Branch • Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) • General discussions of the principles and philosophy of radiation protection, and data and models for dose limits, can be found in the publications of ICRP (International Commission on Radiological Protection) and IAEA (International Atomic Energy Agency)

19 Definitions

Accredited compliance test means a test or tests performed by a person holding an accreditation granted under section 30 of the Act and acting under the authority conferred under section 31 of the Act.

Annual limit on intake (ALI): a quantity of a radionuclide which, if taken into the body during one year, would lead to a committed effective dose equal to the annual effective dose limit for a radiation worker.

Becquerels (Bq): is a measure of the radioactivity of a source. It is defined as the activity of a quantity of radioactive material in which one nucleus decays per second.

Dose constraint: A dose constraint is the level of exposure that is not expected to be exceeded at the University of Adelaide. It is not the legal dose limit.

The legal dose limit is 20 mSv a year. However, the University is committed to an occupational dose constraint of 5 mSv a year (where possible). If a radiation worker is approaching 5mSv in a 12month period, the circumstances will be investigated. After investigation an individual will be asked to modify their radiation work. If a radiation worker approaches 20mSv in a 12-month period, they will be stopped from doing further work with ionising radiation until the results of an investigation has been completed.

Dosimeter: also refer to as OSL (Optically Stimulated Luminescence) or TLD (Thermoluminescent Dosimeter): are badges worn by radiation workers to monitor occupational exposure to radiation.

Environment Protection Authority (EPA): the Government Department that regulates the use of ionising radiation in medical, research, industrial and mining organisations, including use of X-rays, and the safe use, transport, storage and disposal of radioactive substances in South Australia.

Effective dose (also refer to as absorbed dose or equivalent dose): is the sum of equivalent doses of ionising radiation for all tissues and organs of the body determined by adding together each equivalent dose for a tissue or organ after it has been multiplied by the tissue weighting factor appropriate to that type of tissue or organ. It is the probability of a harmful effect from radiation exposure depends on what part or parts of the body are exposed.

Industrial radiography is the act of utilising radiation generators, sealed radioactive sources, exposure containers and industrial radiography equipment to form an image of the internal state of an inanimate object or material which may be evaluated visually, instrumentally, or digitally.

Ionising radiation: radiation which produces electrically charged particles known as ions in the materials it strikes. This process is called ionisation.

Licensed Supervisor: a person who has an EPA licence for the activity being undertaken and is responsible for supervising unlicensed workers who use ionising radiation. Note that this person could be a person who does not have formal line management for the worker.

Millisieverts (mSv) and microsieverts (uSv or µSv): a measure of a dose of radiation that a radiation worker receives.

Notifiable radiation incident: in accordance with Regulation 95 is a notifiable radiation incident is a radiation incident declared by Schedule 3 of the Regulations (for broad categories refer to [Appendix G](#)) which are required to be reported to the EPA.

Radiation Incident: is any unintended occurrence involving a radiation source which results in, or has the potential to result in, an exposure to ionising radiation to any person or the environment that is outside the range of what is normally expected for a particular practice, and includes an occurrence resulting from operator error, equipment failure or the failure of the management system that warrants investigation.

continue

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Definitions (continued)

Radiation protection principles:

This principle is set out within the Radiation Protection and Control Act 2021 and defines that people, and the environment should be protected from unnecessary exposure to radiation through the processes of justification, limitation and optimisation.

When conducting a risk assessment or designing research or teaching activities using radiation, take the following into consideration:

Justification – is weighing the detriment versus the benefits of using radiation and only undertaking the activity if the benefits outweigh the detriment.

Limitation – which is setting dose limits or specifying radiation emissions or absorption standards and implementing controls to ensure that the limits, emissions or standards are met. Also, to be aware that the University dose limit is 5 mSv which is monitored quarterly by those radiation workers who are issued a personal dosimeter.

Optimisation of protection – means to keep the magnitude of the individual dose to as low as reasonably achievable by using controls.

Radiation Work: is defined as all work involved with ionising radiation. For example, purchasing, using, and disposal of sealed, unsealed and x-ray apparatus.

Radiation Worker: is defined as all staff, students, visitors, and volunteers, who either hold an EPA license or are unlicensed and are working with ionising radiation.

Safety Issue

Any safety concern (hazard, near miss, injury/illness) that occurs in an area or location that the University controls or owns or is an activity that the University directly controls (such as a field activity).

It can be an issue involving staff, volunteers, students, members of the public or contractors.

Sealed radioactive material: (a sealed source) includes low activity calibration sources, irradiators and neutron sources, and may be fixed or portable.

Type of Premises (e.g. Type C): a classification of premises depending on the group(s) of radionuclides which are kept or handled. In the University the majority of types are C which is the lowest classification (also referred to as low level laboratory), for more information refer to Tables 3.1 & 3.2 [AS 2243.4-2018 Safety in laboratories - Ionising Radiation](#).

University Radiation Safety Officer (URSO): a person who conducts the duties as set out for a Radiation Protection Adviser in [AS 2243.4-2018 Safety in laboratories - Ionising Radiation](#) and in the [Regulations](#), including advice, training, waste management and general supervision of radiation safety in the University and is recognised by the Radiation Protection Branch of the EPA as suitably qualified to conduct these activities.

Worker: according to the [WHS Act 2012 \(SA\)](#) a person who carries out work in any capacity for a person conducting a business or undertaking, including work as -

- (a) an employee; or (b) a contractor or subcontractor; or (c) an employee of a contractor or subcontractor; or
- (d) an employee of a labour hire company who has been assigned to work in the PCBU; or (e) an outworker; or
- (f) an apprentice or trainee; or (g) a student gaining work experience; or (h) a volunteer; or (i) a person of a prescribed class.

The person conducting the business or undertaking is also a worker if the person is an individual who carries out work in that business or undertaking. Note - Higher Degree Research students and Academic visitors are likely to be workers under the [WHS Act 2012 \(SA\)](#).

X-ray analysis apparatus: an apparatus that is used to analyse the properties or composition of materials by the techniques of X-ray fluorescence (XRF) or X-ray diffraction (XRD).

X-ray diagnostic apparatus: an ionising radiation apparatus that is used for imaging humans and animals for the purpose of diagnosis, visualisation or intervention.

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SPECIFIC REQUIREMENTS

Before undertaking any of the following activities for the first time at the University, [Human Resources](#) must be consulted.

Activity	Legislative Reference
Bore hole logging involving sealed radioactive sources	Code of practice for the safe use of sealed radiative sources in borehole logging (1989) Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA
Bore hole logging involving X-ray apparatus	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of compliance for apparatus used for borehole logging (2022) EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Cabinet X-ray apparatus	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA Statement on cabinet X-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes (1987) ARPANSA
Chiropractic X-ray apparatus used for plain radiography	Code of Compliance for Medical, Veterinary, and Chiropractic X-ray Apparatus 2022 EPA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Practice for Radiation Protection in the Application of Ionizing Radiation by Chiropractors (2009) ARPANSA Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Dental X-ray apparatus used for plain, panoramic or cephalometric radiography or cone-beam computed tomography	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005) ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Compliance for Dental X-ray Apparatus Used for Plain, Panoramic & Cephalometric radiography and Cone-beam Computed Tomography 2022 EPA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Fixed radiation gauges	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges (2007) ARPANSA
Human brachytherapy	Regulation 78
Industrial radiography (means the use of X-rays, gamma rays or neutrons to obtain information non-destructively on the internal state of objects and materials)	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of Radiation Protection Requirements for Industrial Radiography (2018) ARPANSA
Irradiators involving radiation generators and sealed radioactive sources of cobalt-60 or caesium-137	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of practice for the design and safe operation of non-medical irradiation facilities (1988) ARPANSA
Medical X-ray apparatus used for plain radiography, mammography, computed tomography, fluoroscopy or absorptiometry	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code for Radiation Protection in Medical Exposure (2019) ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Compliance for Medical, Veterinary, and Chiropractic X-ray Apparatus 2022 EPA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Moisture gauge containing a sealed radioactive source	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of Practice for Portable Density/Moisture Gauges Containing Radioactive Sources (2004) ARPANSA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Particle accelerators	Section 4.7.7 AS 2243.4-2018 Safety in laboratories - Ionising Radiation.
Portable XRF (pXRF)	Portable XRF apparatus guideline (2023) EPA
Radio frequency fields	Radiation Protection Standard for Limiting Exposure to Radiofrequency Fields—100kHz to 300 GHz (2021) ARPANSA

