

# Personal Radiation Monitoring Procedure

## Section 1 - Purpose and Scope

(1) This Procedure is intended to provide appropriate technical information to Radiation Safety Officers (RSOs) and outlines the requirements for personal radiation monitoring for UQ workers working with radiation sources. It is applicable to all University of Queensland (UQ) radiation workers as required by the [Radiation Safety Regulation 2021](#).

## Section 2 - Process and Key Controls

(2) Personal radiation monitoring is referred to under Section 38 of the [Radiation Safety Act 1999](#) (the Act). As such, the following key controls are required:

- a. Persons who use radiation sources may require personal monitoring as a requirement of a specific licence condition or by a provision in the approved Radiation Safety and Protection Plan (RSPP).
- b. Dosimeters are issued to an individual. A personal dosimeter must not be worn by any other person or used for any purpose other than the monitoring of that individual's exposure to radiation.
- c. All dosimeters must be stored in a location away from any radiation sources when not in use.
- d. Personal dose records must be kept for not less than 30 years after the last exposure assessment or at least until the person has reached the age of 75 years.

## Section 3 - Key Requirements

### Part A - Types of Radiation Monitors

#### Photon Radiation: X-rays and Gamma Rays

##### Passive Dosimeters

(3) Thermoluminescent dosimetry (TLD) and optically stimulated luminescence (OSL) dosimeters have been the most common means of monitoring the radiation exposure of users of gamma emitters - including unsealed sources of  $^{125}\text{I}$  and  $^{51}\text{Cr}$  and sealed sources such as  $^{137}\text{Cs}$  and  $^{60}\text{Co}$ . They are also suitable for persons working with diagnostic X-rays, including those used at UQ's veterinary and dental practices. These personal dosimeters are available from service providers.

##### Electronic Personal Dosimeters (EPD)

(4) Electronic personal dosimeters (EPDs) may also be used to record X-ray and gamma ray doses. They can give continuous readout of cumulative dose and current dose rate and warn the person wearing it when a specified dose rate or a cumulative dose is exceeded. EPDs are especially useful in high dose areas, or for workers wanting to know the personal dose received from a new radioisotope in real time.

## Analytical X-rays

(5) In the majority of cases, personal monitoring with conventional TLD or OSL is not required for users of X-ray fluorescence (XRF) and X-ray diffraction (XRD) units. Such equipment has either a totally enclosed target chamber or, where external beams are available, sophisticated interlock systems are fitted to prevent access to the direct beam. The very small diameter of the beam also means that any exposure that may have occurred would be only of a very restricted area and so would be unlikely to be detected by a conventional dosimeter worn on the chest or waist.

## Neutron Radiation

(6) Users of neutron sources, which are incorporated in soil density or moisture gauges, are required to use specialised neutron dosimeters. Similar to TLD/OSL monitors, neutron dosimeters are available from service providers.

## Beta Radiation

### Thermoluminescent Dosimetry (TLD)

(7) Beta radiation with average energies greater than 200 keV can be monitored using the standard TLD dosimeters supplied by service providers. The energy limitation means that only  $^{32}\text{P}$  and some of the less common high energy beta (or beta and gamma) emitters (e.g.  $^{36}\text{Cl}$ ,  $^{46}\text{Sc}$ ,  $^{82}\text{Br}$  and  $^{103}\text{Ru}$ ) can be satisfactorily monitored with these personal dosimeters.

### Optically Stimulated Luminescence (OSL)

(8) The OSL dosimeters are also sensitive to beta radiation, although the lower energy limit for useful results is 150 keV which effectively restricts their beta monitoring capability to  $^{32}\text{P}$  (and other high energy beta emitters listed above) and not for monitoring users of tritium,  $^{14}\text{C}$ .

### Finger/Extremity Dosimeters

(9) Users of  $^{32}\text{P}$  must use TLD or OSL finger or extremity dosimeters, particularly where pipetting high specific activity stock solutions is a common practice. These are available from service providers.

### Low Energy Beta Emitters

(10) Tritium and  $^{14}\text{C}$  have relatively low average beta energies and external monitoring is of little value when the relatively small amounts typically handled in laboratories are considered. In any case, the principal hazard of these substances is linked to inhalation or ingestion rather than external exposure. The control measures are therefore directed at entirely preventing the exposure rather than at monitoring and must be completed through the risk assessment process in [UQSafe](#).

