Management and Disposal of Radioactive Waste Procedure

Section 1 - Purpose and Scope

(1) This Procedure applies to all workers at The University of Queensland (UQ) who generate radioactive waste through their activities and provides advice on the processes required to ensure compliance with Part 5 of the Radiation Safety Act 1999 and Part 4 of the Radiation Safety Regulation 2021 to ensure user and public safety and to prevent environmental contamination.

(2) This Procedure details how the following types of radiation waste will be managed at UQ:

a. liquid and solid radioactive wastes produced when using unsealed radioactive substances;
b. disused sealed radioactive substances;
c. radiation apparatus.

(3) All radioactive waste procedures for facilities will be specified in the relevant approved Radiation Safety and Protection Plan (RSPP).

(4) The Procedure should be read in conjunction with other Radiation Safety procedures and guidelines.

Section 2 - Process and Key Controls

(5) For the management of radiation waste, the following requirements must be observed:

a. All waste must be managed appropriately through a risk management process.
b. Waste accumulation is not permitted in UQ facilities unless it is necessary and such waste is managed appropriately (see clauses 37-42).
c. Risk management processes are required to provide protection to people and the environment through managing waste appropriately.
d. Personal protective equipment (PPE) must be worn by people when moving, diluting or disposing of radioactive waste as per the risk assessment.
e. Waste can only be removed by appropriately licenced persons.

Section 3 - Key Requirements

(6) The management of radioactive waste must include the regular disposal of the waste, and planning for ongoing removal of the waste must occur and the Organisational Unit must budget for at least annual removal of radioactive waste. This requirement must be included in the RSPP. Users must dispose of radioactive waste as required and record any disposal in the register of radioactive waste (see clause 41).

Management of Radioactive Waste

(7) There are requirements for disposing of different types of radiation sources as waste:

a. radiation apparatus;
b. sealed radioactive material;
c. unsealed radioactive material with low concentration levels;
d. unsealed radioactive material for elevated concentration levels (Approval to Dispose may be required – refer to clauses 34-35).

(8) There are essentially two ways of managing unsealed radioactive wastes:

a. dilution and dispersion;
b. concentration and containment.

(9) While the latter option is appropriate for materials associated with the nuclear fuel cycle, it is not required for the relatively low radiotoxicity substances used for research in the biological sciences or most other research fields at UQ.

(10) Radioactive wastes can generally be disposed of safely by dilution to very low concentrations prior to release. This is recognised by international bodies and acceptable concentrations of most isotopes are specified in the Regulation.

(11) The legislation provides for two ways in which radioactive material can be disposed of:

a. by compliance with particular schedules of activities and concentrations given in the Regulation [part 3 and Schedules 3]; or
b. by the granting of a specific approval [Section 26(1) and Section 58 of the Act].

(12) The physical nature of the waste determines to a significant degree the actual disposal procedures to be adopted:

a. liquid waste categorised into those that are water-soluble and those based on organic solvents;
b. solid waste generally consisting of laboratory waste (e.g., contaminated glassware, consumables, etc.) and other research material such as plant and animal tissues which still contain radioactive tracer material;
c. disused sealed radioactive waste.

Liquid Radioactive Waste

Water-soluble Materials

(13) The Regulation allows for disposal of radioactive material to the sewerage system provided the concentrations are below scheduled limits in the Regulation.

(14) Maximum concentration or activity levels vary depending on the radionuclide and how the radiation source is being disposed of:

a. For air, water or sewerage system concentration levels, refer Sections 9 and 10 of the Regulation.
b. For concentration levels in all other methods of disposal, refer Sections 11 and 12 of the Regulation.

(15) In disposing of water-soluble liquid waste to the sewer, precautions are required to prevent splashing or aerosol formation which could spread contamination or create a respirable fraction. Best practice is the use of “flushing rim” laboratory sinks which allows flushing with known volumes of water while minimising splashing.

(16) If flushing rim sinks are not available then standard (or deep) conventional laboratory sinks can be used to dilute and flush liquid waste so long as suitable arrangements (e.g., decreasing the water flow rate, using anti-splashing water tap) are made to prevent splashing and to allow for the gradual flow of waste liquid into a stream of water as it runs to waste.

Required Dilutions

(17) Requirements for the maximum concentrations of radioactive substances allowable in wastewater that flows to a sewer main are given in Column 4 of Schedule 3 of the Regulation. UQ licensees must consider the concentration limits as applying to their individual laboratories.