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SPECIFIC REQUIREMENTS	
Activity	Regulation numbers
Sealed radioactive material	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code for the Safe Transport of Radioactive Material (2019) ARPANSA Code for the Disposal of Radioactive Waste by the User (2018) ARPANSA Code for Disposal Facilities for Solid Radioactive Waste (2018) ARPANSA Code for Radiation Protection in Medical Exposure (2019) ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Practice for the Security of Radioactive Sources (2019) ARPANSA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Scintigraphy	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code for the Safe Transport of Radioactive Material (2019) ARPANSA Code for the Disposal of Radioactive Waste by the User (2018) ARPANSA Code for Disposal Facilities for Solid Radioactive Waste (2018) ARPANSA Code for Radiation Protection in Medical Exposure (2019) ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA Code of Compliance for Radiation Therapy Apparatus 2022 EPA Code of Compliance for Medical, Veterinary, and Chiropractic X-ray Apparatus 2022, EPA
Medical radiation therapy involving radiation sources or radiation apparatus	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code for Radiation Protection in Medical Exposure (2019) ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Compliance for Radiation Therapy Apparatus 2022 EPA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Ultraviolet radiation	Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation (2006) ARPANSA
Unsealed radioactive material	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code for the Safe Transport of Radioactive Material (2019) ARPANSA Code for the Disposal of Radioactive Waste by the User (2018) ARPANSA Code for Disposal Facilities for Solid Radioactive Waste (2018) ARPANSA Code for Radiation Protection in Medical Exposure (2019) ARPANSA Code of Practice for the Exposure of Humans to Ionizing Radiation for Research Purposes (2005) ARPANSA Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005) ARPANSA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Veterinary lasers	Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine (2009) ARPANSA
Veterinary radiation therapy involving radiation sources or radiation apparatus	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine (2009) ARPANSA Code of Compliance for Radiation Therapy Apparatus 2022 EPA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
Veterinary X-ray apparatus used for computed tomography or dental, fluoroscopy, or plain radiography	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of Practice and Safety Guide for Radiation Protection in Veterinary Medicine (2009) ARPANSA Code of Compliance for Medical, Veterinary, and Chiropractic X-ray Apparatus 2022 EPA Code of Compliance for Facility Design and Shielding 2022 EPA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA

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SPECIFIC REQUIREMENTS	
Activity	Regulation numbers
X-ray analysis apparatus (excluding pXRF)	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Code of practice for protection against ionizing radiation emitted from X-ray analysis equipment (1984) ARPANSA Code of Compliance for Labelling and Signage of Ionising Radiation Sources 2022 EPA
X-ray equipment, using enclosed shielding, involving the examination, testing or sorting of articles, products or other materials excluding cabinet X-ray and X-ray analysis apparatus	Code for Radiation Protection in Planned Exposure Situations (Rev.1) (2020) ARPANSA Statement on enclosed X-ray equipment for special applications (1987) ARPANSA

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SUPERVISION, INFORMATION, INSTRUCTION AND TRAINING

Type	Requires an EPA licensed supervisor	Requires everyone to be EPA licensed	General radiation Information Refer to note 4	Specific task information	Supervision Refer to note 5	Support to non-licensed radiation workers Refer to note 5
Unsealed Sources in a C type lab	Yes	No Refer to note 6	Yes	Yes	Direct until sufficient information has been provided on the task to perform it safely	Licensed supervisor is no more than 5 mins away
XRD (fully enclosed primary beam)	Yes	No	Yes	Yes	Direct until the apparatus has been demonstrated to the worker	Licensed supervisor is no more than 30 mins away
XRF (enclosed primary beam)	Yes	No	Yes	Yes	Direct until the apparatus has been demonstrated to the worker	Licensed supervisor is no more than 30 mins away
XRF (handheld)	Yes	Yes Exemption refer to note 6	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators Exemption refer to note 6
Sealed sources - probes	Yes	Yes	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators
Sealed sources – other (not radioactive) Refer to note 1	No	No	No	No	NA	NA
Sealed sources – other (Under licensed supervision) Refer to note 2	Yes	No	Yes	Yes	Direct until sufficient information has been provided on the task to perform it safely	Licensed supervisor is no more than 30 mins away
Sealed sources – other (handled by licensed person only) Refer to note 3	Yes	Yes Exemption refer to note 6	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators Exemption refer to note 6	NA only EPA licensed operators
Students using ionising apparatus Refer to note 6	Yes	No	Yes	Yes	Direct	Licensed supervisor has to be in the same location whilst the student is using the ionising apparatus.
DEXA (densitometer for animals or humans)	Yes	Yes Exemption refer to note 6	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators.
Xrays used for imaging (operator) Refer to note 9	Yes	Yes Exemption refer to note 6 & 7	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators	NA only EPA licensed operators

SUPERVISION, INFORMATION, INSTRUCTION AND TRAINING

Note 1. Not radioactive

- all radionuclides which are classified as at an exempt activity according to table I.3 (naturally occurring radiation) or table I.1 for all other nucleotides) of the IAEA Safety Standards.

Note 2. Conducted under licensed supervisor

- Group 1 & 2 less than 5MBq.
- Group 3 and 4 radionuclides (not including tritium in gaseous tritium light sources) less than 50 MBq.
- Tritium in gaseous tritium light sources less than 20 GBq.

Note 3. Must be licensed

- Group 1 and 2 greater than 5 MBq;
- Group 3 and 4 greater than 50MBq; and
- Tritium in gaseous tritium light sources greater than 20 GBq.

Note 4. General Radiation Information could include (where applicable):

- Radiation basics (properties of ionising radiation);
- Radiation (hazards; effects; dose limits; conversions);
- Measurement (dose rates; quantifying dose; weighting factor; meters; personal dosimeters; exposures);
- Keeping safe (time, distance, shielding);
- Legal requirements;
- University requirements;
- X-ray unit specifics;
- Sealed source specifics;
- Unsealed substances specifics.

The licenced supervisor must have a written method for assessing competency into the procedure (including observation and practical assessment) and include details of how directions will be conveyed to the unlicensed person.

Note 5. Supervision and support is required to satisfy the legislative requirements of radiation workers working without an EPA licence. If the requirements set out in the table above for supervision and support cannot be satisfied, then the worker **must** be EPA licensed. The licenced supervisor must set out how the supervisor will be available for reasonable access (either face to face, or by other means as appropriate to foreseeable circumstances).

Note 6. Exemption for students from holding a licence - students using or handling radioactive material are exempt from licensing under Regulation 17(2b) and 18(1b) refer to [Appendix I](#).

Note 7. Unlicensed veterinary nurses/technologists/assistants are not allowed to operate the apparatus, only an EPA licensed veterinary nurses/veterinary technologist/ veterinary surgeons/ radiographer **are allowed to operate** x-ray apparatus. The only exception for unlicensed veterinary nurses/assistants is if a licenced veterinary surgeon/nurse/technologist or radiographer have to hold the animal during the imaging where they are unable to operate the apparatus, the licenced person may then instruct the unlicensed nurse/assistant to undertake the radiograph on their behalf.

Note 8. Supervision in this context, is that the EPA licenced veterinary nurses/veterinary technologist/ veterinary surgeons/ radiographer **must be** present in the x-ray room and are directly conducting the activity. Refer to [Appendix I](#).

Note 9. As at 2024 the EPA is now allowing Bachelor of Veterinary Technology graduates and Cert IV in Vet nursing to apply for licenses (if they desire), they will also consider veterinary nursing qualifications from other countries if these qualifications are recognised in Australia by the VCNA. The licences will not require an exam to obtain however will restrict the licensee to routine veterinary radiography and will not include CT or Fluoroscopy operations.