## Part B - Using Dosimeters

(11) The instructions provided by the issuing service for each type of dosimeter must be followed closely, however, there are some procedures common to all personal monitoring practices, these are:

- a. dosimeters must only be worn in the workplace and be returned to a designated location at the end of the work period.
- b. all dosimeters must be stored in the same location when not in use, together with any control dosimeter issued. The area chosen for dosimeter storage must be located away from sources of radiation.
- c. dosimeters are issued to an individual. They must not be worn by any other person or used for any purpose other than the monitoring of that individual's potential exposure to radiation.

## Wearing Periods

(12) For UQ practices, the following monitoring periods are required:

Practice Category	Dosimeter Wearing Period
Unsealed sources research laboratories (beta or beta and gamma emitters)	3 months
Veterinary X-ray	3 months
Dental X-ray	3 months
Analytical X-ray	3 months
Soil moisture gauging	1 month
Fixed radiation gauges (service and installation only)	3 months

(13) These monitoring periods are for whole-body dosimeters only. Extremity dosimeters are generally changed monthly or according to the advice of the supplier.

## Managing Dosimeters

(14) It is the responsibility of the Organisational Unit to order and maintain their radiation dosimetry. Where radiation sources are used for the first time, or work is beginning with a new radioisotope or type of X-ray unit, the local RSO can contact the Radiation Protection Consultant (RPC) regarding personal monitoring requirements.

(15) The cost of personal monitoring is the responsibility of the Organisational Unit where the radiation sources are used.

# Section 4 - Roles, Responsibilities and Accountabilities

## Possession Licensee

(16) UQ has been granted three Possession Licences for the radiation sources under [the Act](#). The Possession Licensee is responsible for ensuring compliance with both the legislation and specific licence conditions.

- a. The Chief Operating Officer of UQ is the nominee for one possession licence that encompasses the majority of UQ's radiation equipment, radioactive substances and Class 4 lasers used in medical, cosmetic or related procedures.
- b. Director, Centre for Advanced Imaging (CAI) is the licence nominee of another possession licence for the radiation equipment and radioactive substances used in CAI.
- c. Director, Herston Imaging Research Facility (HIRF) is the licence nominee of the third possession licence for the radiation equipment and radioactive substances in HIRF.

(17) The Possession Licensee can nominate a nominee to carry out activities on their behalf and this can be any Senior Executive member. To be nominated, the Senior Executive member must contact the Health, Safety and Wellness Division (HSW Division) so the process can be completed and QRH be informed of the nomination.

## Nominee

(18) The Nominee's responsibilities, which can be delegated to Executive Deans, Institute Directors or Heads of School, are as follows:

- a. Implement an RSPP for the practice to be followed by all persons involved in carrying out the radiation practice.
- b. Appoint an RSO.
- c. Apply for [Approval to Acquire](#) for each radiation source or continuing to acquire unsealed sources (if applicable).
- d. Ensure radiation sources in their area of responsibility, the premises in which they are used, and where radioactive substances are stored, comply with the relevant [Radiation Safety Standards](#) whenever the radiation practice is being carried out.
- e. Apply for [Approval to Relocate](#) a radiation source to a place outside of Queensland's jurisdiction.
- f. Ensure the disposal of radioactive material is in a manner consistent with their RSPP and the concentration of radionuclides in the material is less than that prescribed in [the Regulation](#).
- g. Apply for [Approval to Dispose](#) if the Possession Licensee wishes to dispose of radioactive material in excess of the disposal levels prescribed in the [Regulation](#).
- h. Ensure compliance with both the legislation and the licence conditions.

