Emergency Response Plan for Radioactive Liquid Spills Procedure

Section 1 - Purpose and Scope

(1) This Procedure provides The University of Queensland (UQ) workers with information in minimising the impact of incidents involving spills of radionuclides in liquid form and is applicable to all UQ workers who work with radioactive material.

(2) This Procedure should be read in conjunction with the other UQ radiation safety procedures and guidelines.

Section 2 - Process and Key Controls

(3) Key controls include:

a. Treatment of skin penetrating injuries must take priority over decontamination and be dealt with in accordance with established first aid procedures.
b. Monitoring performed at an early stage following an incident but not at the expense of delaying treatment.
c. Removal of radioactive contamination should only commence after any patient's condition has been stabilised and when the procedures can be performed without compromising medical treatment.
d. Notification to Radiation Safety Officer (RSO) and other laboratory workers.
e. Monitoring and control of the contamination.
f. Decontamination of personnel, work areas and equipment.
g. Incident reporting and investigation in UQSafe.

Section 3 - Key Requirements: Sequence of Emergency Procedures

Treatment of Injured Person

(4) The treatment of injured persons must be dealt with immediately by activating the UQ emergency procedures. Depending on the severity of the injury, either emergency services must be called first by dialling 000 for an ambulance then security on phone 3365 3333 and describe the situation, or by calling UQ Security first. A copy of the Radiation Safety Data Sheet must go with the injured person to the medical practitioner.

(5) Where a person has been contaminated, contaminated clothing must be removed any affected area of skin decontaminated (see clauses 17-20).

Notify the Radiation Safety Officer (RSO) and Other Persons Working in the Area of the Spill

(6) Any spill must be notified to the local RSO as soon as practicable after the spill who will then assess the incident

and determine the response required. Local RSO contact details are listed on the Health, Safety and Wellness webpage: Local Safety Network Contacts and Support.

(7) The Radioisotope Fact Sheet must be provided to the RSO for the spilled material prior to any clean-up or decontamination commencing.

(8) For all contamination incidents, access to the area must be controlled by the RSO, or someone designated by the RSO for this task. Where there is contamination of persons, the RSO will ask all non-essential personnel to leave the area.

(9) A control point must be established immediately outside the laboratory where personnel can be checked for radioactive contamination as they leave the area. The local RSO may call on the assistance of other UQ RSOs or the Radiation Protection Consultant (RPC) to assist with this process.

Contain the Spill and Monitor for Contamination

(10) All appropriate personal protective equipment (PPE) must be donned before any attempt to clean up the spill.

(11) Absorbent paper or absorbent pads should be dropped onto the spill and the remaining material wiped up. Wiping must be inward, i.e., towards the centre of the spill to prevent the spread of contamination.

(12) After the spill has been contained and mopped up with absorbent material, the extent of any remaining contamination must to be determined. A careful survey is to be performed using a meter with an appropriate response to the radiation emitted by the contaminant.

(13) From the Safety Data Sheet (SDS) which outlines the radiation emitted, the half-life and chemical properties of the contaminant, the RSO can determine the best course of action to allow the area to be released from further control. Two risk-informed courses of action may be considered either:

a. immediate decontamination of the affected area, or
b. closure of the whole laboratory to allow the activity to decay to acceptable levels (short-lived radionuclides only).

(14) The latter option is the most desirable in terms of limiting occupational exposure and the production of radioactive waste. This may not be reasonably practicable in all circumstances and the RPC should be consulted.

Decontamination

(15) Decontamination should be carried out in a planned and logical manner by the worker causing the contamination. Assistance from the local RSO is available if required. Laboratories in which radioactive materials are used must maintain a decontamination kit so that the necessary materials are always at hand.

(16) The following materials[1] will be required for decontamination operations:

a. Radiation survey meter with appropriate response to the radiation emitted by the contaminant;
b. Appropriate PPE, such as laboratory coat, safety glasses, gloves and overshoes;
c. Suitable tongs or forceps to hold swabs while minimising dose to the hands;
d. Decontamination materials such as water, detergent, Decon90, Radiacwash, or other agents capable of removing or complexing with the spilled material; and
e. Absorbent cloth or tissues.
f. Waste disposal containers lined with a non-absorbent material to prevent leakage must be used to contain contaminated material collected during the clean-up e.g., resealable plastic drum lined with a plastic bag.