Organic Solvent Wastes

(18) Solvent waste cannot be disposed of in general waste streams due to their hazardous properties, even where the radioactive content is insignificant. Consequently, solvent waste must be collected in drums according to solvent type and then disposed of as a hazardous chemical.

(19) The Regulation requires the concentration of a radionuclide in waste (other than where the waste is disposed of into the air, water or a sewer system) to be less than half the concentration given in Column 2 of Schedule 1 in the Regulation.

(20) The radioactive content of the scintillant waste can be assessed by counting a sample in a liquid scintillation counter with automatic quench correction. Concentrations in disintegrations per minute (dpm) per litre can be converted to becquerels per litre by dividing by 60.

(21) It is important not to mix scintillants containing different radionuclides as this would make activity assessment difficult including decay times.

(22) The concentration in most scintillant waste is likely to be well below the level of prescription although some may require storage for decay or additional dilution. In most cases, dilution is not needed. If it has be diluted, the UQ Science Store should be contacted for further guidance – to see if same solvent (waste) is available.

(23) Where solvents have to be stored for decay, they must be appropriately stored in line with the Chemical Storage Safety Procedure and labelled (refer to Chemical Labelling Guideline) with details of the contents, including:

a. the chemical nature of the solvent;
b. radioisotope(s);
c. the radioactivity;
d. the person responsible;
e. the date after which the solvent can be disposed of as hazardous chemical waste.

(24) Flammable solvents must be stored in accordance with the requirements outlined in the Flammable and Combustible Liquids: Storage and Handling Procedure.

Management of Solid Radioactive Waste

(25) The Regulation requires the concentration of a radioisotope in waste (other than where the waste is disposed of into the air, water or a sewer system) be less than half the concentration given in Column 2 of Schedule 1 in the Regulation.

(26) Short lived solid wastes (e.g., those with half-lives of less than a few months) must be retained within appropriate plastic bags (shielding may be required) in the laboratory or dedicated storage room until the radioactivity has fallen to exempt levels under the Regulation.

(27) The person who creates the waste must make an assessment of the activity present in materials such as discarded and contaminated lab consumables that form the bulk of solid wastes from laboratories. While a survey meter can be used to detect the presence of radioactivity, attenuation by packaging material and irregular source geometry can lead to substantial underestimation of the amount of active material present. If there is any uncertainty, the package must be stored for a longer period.

(28) With Tritium and Carbon 14, the amounts packaged for disposal must be within the guidelines as there will be no appreciable decay of activity over practical time spans.

Disposal Procedures for Solids and Packaging

(29) Solid waste being stored for decay must be labelled with:

a. details of the radioactive content;
b. the person responsible;
c. the date after which the material can be disposed of.

(30) Areas in which wastes are stored for decay must be appropriately signed and access controlled. The storage room requires certification by an accredited person every five years to ensure the safety and compliance according to Radiation Safety Standard 2021.

(31) Solid waste, empty packaging or containers which once contained radioactive materials must be checked with an appropriate meter to confirm any contamination. Uncontrolled disposal may occur where solid waste and empty packaging have a sufficiently low activity concentration (refer to schedule 3 of the Regulation) and have no other hazardous properties. They must not bear any radioactive or other warning labels when being disposed of.

Disposal of Disused Sealed Radioactive Substances

(32) The disposal of disused sealed radioactive substances is different from liquid and solid radioactive waste. Generally, there are two disposal methods which are practically feasible for UQ workers.

(33) The preferred strategy is to return the source to the supplier or manufacturer. This request can be done at any time but ideally this requirement is included in the purchase contract indicating the sealed source(s) will be returned to the supplier or manufacturer when disused, with or without extra cost, before the contract is signed. The other is to gain a disposal approval from Queensland Radiation Health.

Disposal Approvals

(34) There may be cases in which the nature of the waste or the proposed method of disposal do not fit clearly into the categories set out in the Regulation. In these circumstances, an application for Approval to Dispose of radioactive material is required.

(35) The assistance of the Radiation Protection Consultant (RPC) should be obtained where the need for such an application arises.

Disposal of Radiation Apparatus

(36) Disposal of radiation apparatus, requires:

a. the equipment is rendered (by local RSO or accredited person) permanently inoperable, incapable of being repaired, and incapable of producing radiation (for example by destroying the main components, such as the X-ray tube);
b. all radiation warning signs removed (e.g., radiation hazard signs);

c. notice is given by the RSO within seven days after disposal to the Queensland Radiation Health;
d. Updating of the UQ register of radiation apparatus (see Radiation Safety - Regulatory Compliance and Risk Management Procedure).