## Radiation Safety Officers (RSO)

(19) [The Act](#) requires each Possession Licensee to appoint a qualified RSO. The RSO is required to:

- a. Hold an RSO Certificate relevant to the radiation practice.
- b. Advise the Possession Licensee/nominee about the radiation safety status of the practice and ways to remedy issues or improve safety.
- c. Inform the HSW Division, via the RPC, of the status of radiation safety of the practice.
- d. Identify whether the licensee's approved RSPP for the practice is being complied with by recommending the activities to be taken to ensure compliance with the RSPP.
- e. Identify and advise the Possession Licensee/nominee of ways to minimise exposure to radiation to people from the radiation source.
- f. Provide or arrange the provision of training to users.
- g. Identify whether [the Act](#), [the Regulation](#), RSPPs and applicable radiation safety standards for the radiation source and premises where the practice is being carried out are being complied with, and report to the Possession Licensee/nominee any contravention and recommend the actions that need to be taken to ensure compliance with the standards.
- h. Review the RSPP regularly to ensure its continued effectiveness and advise the Possession Licensee/nominee of the results of the review.
- i. Provide or arrange the provision of personal monitors when required.
- j. Ensure the disposal of radioactive waste is compliant with the legislation and the RSPP.
- k. Keep and maintain required records, e.g., radiation register, register of radioactive waste, radiation monitoring results, equipment maintenance, source shipments, waste management and records of training.
- l. Supervise the management of radioactive waste and provide specialist advice and assistance where necessary to ensure safety, e.g., incident recovery and clean-up operations.
- m. Audit the storage of radioactive waste at least every six months as per the [Management and Disposal of Radioactive Waste Procedure](#).
- n. Report as required to the Possession Licensee/nominee and the HSW Division regarding any issues or changes that may affect the Possession Licence.
- o. Ensure users are appropriately licensed where applicable.
- p. Monitor and review of personal radiation dose where applicable.
- q. Ensure risk assessment, licence, approval and compliance certificates are in place and current.
- r. Review relevant documentation to ensure the effectiveness of RSPP, SOP, risk assessment, etc.
- s. Ensure all persons have access to the relevant RSPPs.

- t. Ensure audits of radiation practices and compliance with [radiation safety legislation](#), including records of radiation licences, RSPPs, approvals and Compliance Certificates kept in radiation database and recorded in the register of radiation apparatus.
- u. Assist with the decontamination and cleanup if required, reporting and investigation.
- v. Conduct regular review of relevant documentation such as RSPP, SOP, risk assessment, etc. to ensure the document effectiveness.

## **Radiation Protection Consultant (RPC)**

(20) The RPC provides overall guidance to all UQ workers on matters pertaining to radiation. The RPC monitors the implementation of UQ's RSPPs as approved by the regulatory authority, provides support for radiation governance and compliance across UQ and monitors compliance with [radiation safety legislation](#).

(21) The RPC is the primary source of advice and expertise for:

- a. radiation legislative and scientific requirements;
- b. RSPPs;
- c. radiation research project approvals;
- d. overall guidance to RSOs;
- e. radiation safety training for radiation users.

(22) In addition, the RPC provides reports regularly via the Director of the HSW Division, to Possession Licence nominees about any issues or changes that may affect the Possession Licence.

## **User**

(23) The primary responsibilities of a user are to:

- a. hold the relevant licence if required;
- b. abide by the conditions stated in their licence;
- c. ensure any radiation dose received by a person is not higher than the limits prescribed in the Regulation and are as low as reasonably achievable;
- d. minimise risks to persons in the environment to reduce harm;
- e. update the register of radioactive waste;
- f. dispose of their radioactive waste appropriately;
- g. ensure the therapeutic or diagnostic procedure prescribed by authorised persons, or under approved human ethics program, if applicable;
- h. notify the RSO of any incident;
- i. clean up after a spill (after first seeking advice from RSO or RPC);
- j. report the incident in [UQSafe](#) database;
- k. assist with the incident investigation;
- l. maintain accountability for radiation sources used under the Possession Licence authority and ensure the licensee is adequately informed of any issues that might affect radiation safety or of any actions needed to be taken to ensure compliance with the RSPP and Regulation.

## **Health, Safety and Wellness Division**

(24) Health, Safety and Wellness Division (HSW Division) is responsible for maintaining the required level of central oversight and assurance by:

- a. employing an RPC to oversee the safe management of radiation use at UQ;
- b. assessing whether organisational units and UQ workers can demonstrate compliance with UQ radiation safety procedures and guidelines, RSPP and licence conditions;
- c. reporting to Queensland Radiation Health and investigating any incidents, as required.

## **Radiation Safety Officers Network**

(25) This is a formal network of UQ RSOs. The forum allows the RPC and RSOs to consult on, and review regulatory, organisational and technical radiation matters at UQ.