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HAZARD MANAGEMENT, MONITORING TASKS and EQUIPMENT

UNSEALED SOURCES

Hazard Management

For hazards associated with unsealed sources refer to [Radiation FAQs](#)

Monitoring

Two types of monitoring are used in laboratories with unsealed radioactive materials:

- measurement of the external radiation field; and
- measurement of contamination of benches, equipment and workers by the radioactive material.

An exemption from personal monitoring exists for users of certain radionuclides for example H3, C14 and other radionuclides in limited quantities such as S35 (See [Appendix I](#)).

Monitoring is to be carried out with a survey meter suitable for the type of radiation being used. It is essential that each laboratory and area have ready access to a detector that can be used to monitor surface contamination and spills. In some cases, contamination will have to be checked using a wipe test (see section at the end of this Appendix).

External radiation field

Monitoring Techniques for External radiation fields

- Monitors should be checked before use in a low background area and with a known source to verify their proper operation. (Calibration of monitors are to be aligned with the manufacturer's instructions).
- If the radiation field is much greater than expected do not continue the survey. Exit, close off the area and seek help from your licensed supervisor or the University Radiation Safety Officer.
- Always measure the external field from a new supply of radionuclide before opening it.
- Measure the radiation field close to the source and at the distances where you will be using the material (at the hands and at the body).
- Estimate your body dose from the measured dose rate and your expected working time. This should normally be less than 2microSv per hour but needs to be considered in relation to the time taken for the operation. If it is more than expected consult your licensed supervisor.
- Ensure that you have pre-calculated numbers and actions listed on the local working rules.

Contamination

The amount of radioactive material on a surface (contamination) is generally expressed in terms of counts per second. Contamination limits are expressed in Becquerel per square cm.

Monitoring for contamination should be carried out routinely so that contamination is to be kept to a minimum on surfaces and the below the recommended levels as per Table B2 [AS 2243.4-2018 Safety in laboratories - Ionising Radiation](#)

If a researcher at the University of Adelaide is using a radiation monitor to detect surface contamination of unsealed radiation, the monitors will only require calibration once every 3 years (based on an assessment of risk by the University Radiation Safety Officer).

Monitoring Techniques for Contamination of low energy unsealed sources by Wipe Tests

For very low energy beta emitters such as H3, the wipe test is the only satisfactory check for contamination. For instructions on the technique, refer to [Radiation FAQs](#).

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HAZARD MANAGEMENT, MONITORING TASKS and EQUIPMENT

SEALED SOURCES

[Code of Practice for Portable Density/Moisture Gauges Containing Radioactive Sources \(2004\) ARPANSA](#)

Refer to this code for monitoring and radiation levels, storage and transport and other requirements for all self-contained surface, or near surface, portable density/moisture gauges that incorporate one or more radioactive sources (excluding bore holes density devices greater than 10 metres).

General Hazards

In general, sealed sources present an external radiation hazard. With fixed sources, shielding normally reduces the external radiation dose rate to acceptable levels. With portable sources, there may be a conflict between the thickness of the shielding and the portability. Calibration and demonstration sources are weaker but their small physical size and portability can lead to the external dose becoming an issue if they are misplaced, lost or stolen.

If the sealed capsule is corroded or broken the radioactive material can leak out. The activity of the radionuclides in sealed sources are usually much higher than the activities of unsealed radioactive materials used in laboratories, so a leak from a broken source will be a major contamination hazard. It is an event requiring immediate notification to the EPA.

Portable density/moisture gauges

Maintenance and Checking of Sealed Sources

- Repairs, maintenance and modifications to sealed sources must never be carried out unless the University Radiation Safety Officer, after consulting the Radiation Protection Branch of the EPA, has given explicit written permission for the work.
- A program must be implemented of routinely checking that the source mechanics (mechanism which returns the source to the shielded area) are working correctly. Mechanical failure can make it impossible for the source to return to its shielded container or cause the source to become loose during transport.
- Do not continue to attempt to use a source that has any difficulties in its operation.
- Report all such operational problems immediately to your licensed supervisor and to [Human Resources](#).

Monitoring and Wipe Tests

The purpose of monitoring equipment containing sealed sources is to make sure that the shielding is intact and the source is properly housed inside the shield. An annual dose rate survey around the source shield using a dose rate meter should be conducted by the licensed supervisor.

The sealed source or its housing shall be examined for contamination and integrity and wipe tests will be conducted every 12 months by the University Radiation Safety Officer, normally at the time of renewal of the source registration.

X-RAY ANALYSIS UNITS

Hazard Management

For general requirements, working rules and hazard management when working with ionising radiation refer to [Code of Practice for Protection against Ionizing Radiation Emitted from X-ray Analysis equipment \(1984\) ARPANSA](#)

Monitoring

All Xray apparatus (used on human only) must adhere to cyclic compliance testing as outlined by [Cyclic compliance testing of diagnostic X-ray apparatus 2024 published by EPA](#).

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HAZARD MANAGEMENT, MONITORING TASKS and EQUIPMENT

X-RAY ANALYSIS UNITS_continued

Radiation Therapy Apparatus

[Code of Compliance for Radiation Therapy Apparatus 2022 EPA](#)

Refer to this code for the mandatory requirements for the construction and installation of apparatus used for radiation therapy, including X-ray apparatus integrated with the radiation therapy unit used for treatment image guidance, where such apparatus is not standalone dental or medical class diagnostic X-ray apparatus.

Medical, Veterinary and Chiropractic

[Code of Compliance for medical, veterinary and chiropractic X-ray apparatus 2022 EPA](#)

Refer to this code for the testing and other special requirements for fixed, mobile, and portable apparatus used or designed to be used for— (a) mammography or soft tissue radiography (b) medical or veterinary computed tomography (c) medical or veterinary fluoroscopy (d) medical, veterinary or chiropractic plain radiography (e) medical X-ray absorptiometry

This code prevails to the extent of any other codes or documents published by ARPANSA

Dental

[Code of Compliance for Dental X-ray Apparatus Used for Plain, Panoramic & Cephalometric radiography and Cone-beam Computed Tomography 2022 EPA](#)

Refer to this code for the testing and other special requirements for dental x-ray apparatus.

Compliance testing - The apparatus and all items of equipment necessary for its safe operation must be maintained in good working order. Dental apparatus used on humans must undergo cyclic compliance testing with a frequency once every five years. The cyclic testing for dental apparatus will be introduced in South Australia from **February 2026**. Until the commencement of cyclic testing in February 2026, the apparatus must undergo annual servicing as per the manufacturer recommendations.

Until February 2026 the following must be completed

- Monitoring must be done after any radiation incident or accident involving the apparatus, or after a service.
- Regular radiation monitoring of the x-ray analysis units must be carried out at least every 6 months, in accordance with the manufacturer's instructions.
- Checks of all the interlocks and warning lights must be carried out at least every 6 months.
- A record must be kept of all the radiation surveys, interlock checks and checks of the warning lights.

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HAZARD MANAGEMENT, MONITORING TASKS and EQUIPMENT

XRD and XRF APPARATUS

Monitoring

For all requirements for pXRF refer to [Portable XRF apparatus guideline \(2023\) EPA](#)

- Monitoring or testing of XRD apparatus is to be carried out by the supplier or [EPA accredited testers](#) or competent person/licenced person (note if an x-ray tube needs replacing this must be performed by a person with an xray installer licence).
- Monitoring of the apparatus and testing of interlocks is to occur at least once every 6 months, and extra monitoring/testing is to occur after:
 - new installation;
 - reassembly; or
 - an incident involving the apparatus.
- Monitoring to include (every 6 months):
 - Survey (dose rate at the surface of the XRD/XRF or 5 cm from the portable XRF)
 - Safety feature checks:
 - Interlocks (checking that opening a door prevents the x-ray to be emitted, holding a pXRF away from the target to verify proximity sensor is working)
 - Lights (failsafe lights or 2 sets of lights)
 - Signs and labels are in place
 - PIN or key prevents any unauthorised access
- Records of all monitoring and testing must be maintained
 - identifies the apparatus involved
 - the name and date
 - for monitoring—recording the details of any change in radiation emission was detected
 - for testing— record the safety device and whether they passed or failed the check
 - any action taken as a result of the monitor or check (where applicable).