Radioactive Waste Storage

Storage Containers

(37) Radioactive waste must be stored in appropriate containers. For example, left-over radioactive material must be kept in the original container; contaminated items such as gloves stored in plastic bags; large quantities of liquid stored in glass containers after taking chemical safety into account (refer to Chemical Storage Safety Guideline).

(38) All stored radioactive waste must be labelled with radiation warning signs and the following information where possible: radioisotope(s), activity and date of measurement.

Radioactive Waste Storage Area or Room

(39) Radioactive waste must be stored securely in a storage area or room. Access should be given only to authorised persons. The name and contact number of the local RSO must also be displayed on the wall or door.

(40) Storage area or room must be certified by an accredited person every five years to ensure the compliance with Radiation Safety Standard 2021.

Register of Radioactive Waste

(41) This register is a central shared document, e.g., via MS Teams, that is maintained and kept up to date by the RSOs and RPC. The Organisational Unit RSO will update the register when radioactive waste is disposed of or added. In addition, for nuclear material regulated by the Australian Safeguards and Non-Proliferation Office (ASNO), an ASNO database must be updated by RPC annually.

Audit of Radioactive Waste Storage

(42) The RSO for each radiation practice must audit the storage of radioactive waste at least every six months and make a record of such that includes information on – quantity of waste stored matches that recorded in the register of radioactive waste, the waste is securely stored with access restricted, the waste is stored such that it is not a risk to people, property or the environment, that plans and budget are in place to safely dispose of the waste ongoingly in order to prevent a build-up of legacy radioactive waste.

Disposal of Nuclear Material Regulated by ASNO

(43) For the disposal of nuclear material regulated by ASNO, an application must be submitted by the RPC and the approval from ASNO must be in place prior to the disposal.

Radiation Safety and Protection Plan (RSPP)

(44) The RSPP for each radiation apparatus or radiation source associated with a radiation practice must specify how associated radiation waste will be disposed of and how often.

Section 4 - Roles, Responsibilities and Accountabilities

Possession Licensee

(45) 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.

(46) 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

(47) 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 unseal 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 Officer (RSO)

(48) 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, 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 this 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 are 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)

(49) 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.

(50) 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; and
e. radiation safety training for radiation users.

(51) 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

(52) 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 are 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

(53) 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 procedure, guidelines, RSPP and licence conditions.
c. Reporting to Queensland Radiation Health and investigating any incidents, as required.

Radiation Safety Officer Network

(54) 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.

(55) 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

(56) 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.

Records of Radioactive Waste Disposal

(57) Local RSOs must ensure a:

a. record of radioactive waste disposal is maintained and the disposal is compliant with the legislation and this Procedure;
b. disposal record of sealed substances through a competent contractor are kept; and
c. updating of the register of radioactive waste.

(58) For each disposal operation, a record should include:

a. the date;

b. the manner of disposal;
c. the radioisotope(s);
d. the amount disposed of; and
e. the user responsible.

Section 6 - Appendix

Definitions

Term	Definition
Accredited Person	An individual with skills, knowledge and experience in assessing particular radiation sources or premises where they are used or stored for compliance with radiation safety standards. A person who has an Accreditation Certificate is allowed to issue Certificates of Compliance for the types of radiation sources or premises detailed in their certificate. A list of accredited person can be found on QRH website.
Nuclear Material	Uranium, plutonium, and thorium, in any form, consisting of natural and depleted uranium, or enriched uranium, uranium-233, and plutonium-239.
Radiation Protection Consultant (RPC)	A qualified expert appointed by the responsible person to supervise radiation safety activities and to ensure radiation safety. An PRC is deemed to have the authority to implement procedures and to intervene in situations where safety has been or is being compromised.
Radiation Safety Officer (RSO)	For a radiation practice, means a person who holds a relevant certificate issued under the Act and who the possession licensee nominee has appointed as the Radiation Safety Officer for the particular practice.
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.
UQ Workers	For the purposes of this Procedure includes: • staff - continuing, fixed-term, research (contingent funded) and casual staff; • contractors, subcontractors and consultants; • visiting academics and researchers; • academic title holders, visiting academics, emeritus professors, adjunct and honorary title-holders, industry fellows and conjoint appointments; • higher degree by research students; • volunteers and students undertaking work experience.

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