(26) The RSO Network meets four times a year and is chaired by the RPC. All participants are invited to contribute discussion and presentation items for the meeting. The RSO community provide secretariat duties as needed. All presentations and minutes are retained by HSW Division.

## **Section 5 - Monitoring, Review and Assurance**

(27) The RPC oversees radiation safety arrangement at UQ and reviews the specific aspects of radiation safety regularly. Local RSOs communicate radiation safety issues to the RPC as required.

## **Section 6 - Recording and Reporting**

### **Record Keeping**

(28) Possession Licensees who are required to provide personal monitoring are obliged under Section 38(4) of [the Act](#) to keep up-to-date records of doses as assessed by the monitoring service. Personal monitoring records are to be kept for the duration of the wearer's working life. The records are to be kept for not less than 30 years after the last exposure assessment, or at least until the person has reached the age of 75 years.

(29) In practice, radiation monitoring records will continue to be kept by local RSOs for the possession licensee.

(30) Personal dose records will be retained by local RSOs. The personal monitoring record for each monitored person must contain the following information:

- a. The results of all the assessments.
- b. The name, gender and date of birth of the monitored person.
- c. The name and postal address of the possession licensee.
- d. The date the monitored person started to be monitored for any radiation doses received in relation to the carrying out of the practice.
- e. The date the monitored person ceased to be monitored for any radiation doses received in relation to the carrying out of the practice.
- f. Details of the basis for the monitored person being required to wear a personal monitoring device.
- g. The type of radiation to which the monitored person has been exposed in relation to the carrying out of the practice.
- h. The period the assessment of a personal monitoring device worn by the monitored person, in relation to the carrying out of the practice.
- i. The estimated total effective dose, determined as a result of the assessment, for the monitored person for the period.
- j. Details of the methodology used in the assessment.

(31) The RPC is to also maintain, and annually review, central record keeping of the personal monitoring. This is achieved through the personal monitoring providers sending records to the RPC on an annual basis.

## Reporting of Radiation Doses

(32) Section 38(2) of [the Act](#) requires the results of the assessment of dosimeters be provided to Queensland Radiation Health (QRH) as soon as practicable. To allow this to be done, possession licensees may approve the direct transfer of radiation monitoring results from the relevant monitoring service to QRH.

(33) In the case of abnormal dose reading, the local RSO must inform the relevant worker, investigate why it happened, implement any new controls to minimise the exposure where applicable and meanwhile notify the RPC. If the personal dose is above the regulatory limit, it must be reported to QRH through the HSW Division.

# Section 7 - Appendix

## Definitions

Term	Definition
Ionising Radiation	Electromagnetic or particulate radiation capable of producing ions but does not include electromagnetic radiation of a wavelength greater than 100 nanometres.
Optically Stimulated Luminescence (OSL)	A method for measuring doses from ionising radiation.
Radiation Safety and Protection Plan (RSPP)	Is the risk management plan for a particular type of radiation practice. The relevant RSPP must be complied with by all users and other persons involved in the practice.
Thermoluminescent Dosimeter (TLD)	A type of radiation dosimeter, consisting of a piece of a thermoluminescent crystalline material inside a radiolucent package. When a thermoluminescent crystal is exposed to ionising radiation, it absorbs and traps some of the energy of the radiation in its crystal lattice.
X-Ray Diffraction (XRD)	Is the elastic scattering of X-ray photons by atoms in a periodic lattice. The scattered monochromatic X-rays that are in phase give constructive interference.
X-Ray Fluorescence (XRF)	Is the emission of characteristic "secondary" (or fluorescent) X-rays from a material that has been excited by being bombarded with high-energy X-rays or gamma rays.
UQ Workers	For the purposes of this Procedure includes: <ul style="list-style-type: none"> <li>• staff - continuing, fixed-term, research (contingent funded) and casual staff</li> <li>• contractors, subcontractors and consultants</li> <li>• visiting academics and researchers</li> <li>• academic title holders, visiting academics, Emeritus Professors, adjunct and honorary title-holders, Industry Fellows and conjoint appointments</li> <li>• Higher Degree by Research students</li> <li>• volunteers and students undertaking work experience.</li> </ul>

## Status and Details

<b>Status</b>	Current
<b>Effective Date</b>	4th January 2023
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<b>Enquiries Contact</b>	Health, Safety and Wellness Division