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PERSONAL MONITORING (Dosimeters)

The University has undertaken a review of certain activities in order to exclude the need for wearing dosimeters for those activities that the annual effective dose will not exceed 1 mSv under normal conditions, and not exceed a 20 mSv effective dose. Refer to [Appendix I](#) for those activities which an exemption has been included in the radiation management plan.

When registering as a Radiation Worker you will be advised by [Human Resources](#) if a dosimeter is required and which type (body or finger monitor) depending on the work you are undertaking.

The cost for the dosimeter will be borne by the Faculty/Division and the Faculty/Division will receive accounts accordingly.

Wearing of Radiation Dosimeters

- Before starting an operation, all individuals participating must ensure they are wearing their approved personal dosimeters.
- The monitor is worn at waist or chest height and underneath protective devices such as lead rubber or lead plastic aprons.
- Do not place objects such as coins, pens, etc in front of approved personal dosimeters.
- A monitor is only to be worn by one person. You must never wear a monitor assigned to another person (please contact [Human Resources](#) if you do not have an alternative).

Finger Dosimeters

The legislated allowable occupational annual radiation exposure limit to the hands for radiation workers is 500 milliSievert (mSv) in a calendar year. When the University's safety factor is applied, this translates to 25 mSv/year, and approx. 6 mSv per quarter. Therefore, any finger badge dose which receives over 6 mSv in a quarter will be investigated by [Human Resources](#).

Storage of Dosimeters

- The "control" dosimeter measures background radiation and should be stored where background radiation levels are low and away from direct fluorescent light (e.g. a drawer).
- When not in use the approved personal dosimeter should be stored with the "control".
- "Controls" must be returned to the monitoring provider with the batch of approved personal dosimeters with which they are issued.

Storage and handling of Personal Dosimeters during Domestic and International Air travel

- People working in different locations should have their own control badge (series) even if they are with the one group.
- **Do not** place the dosimeter in checked luggage.
- At the security screening point either:
 - a. take the dosimeter out of the baggage and ask the security personnel to pass it around the cabinet x-ray machine; or
 - b. transport the assembled dosimeter in the bottom of the carry-on luggage with the front of the dosimeter and "control" facing up towards the X-ray tube. Ensure luggage is placed on the conveyor belt leading to the cabinet X-ray machine so that the dosimeter is at the bottom and facing up. If there is a group of people traveling to the same location, place all the dosimeters in the one bag and ensure that the monitors are on the bottom as described above and are not overlapping each other in the bag.
- When returning the dosimeter to the monitoring provider at the end of the monitoring period, note on the monitor detail form returned with the dosimeters which personal monitors went through carry-on or checked luggage, whether it was for domestic or international flights, and the total times it went through a cabinet x-ray machine.
 - When not in use the approved dosimeter should be stored with the "control".
 - "Controls" must be returned to the monitoring provider with the batch of approved dosimeters with which they are issued. The dosimeters will be adjusted with the recorded reading of the "control" to reflect the actual personal readings for each user.

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

All new facilities (containing sealed, unsealed or x-ray apparatus) must be approved by the University Radiation Safety Officer to ensure compliance to [Code of Compliance for Facility Design and Shielding 2022 EPA](#).

UNSEALED SOURCES

All laboratories in which radionuclides are used and stored must be classified and registered with HSW Team and the EPA. General requirements for classes of facilities using unsealed sources are in Table 3.4 [AS 2243.4-2018 Safety in laboratories - Ionising Radiation](#).

Additional requirements

- If an operation or process carried out in a laboratory is likely to produce airborne radioactivity more than the concentration that could result in a radiation worker receiving an annual limit on intake due to inhalation, a fume cupboard must be provided.
- The working rules and emergency procedures must be displayed in the laboratory.
- Visits by people other than registered radiation workers should be minimised if possible and they should be warned not to touch anything that may cause contamination.
- The laboratory is to be locked when no registered radiation workers are present.
- Display in a prominent position a sign that contains a prohibition against eating, drinking, and smoking on the premises.

Signage and labelling

- The entrance door of the premise must carry the radiation symbol and a warning sign, state the words " RADIATION AREA" or "STORE FOR RADIOACTIVE MATERIAL" and,
 - The type of premise (note that most types within the University are Type C)
 - Has a sign on the entrance with the name and phone number of the licensed supervisor & URSO and the person to contact in the event of an emergency.
 - The sign must be no less than 4500 square mm surface area and comply with the requirements of AS 1319-1994 Safety Signs for the Occupational Environment applying to warning signs.
 - The sign must be legible from a distance of 2m.
- All work benches where unsealed isotopes are used and sinks/drains that are used to carry radioactive effluent must be labelled with radiation symbol.
- All radioactive materials (including stored samples and waste) must be labelled with a radiation symbol; the quantity, activity and type of radioactive material; the name of the licensed supervisor and date. However if the size does not allow this then contact HSW team for alternatives
- Storage areas (including refrigerators) must be marked with the appropriate radiation signs.

Storage

- Radioactive materials must be stored within a labelled facility which is licensed by the EPA and have reasonable precautions against unauthorised access (e.g. room locked when unattended).
- Always store radionuclides according to directions given in the manufacturer's specification sheets.
- Where possible radionuclides should be stored in a double container, with the outer one of plastic in case of breakage.
- Radionuclides at all times must be appropriately shielded.
- Never leave radionuclides in unsealed containers in cold rooms or refrigerators.
- Make sure that containers that will be frozen are not full and cannot break on freezing. Use an outer container as a precaution.
- Ensure that no food or drinks are stored in radiation storage locations.

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

UNSEALED SOURCES continued

Transportation

The legislation does not apply to excepted packages which is a package if it meets one of the following conditions: (b) it contains instruments or articles not exceeding the activity limits specified in Table 4 in ARPANSA's Code (d) it contains radioactive material not exceeding the activity limits specified in Table 4 in ARPANSA's Code

- Consignment notification must go with the source. The notification must contain:
 - sufficient information to enable the identification of the package or packages, including all applicable certificate numbers and identification marks.
 - information on the date of shipment, the expected date of arrival and the proposed routing.
 - the name(s) of the radioactive material(s) or nuclide(s).
 - descriptions of the physical and chemical forms of the radioactive material, or whether it is special form radioactive material or low dispersible radioactive material. (e) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq).
- Licensed persons are required for transportation of unsealed sources (excluding excepted packages). Contact [Human Resources](#) before undertaking any transportation of unsealed sources.

Record-Keeping

A register of unsealed sources must be maintained for each laboratory that contains the:

- radionuclides contained in the laboratory and their activity or nominal activity.
- date to which the activity refers and the date when the substance entered the laboratory.
- physical and chemical nature of each material.
- name of the person in charge of the material.
- place of storage or use.
- date and manner of disposal.

Note that entries on the register must be made within 24 hours after each unsealed radioactive material kept or handled at the premises is first taken onto the premises

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

SEALED SOURCES

Signage

- The entrance door of the location that the source is kept must carry the radiation symbol and a warning sign, state the words "RADIATION AREA" or "STORE FOR RADIOACTIVE MATERIAL",
- Has the name and phone number of the person to contact in the event of an emergency
- The sign must be no less than 4 500 square mm surface area and comply with the requirements of AS 1319-1994 Safety Signs for the Occupational Environment applying to warning signs.
- The sign must be legible from a distance of 2m.

Labelling

- The source or outer container must be labelled with "Radioactive"; the quantity, activity, and type of radioactive material; the name of the licensed supervisor and date.

Storage

- The source/s assembly must be fully retracted and key locked into the shielded position.
- The gauge must not be stored with explosives, combustible, corrosive or oxidising chemicals.
- The room must be locked unless a licensed person is present.
- The room key should only be available to the people licensed to operate the source.
- The ambient dose does not exceed 10 microSv/hour and so that a member of the public does not receive a dose exceeding 1mSv per year.

Transportation

The [Code of Practice for the Safe Transport of Radioactive Material](#) controls the transport of all radioactive materials on public roads, rail and waterways (under Australian jurisdiction). In practice it is only neutron moisture probes that are regularly moved via public roads. The general radiation hazard from these sources could be considerably increased if there is a road accident and emergency services and other aid workers are not aware that a radiation hazard exists.

The legislation does not apply to excepted packages which is a package if it meets one of the following conditions: (b) it contains instruments or articles not exceeding the activity limits specified in Table 4 in ARPANSA's Code (d) it contains radioactive material not exceeding the activity limits specified in Table 4 in ARPANSA's Code.

Transport Arrangements

- Only a licensed persons are to transport sealed sources.
- The source/s assembly must be fully retracted and key locked into the shielded position.
- The probe or gauge must not be transported in the passenger compartment of the vehicle and must be carried as far away as possible from the driver and any passengers.
- A holder for the gauge carrying case must be securely fixed in the vehicle and the gauge must not be able to break loose in normal situations.
- The case must be able to be securely locked and carry signs saying "Warning - Radioactive" with the radiation symbol and the name and telephone number of the person responsible for the source.
- The transport arrangements must be such that the security of the gauge is ensured at all times.

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

SEALED SOURCES continued

Vehicle Labels and Notices

- The vehicle must be labelled with 3 vehicle labels of the type described in the Code of Practice for the Safe Transport of Radioactive Material. These Class 7 Dangerous Goods placards must be a minimum of 25cm square, and the UN number can be written on this in the white space.
- Consignment notification must go with the source. The notification must contain:
 - sufficient information to enable the identification of the package or packages, including all applicable certificate numbers and identification marks.
 - information on the date of shipment, the expected date of arrival and the proposed routing.
 - the name(s) of the radioactive material(s) or nuclide(s).
 - descriptions of the physical and chemical forms of the radioactive material, or whether it is special form radioactive material or low dispersible radioactive material. (e) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq).
- A notice must be carried in the glovebox giving details of the source, the phone number of the University Radiation Safety Officer (0410 388 018 or 83134638) and the emergency phone number of the Radiation Protection Branch 8463 7826.

Interstate

All handheld apparatus and sealed sources used interstate must be registered for use in that state. Contact [Human Resources](#) if you are intending to undertake this type of activity.

Short Term hire (3 months or less)

Contact the HSW team for details to comply with the requirements of section 59 of the Regulations.

Record-Keeping

Local source register

The licensed supervisor must maintain a local source register with the following details:

- the name of the source manufacturer, model or type and serial number
- the registered number of the source
- the identifying label of the source
- the radioactive nuclide, its activity or nominal activity and the date of measurement
- if it is a non-fissile neutron source – the target element
- if the source is incorporated or mounted in an instrument or other equipment – sufficient information to identify the instrument or other equipment including its manufacturer, model, serial number, date of manufacture and location where it is usually stored
- the normal location of the source (storage place)
- the name of the licensed person who is responsible for the source.
- the date on which the person took possession of the source.

SEALED SOURCES continued

When the source is taken off campus, then the register must also contain:

- the signature of a licensed person who has taken charge of the source, the time and date of removal and time and date of return to the premises controlled by the University;
- the licence plate registration number of that vehicle where applicable, and
- any temporary location/s, and the site, district or other locality at which the source is to be used;

If sources are used for undergraduate teaching in different laboratories under the supervision of different staff members, one person must be nominated to be responsible for maintaining the register of the day-to-day movements of the sources.

When the source is returned to the premises controlled by the University, the person returning it must:

- sign the register on the date on which it is returned; and
- report in the register details of any abnormal occurrence that may indicate a fault in the source, capsule, container or control mechanism.

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

APPARATUS (X-ray)

Labelling

- All apparatus must have attached to, or adjacent to, the control which actuates the production of ionising radiation a label which:
 - Says "RADIATION PRODUCED WHEN ENERGISED" (or similar) with a radiation symbol, and
 - is clearly legible at a distance of 2 metres.

Facilities

- The entrance door or each walkway or access route to the installation must carry the radiation warning sign, state the words "Warning - Radiation Area" or "X-RAYS",
- The sign must be no less than 4 500 square mm surface area and comply with the requirements of AS 1319-1994 Safety Signs for the Occupational Environment.
- The sign must be legible at a distance of 2m.
- Visits by people other than authorised radiation workers should be minimised if possible and should be warned not to touch the control panel.
- The facilities must be locked when no authorised radiation worker is present.

Storage

- Unused apparatus must be stored in accordance with manufacturer's instructions.
- Unused apparatus must be stored so that unauthorised persons cannot gain access.

Transportation

- During transportation ensure no unauthorised access to the equipment.
- Ensure the equipment is secured so as to avoid damage to the source.

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

APPARATUS (XRF)

Labelling

- All apparatus must have attached to, or adjacent to, the control which actuates the production of ionising radiation a label which says "caution" or warning and a radiation symbol.
- Apparatus must also be fitted with an illuminated sign or a combination of a light and sign that clearly indicates that the apparatus is energised.

Facilities

- A sign must be present at the entry to the room where the XRF is installed which:
 - Says "DANGER" and "KEEP OUT" and is clearly legible at a distance of 2 metres.

The facilities must be locked when no authorised radiation worker is present.

Transportation

- Ensure no unauthorised access to the equipment.
- A special register entry is required when an apparatus is taken off campus (for example, a portable X-ray device is taken to a farm).

Interstate

- All handheld apparatus and sealed sources used interstate must be registered for use in that state. Please contact [Human Resources](#) if you are intending to undertake this type of activity.

Record-Keeping

- Schools must maintain a local apparatus register for portable devices with the following details:
 - The identifying details of the apparatus.
 - The normal location of the source (storage place).
- A licensed person must sign out the apparatus when it is removed from the store and record its temporary location, the time and date. On its return it must be signed in with the time and date.
- If apparatus is used for undergraduate teaching in different laboratories under the supervision of different staff members, one person must be nominated to be responsible for maintaining the register of the day-to-day movements of the apparatus.
- A special register entry is required when an apparatus is taken off campus (for example, a portable X-ray device is taken to a farm).

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FACILITIES, STORAGE, TRANSPORTATION and RECORD-KEEPING

APPARATUS (XRD)

Labelling

- All apparatus must have attached to, or adjacent to, the control which actuates the production of ionising radiation a label which:
 - Says "RADIATION PRODUCED WHEN ENERGISED" (or similar) with a radiation symbol, and
 - is clearly legible at a distance of 2 metres.
- Also apparatus must be fitted with an illuminated sign or a combination of a light and sign that clearly indicates that the apparatus is energised.

Facilities

- A sign must be present at the entry to the room where the XRD is installed which:
 - Says "RADIATION AREA" or "X-RAYS" or similar with a radiation symbol, the surface area of the sign must be no less than 4 500 square mm, comply with the requirements of AS 1319-1994 Safety Signs for the Occupational Environment and
 - is clearly legible at a distance of 2 metres.
- The facilities must be locked when no authorised radiation worker is present. The X-ray unit must never be left unattended whilst in operation.

Short Term hire of ionising apparatus (3 months or less)

Contact the HSW team for details to comply with the requirements of section 44 of the Regulations.

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DISPOSAL

UNSEALED SOURCES

Radioactive waste is managed by an annual Radioactive Waste Management Plan that is approved by the EPA which is written and submitted by [Human Resources and approved by URSO](#).

EPA approval is not required if the waste meets the requirement of Schedule 1 [Code for the Disposal of Radioactive Waste by the User \(2018\) ARPANSA](#). Specifically S1.1 for waste to landfill or S1.2 for waste to sewer or S1.3 for waste to atmosphere. If under any doubt consult with [Human Resources](#) prior to disposal.

Waste categories

- In the University radioactive waste is classed by three main types:
 - a. Solid waste that is taken into short- or long-term storage and subsequently sent out for incineration or disposed as normal waste once decayed below exemption levels.
 - b. Liquid waste that is miscible with water and is discharged to the sewer.
 - c. Mixed waste, mainly liquid scintillation fluids in vials. These are treated as solid waste, taken into storage, and where possible sent for incineration.

Aqueous liquid waste

All disposal of aqueous waste going to the sewer must be:

- put into designated and properly labelled sink.
- accompanied by a minimum amount of water (15L normally).
- a solution which is:
 - non-hazardous and within the pH range of 6 to 10.
 - not a concentrated acid or base.
 - not a highly toxic, malodorous (bad odour), or lachrymatory (produces tears) substances.
 - not a substance which might interfere with the biological activity of wastewater treatment plants.
 - not a chemical which could create fire or explosion hazards,
 - not a chemical which could cause structural damage or obstruct flow.
- entered in the record of radioactive waste disposal within the laboratory.

Solid waste

- All solid waste or waste which does not conform to the above (liquid) criteria are to be contained in 20L yellow plastic pails. This includes liquid scintillation fluids in the scintillation vials.
- Different radionuclides must be kept in separate pails.
- The pail must be labelled with the nuclide, the activity amount, the laboratory from which it came, the worker and the licensed supervisor. This information is entered on the standard A6 label and the label must be taped to the lid of the pail (adhesive tape along one edge only). The radiation waste label is available at [Radiation waste label yellow bins](#). Importantly no other labelling or writing can appear on a pail.
- When a pail is full the lid needs to be hammered down evenly for security.
- The information on the label is entered in the record of radionuclides bought and sent to disposal. This record is subject to EPA audit.
- Store full pails safely in laboratory with label affixed (see solid waste section below) until you are ready to move it to the storage locations at North Terrace or Waite (contact [Human Resources](#) if you require access to these storage locations). Roseworthy workers contact [Human Resources](#) for advice regarding safe storage and disposal.
- Any waste that is not packaged correctly will have to be returned to the original laboratory for re-packaging.
- Empty yellow pails and black lids are kept in the storage locations for your use. Roseworthy – contact [Human Resources](#) if pails and lids are required.
- Important: Tin drums, plastic bags, re-used plastic containers and similar containers may not be used for radioactive waste and any waste of this kind will be returned for repackaging.

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DISPOSAL

SEALED SOURCES

Please contact [Human Resources](#) regarding disposal of sealed sources.

APPARATUS (X-ray, XRD and XRF)

Please contact [Human Resources](#) regarding disposal of x-ray apparatus. Before the machine is disposed of the University is required to seek approval from the EPA outlining how the machine has been made inoperable (this is more than cutting the power cord).

Once approval has been granted by the EPA then the machine can be scrapped.

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EMERGENCIES AND ACCIDENTS

EMERGENCY NUMBERS:	Contact
Emergency Services (ALWAYS inform them that the emergency is in an area using ionising radiation or radioactive material)	(0)000
University Radiation Safety Officer (URSO): Dr Kent Gregory	0410 388 018
Human Resources	83134638 or 83131111 or 0404489059 or 0420958394
Radiation Protection Branch of the EPA	1800 307 733

Please note that any notifiable radiation incident will need to be reported by the URSO to the EPA and reported by Human Resources to SafeWork SA.

NOTIFIABLE RADIATION INCIDENTS

Human Resources and the University Radiation Safety Officer will follow up with an investigation of the incident and report to the where required Radiation Branch of the EPA and SafeWork SA.

The following incidents are the broad categories of notifiable incidents (details are found by contacting Human Resources or referring to schedule 3 of the Regulations)

- Medical exposure of a patients to ionising radiation (not authorised or observable acute effects or wrong patient or the wrong tissue or wrong activity).
- Incidents that cause or may lead to radiation injuries or radiation doses exceeding the annual dose limits to workers/members of the public.
- Loss of theft of a radioactive source or radiation apparatus.
- Incidents relating to the transport of radioactive material.
- Unintentional or unauthorised discharges of radioactive materials into the environment.
- Damage to, or malfunctioning of, radiation apparatus or sealed source.
- Contamination with, or dispersal of radioactive material.
- Out of control radiation sources.

CONTINGENCY PLANS

- The Licensed Supervisor must ensure that contingency plans for ionising radiation activities are developed and tested in accordance with the [Emergency Management Procedure](#).
- The contingency plan must—
 - a. take into account every radiation incident and radiation emergency that is reasonably foreseeable; and
 - b. contain specific instructions as to how each such accident and emergency is to be dealt with, paying particular regard as to how control may be restored, and the exposure of persons may be kept to a minimum; and
 - c. be included in training session for staff and students so they can respond correctly to any foreseeable event.
- The Head of School must ensure that any equipment and facilities (e.g. monitoring instrument, detector, or alarm) necessary for the effective operation of the contingency plan are provided and maintained in correct working order.

UNSEALED RADIOACTIVE MATERIALS EMERGENCY ACTIONS

RADIOACTIVE SPILLS

Note if the incident is **serious** (hospitalisation or clean up requiring MFS) then dual reporting will be required (Radiation Branch of the EPA and SafeWork SA). The site is not to be cleaned until the EPA and SafeWork SA approvals are granted.

- Treatment for serious or life-threatening injury is to take priority over treatment for contamination.
- Manage any injury (where applicable).
- Assess the situation and avoid contaminating other areas.
- Evacuate the area if necessary (also lock and place a sign in the area).
- Advise – the licensed supervisor, University Radiation Safety Officer and [Human Resources](#) (emergency contact information is contained in the above table)
- Clean up and decontaminate in the following order (treat all cleaning materials as radioactive waste):
 - a. people
 - b. laboratory (only when clean-up is approved)
 - c. equipment (only when clean-up is approved).

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EMERGENCIES AND ACCIDENTS

UNSEALED RADIOACTIVE MATERIALS EMERGENCY ACTIONS

RADIOACTIVE SPILLS continued

- Record the incident in accordance with the [HSW Incident Reporting and Investigation Procedure](#) specifically including the following information:
 - a. the time, date and place.
 - b. the names of those involved, including anyone who may have been affected by the incident;
 - c. The quantity of radioactive material involved, its physical and chemical form and the extent of any dispersal of a radioactive substance. It is important to estimate the amount of activity involved in Becquerel (or Curie);
 - d. The length of time the radioactive material was out of control and when it was reported to licensed supervisor;
 - e. The probable cause of the incident.
- Human Resources and the University Radiation Safety Officer will follow up with an investigation of the incident and report to the where required Radiation Branch of the EPA and SafeWork SA.

Spill Kit for Unsealed Radioactive Materials

Radioiodine

In general, the requirements for a spill kit for unsealed radioactive materials are the same as for a chemical spill involving similar chemical forms. The one major difference is where radioactive iodine (I-125 or I-131) is being used. With radioactive iodine it is important that spills do not oxidise the iodide to volatile iodine, and a reducing agent (5% sodium thiosulfate solution) must be included in the spill kit. If an iodine spill does occur, quickly add sodium thiosulphate to the spill (in an equal volume), place a plastic sheet over the top, exit the room and secure it from other workers. Immediately call Human Resources for assistance (contact information in above table).

Spill Kit Contents

- Personal protective equipment specifically safety glasses and gloves.
- Absorbent material of various kinds for liquid spills:
 - a. Vermiculite or similar absorbent material.
 - b. Absorbent paper and tissues.
 - c. Coated bench protector absorbent paper (e.g. 'Benchkote').
- Variety of plastic bags for the waste absorbent and paper – these should be suitable for transfer to the yellow waste pails.
- Plastic sheeting (polythene is suitable) for covering contaminated areas until hard clean-up and decontamination can be done.
- Strong adhesive tape for fastening the sheet down on the bench, floor or other surface.
- Decon-90 or other appropriate detergent-based cleaning agent. For unusual chemical forms provide a suitable chemical agent for decontamination.
- For radioiodine, a 5% solution of sodium thiosulfate which should be freshly made up regularly.
- A small whiteboard and marker pens so that the area can be sign-posted and a notebook and pen for recording the circumstances of the incident.

continue

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EMERGENCIES AND ACCIDENTS

UNSEALED RADIOACTIVE MATERIALS EMERGENCY ACTIONS continued

DECONTAMINATION

Treat all materials used in the decontamination process as radioactive waste.

Personal Decontamination

When decontaminating people, be as gentle as possible to avoid the contamination passing through the skin. Seek assistance from your licensed supervisor and/or the University Radiation Safety Officer

Skin

- Monitor the skin and get help if necessary; an assistant to monitor the progress is very helpful.
- Remove contaminated clothing if necessary and secure in a plastic bag.
- Gently rub with cotton wool, warm water and mild soap, then monitor again.

Warning do not continue if there is a risk of contamination entering the blood stream through abrasion to the skin.

- Scrub – soft brush – do not damage the skin, then monitor again.
- Use a decontamination product like 'Count-off'.
- If still contaminated report to the University Radiation Safety Officer

Face and Eyes

- Wash only with warm water or sterile saline solution.
- Be careful not to swallow or inhale contamination.
- If washing with water does not remove the contamination, call the University Radiation Safety Officer for assistance.

Other Parts of the Body

- Do not spread contamination.
- If the person's hair is contaminated, keep run off away from nose and mouth when showering.
- Rinse rather than scrub.
- Remove and dispose of all contaminated clothing – do not leave the lab in contaminated clothes but arrange for a new set to be delivered.

Wounds

- Wash only with warm water.
- If washing with water does not remove the contamination, call the University Radiation Safety Officer for assistance.

Ingestion and Inhalation

Internal contamination requires professional medical assistance. Ring 0-000

You must call the University Radiation Safety Officer IMMEDIATELY (contact information in above table)

Laboratory Decontamination

For items like trays, benches, equipment and the floor:

- Notify other people in the vicinity of the spill
- Restrict access until cleaned up.
- Wear personal protective equipment (gloves, gown/apron), shoe covers if the contamination is on the floor.
- Mop the spill with tissues and dry the surface.
- Monitor.
- Decontaminate any remaining hot spots by working from outside inwards with Decon 90; scrub if needed.
- Do not contaminate the cleaning solution – use paper towels/tissues only once.
- If still radioactive then contact University Radiation Safety Officer or Human Resources for advice (contact information in above table).

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EMERGENCIES AND ACCIDENTS

SEALED SOURCES

Loss of control in a closed area (laboratory)

If a sealed source is no longer in its normal shielded container the dose rates may be high. In these circumstances it is most important to leave the area, secure the door and plan a recovery operation. This may involve locating the source using a radiation monitor. Check the dose rate outside the locked room and place Do Not Enter signage on the door. Estimate the radiation field from the unshielded source – what dose will be received if it is recovered with 1 metre tongs? How long can a person operate in the area? In the worst case, call for assistance from the University Radiation Safety Officer or the Radiation Protection Branch of the EPA, after making certain that no-one can enter the area.

Record an incident in accordance with the HSW [Incident Reporting and Investigation](#) Procedure.

Loss of control in a vehicle accident

Neutron moisture probes are the most likely sealed source to be transported in a vehicle.

The possibility of loss of control of a sealed source in a vehicle accident or emergency is high. The person in charge of the vehicle, or another responsible person, must notify the University Radiation Safety Officer and the Radiation Protection Branch of the EPA as soon as possible.

If the source is properly secured in the vehicle, it will not be a major hazard in most road accidents as it will remain in the holder in its carrying case. Emergency Services are trained to handle a situation involving a radiation source, but they must know there is a source in the vehicle.

Record an incident in accordance with the HSW [Incident Reporting and Investigation](#) Procedure.

Loss of control due to a break down in the field

The mechanical breakdown of a moisture probe in the field can be more difficult to handle than the same problem on campus because the proper resources may not be available.

When used in the field:

- Emergency signs and warning tape must be carried so that the source area can be marked off if mechanical failure occurs.
- Mark the area around the broken source as a radiation hazard.
- Inform the University Radiation Safety Officer and the Radiation Protection Branch of the EPA.
- Do not leave the source unattended unless help cannot otherwise be obtained.
- Record in incident in accordance with the HSW [Incident Reporting and Investigation](#) Procedure.

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EMERGENCIES AND ACCIDENTS

X-RAY UNITS

If the Emergency Services are called ALWAYS inform them that the emergency is in an area where an X-ray unit is normally in use. Make sure they are informed that EITHER the X-ray unit is turned off and is safe or that it is still operational and special precautions will be needed (this should be an extremely rare event).

Summary of Emergency Actions

- Turn off the machine.
- Manage any injury – refer the exposed person for medical examination.
- Advise your licensed supervisor and University Radiation Safety Officer.
- Do not take action to correct the fault that caused the exposure. It will be difficult to estimate the absorbed dose if the fault has been corrected.
- Tag out the unit.
- Disconnect the unit from the power and lock the room.
- Record the incident in accordance with the HSW [Incident Reporting and Investigation](#) Procedure and report (if not already done) to the licensed supervisor, the Head of School, Human Resources and the University Radiation Safety Officer.
- The investigation is to be conducted by the University Radiation Safety Officer, Human Resources and the licensed supervisor. An investigation report shall contain:
 - a. details of the incident/accident including: - the time, date and place.
 - b. the names of those involved, including anyone who may have been affected by the incident.
 - c. a description of the incident.
 - d. the results of any dose assessments that have been made, and
 - e. actions taken to prevent the event from happening again.

XRD and XRF

If a user of X-ray analysis apparatus detects or suspects an unnecessary or unexpected radiation field, they must immediately:

- de-energise the apparatus; and
- notify Human Resources (contact information in above table) who will notify the University Radiation Safety Officer of the incident.
- Record the incident in accordance with the [HSW Incident Reporting and Investigation](#) Procedure and report (if not already done) to the licensed supervisor.

A person must not re-energise or modify an apparatus that has been de-energised due to a detected or suspected unnecessary or unexpected radiation field until such time as the University Radiation Safety Officer has:

- inspected the apparatus
- conducted an investigation
- approved of any proposed actions.

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RADIATION INCIDENT INVESTIGATION

Personal Details	
Name	
Staff or Student number	
Contact No	
Course of Study where applicable EMS Placement host and dates Numbers Mobile and Landline	
Were you working with radiation anywhere, apart from the University of Adelaide, during the monitoring period? (if yes please provide the details)	

Work Details	
Is there a specific Job Safety Analysis or Safe Operating Procedure for the task being undertaken? (If yes attach SOP/JSA)	Attached <input type="checkbox"/> Yes <input type="checkbox"/> No
Has training been conducted (view records) for the task undertaken	

Incident Details	
What was the dose reading?	
What is the period of dosimeter reading?	
List the type of radiation you used during the period e.g. <ul style="list-style-type: none"> unsealed radionuclides (i.e. ^{131}I, ^{14}C, ^{32}P)? diagnostic X-ray CT or a fluoroscope mobile diagnostic X-ray Sealed source (i.e. neutron probe) 	
Referring to the SOP or activity, can you think of any part of the process that you would have been exposed to radiation? (please record details)	
Can you think of any reason or situation which would have exposed your badge to X-rays or radionuclides?	

RADIATION INCIDENT INVESTIGATION

INCIDENT DETAILS (continued)

Have you done any work where PPE was not provided and/or used? (provide details)	
What PPE was used? (e.g. lead gowns; lead gloves; thyroid covers; glasses)	
Do you know of any exposures that have imaged any part of your body (hands etc)?	
Have you been through an airport Scanner with your badge during the period?	
Where do you store your monitor? And where do you store the monitors control?	
Has the equipment been tested i.e. compliance tested, wipe tested or other testing? (attach a copy)	
Any other comments or notes	
Cessation of radiation work required pending investigation:	
Inform the person that if they continue to get doses they will be stopped from radiation work before they reach 20milliSv in a 12 month period.	

RADIATION INCIDENT INVESTIGATION

CORRECTIVE ACTION TAKEN TO PREVENT A RECURRENCE

- How could the incident have been avoided?
- Is there an existing risk assessment (RA) for this activity? Yes / No
- Identify the hazards/issues/system deficiencies which resulted in the occurrence (e.g. faulty equipment, inappropriate storage, lack of training/skill, risk assessment not completed, poor design, environmental conditions etc).
- Determine how a recurrence would be prevented.
- Determine appropriate recommendations to prevent a recurrence using the Hierarchy of Controls (there may be a combination of control measures, both short and long-term):
 1. Elimination (i.e. is there a permanent solution?)
 2. Substitution (e.g. is it possible to replace the hazard (e.g. chemical) with one that presents a lower risk?)
 3. Isolation (e.g. is it possible to place a barrier between the operator and the hazard to prevent exposure?)
 4. Engineering (e.g. is it possible to structurally change the environment or plant and equipment to make it safer?)
 5. Administration (e.g. does the safe operating procedure require review, is additional training required for operators, is signage required?)
 6. Personal Protective Equipment [PPE] (e.g. is there a requirement for gloves, helmets, goggles, safety shoes?).

Contributing factors (including HSW system deficiencies)	Corrective Actions taken (or recommended) to prevent a recurrence (Short term and long term as applicable)	Who by	Time/frame or date action complete
Record corrective action in the University incident recording system <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> Attach a copy of this investigation in the University incident recording system </div> <div style="width: 48%;"> Attach a copy of this investigation in the central records management system </div> </div>			

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EXEMPTIONS

The following are exemptions which apply to the University.

Exemption for students from holding a licence - students using or handling radioactive material are exempt from licensing under Regulation 17(2b) and 18(1b)

Regulation 17(2b); 18 (1b) states “that persons enrolled in secondary or tertiary education where the use of radioactive material/operation of ionising radiation apparatus is required as part of the education curriculum and is under the supervision of a person holding a radiation use licence authorising the use are not required themselves to hold a licence.” However, the licensed supervisor must provide supervision (see table in [Appendix B](#)).

Exemptions from holding a licence (refer to Regulation 17, Schedule 4):

- a) persons who use or handle any sealed radioactive source, being a source with an activity of less than the following: (A) for group 1 and 2 radionuclides: 5 megabecquerels; (B) for group 3 and 4 radionuclides (not including tritium in gaseous tritium light sources): 50 megabecquerels; (C) for tritium in gaseous tritium light sources: 20 gigabecquerels.
- b) Exemption for students from holding a licence - refer to exemption 1 above.
- c) persons who use or handle radioactive material in the course of undertaking a training program (radiation therapy, nuclear medicine or radiation oncology when under supervision of someone who does hold an appropriate licence.
- d) persons who use a sealed radioactive source that is contained in a radiation gauge but do not use or handle the source at any time other than by operating the source control mechanism under the directions of a person who holds an appropriate licence.
- e) persons who handle a sealed radioactive source that is contained in a radiation gauge under the direct supervision of a person who holds a licence under section 28 of the Act, and do not dismantle the source container nor handle the source while it is out of the source container.
- f) persons who use or handle an unsealed radioactive substance in type C premises and are working under the directions of a person who— (i) supervises the persons who work in those premises; and (ii) holds a licence entitling the holder to use or handle the radioactive substances used or handled in those premises in the way they are used or handled in those premises.
- g) persons, being members of the public, who handle any radioactive substance that is packaged for transport in accordance with Part 8 of the Regulations.
- h) persons who, being members of the nursing staff employed in a hospital ward in which patients are treated using a radioactive substance, are supervised by a registered nurse in charge of that ward who holds a licence that entitling the holder to use or handle such a radioactive substance in that ward.
- i) persons who are patients undergoing diagnosis or treatment by use of a radioactive substance.
- j) persons who use, for the purpose of industrial radiography, a sealed radioactive source that is in a fully protected enclosure and who use that source under the supervision of a person who holds a licence authorising the use of the sealed radioactive source.
- k) persons who use or handle any naturally occurring radioactive materials during developmental testing operations or operations for or in relation to mining or mineral processing authorised by radiation management licence.
- l) Following apparatus (schedule 4.1)
 - I. Television receivers
 - II. Visual display unit
 - III. Cold cathode gas discharge tubes
 - IV. Electron microscopes
 - V. Ionising apparatus under development or in developmental testing (if in a licensed premise)

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EXEMPTIONS

Exemptions from holding a licence continued

- m) Following sealed sources (schedule 4.2)
- VI. Americium-21 in domestic smoke alarms
 - VII. Solid depleted uranium used as ballast
 - VIII. Encapsulated (metal sheath) depleted uranium
 - IX. Gaseous tritium light source (less than 74 GBq)
 - X. Teaching samples of sealed sources with the following activities: Cobalt-60 200 kBq; Strontium-90 80 kBq; Caesium-137 200kBq; Radium-226 20kBq; Americium-241 40kBq.
 - XI. Geological samples used for teaching or geological displays or at levels not more than 5 micrograms/hour (10cm from surface)
 - XII. Electron capture detector used in gas chromatography containing a nickel-63 less than 750MBq or tritium less than 20 GBq.
 - XIII. Lighting products that include krypton-85.

Exemptions from holding a SA licence mutual recognition

A radiation specialist holding valid authorisation in another jurisdiction can undertake the same activities in South Australia. Operating radiation apparatus, handling of radioactive sources, and accreditation of third-party testers of radiation sources are included in the scheme. An individual will be deemed to be authorised to undertake work in South Australia, normally requiring an SA licence, under their home jurisdiction licence (Note this does not apply to Qld).

- Before you can commence working in South Australia under Automatic Deemed Registration (ADR), you must notify the EPA by completing the online form. You will receive a factsheet outlining some of your key responsibilities.
- ADR applicants must comply with the same conduct and regulatory requirements as SA licensees.
- Your ADR is limited to the scope of work allowed under your home jurisdiction licence and you must also comply with the Radiation Protection and Control Act 2021 (RPC Act) and relevant regulations at all times.
- If your home jurisdiction licence expires, is suspended or in any other way ceases to be valid, you are no longer deemed registered in South Australia (or any other jurisdiction). ADR does not apply if your principal place of residence or work is South Australia.

Exemption for routine veterinary radiography

A veterinary nurse and veterinary technician are eligible to apply for licence to perform routine veterinary radiography. Once licenced this group will be allowed to conduct routine veterinary radiography without the need for direct, in-room supervision by a veterinary surgeon or radiographer (EPA 30 August 2024). Note routine does not include CT or Fluoroscopy radiography.

Exemption for ores

Ores, which are not subjected to chemical processing and are less than 100 kilos are not required to be stored or handled in a licensed premise (Regs 19(1))

Exemption from personal monitoring for specific unsealed sources and using specific Xray apparatus.

The University has undertaken a review for risk and included in the University Radiation Management Plan (RMP) the intent to continue with the following exemptions (which expired in February 2024). The users of the following will not be required to have a personal monitor.

- 3H, 14C and 35S unsealed sources
- plain (intra-oral) dental X-ray units
- XRDs/XRFs.

If you feel that your activity should be exempted from personal monitoring, then please contact Human Resources to arrange an assessment by the URSO and addition into the RMP.

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EXEMPTIONS

Exemption for portable XRF (pXRF)

Notice RPC202401-08 Government Gazette adted 11 Jan 2024 – exempts persons who use or operate a pXRF apparatus from any requirements in the Code of Practice for protection against ionizing radiation emitted from X-ray analysis equipment (1984) published by ARPANSA, subject to the following condition:

The registered owner of the Portable X-ray fluorescence (pXRF) apparatus ensures that the following tables form Section 4 of the Guidelines for pXRF Apparatus 2023 as published by the Department are complied with

- a) Table 4.1 Apparatus requirements for Portable X-ray fluorescence (pXRF) apparatus
- b) Table 4.2 Operational requirements for Portable X-ray fluorescence (pXRF) apparatus

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