Where necessary, the outer container may also need to be lined with shielding material such as lead sheeting.

g. Cleaning must continue until all removable contaminants have been removed. Surface contamination levels must be reduced below the Derived Working Levels for Surface Contamination levels specified in the AS/NZS 2243.4: 2018 Safety in laboratories Part 4: Ionizing radiations and summarised in Table 1. For details on the toxicity groups, see Table 3.1 in AS/NZS 2243.4.

[1] Kit containing these decontamination materials must be readily available within each relevant work area.

Table 1 - Derived Workings Surface Contamination (Non-fixed)

Radiotoxicity Group	Maximum level within laboratory (Bq/cm^2)		Maximum level within on skin or items leaving laboratory (Bq/cm^2)	
	α emitters	non-α emitters	α emitters	non-α emitters
Group 1	0.1	1	0.05	0.5
Group 2	1	10	0.1	1
Group 3	10	100	1	10
Group 4	100	1000	10	100

Decontamination of Workers

(17) The gentlest methods for personal decontamination must be tried first.

(18) The person who is undertaking the decontamination must be wearing the following PPE: laboratory coat, double gloves, safety glasses and overshoes. The contaminated person's body surface and clothing is to be carefully monitored to localise contaminated areas. If possible, without spreading the contamination, the clothing must be carefully removed and placed in a labelled plastic bag or container.

(19) Removing contamination from around the nose, mouth and other body openings as a first priority. The mouth can be washed with dilute hydrogen peroxide solution (dilute hydrogen peroxide from 3% to 1% by mixing two parts water with one part hydrogen peroxide – this gives a 1% concentration) and the eyes with tap water or 1% saline. Skin is best treated initially with mild soap and water; if this fails to remove contamination, Radiacwash towelettes can be used provided the affected area is not near the eyes.

(20) The contaminated person must be assessed for other minor wounds or abrasions, and if visible, covered with waterproof adhesive coverings to prevent activity entering the body. If open wounds are contaminated with radioactive material or the person received a penetrating injury with radioactive material they must be washed first under running water (or sterile saline if available) and gentle bleeding encouraged for approximately one minute. A sterile dressing should then be applied.

Decontamination of Work Areas and Equipment

(21) The person undertaking the decontamination must wear the following PPE: laboratory coat, double gloves, safety glasses and overshoes. The RSO will direct the team to decontaminate the area and equipment to ensure that all material continues to be contained.

(22) To prevent the production of respirable dust, only wet decontamination methods must be used. The removal of contamination should be done with the minimum of rubbing and the swabs should be frequently discarded as radioactive waste in the appropriate waste container for radioactive substances. Frequent radiation level monitoring must be performed to assess progress.

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(23) Where contamination appears fixed after initial tests with simple wet wipes, further washing with a complexing agent such as Decon 90 or Radiacwash will be required. The decontaminating solution should be left on the contaminated surface as long as possible to allow the chemical reaction at the surface to assist the decontamination. If decontamination is unsuccessful, treatment with an abrasive material may be required. This should only be done under wet conditions.

(24) In some cases, it may be advisable to remove the equipment or section of bench for storage, either permanently as contaminated waste, or temporarily, until the contaminant has decayed sufficiently. In exceptional cases it might be necessary to seal in the contamination with concrete or paint. The advice of RPC must be obtained before sealing in any radioactive contamination or for approval to consign a contaminated item to the local storage room.

Reporting and Incident Investigation

(25) When decontamination is complete, the RSO must investigate the incident and determine whether there are any deficiencies in procedures or if personnel need additional training. The RSO must report the incident in UQSafe and investigation completed as outlined in the Health and Safety Incident Investigation Procedure. The relevant Radiation Safety Protection Plan (RSPP) and Standard Operating Procedure (SOP) should be reviewed after any incident to identify any areas for improvement, and corrections or updates made as required to prevent a recurrence. The RPC must be listed as a specialist advisor on any incident report that involves radioactive contamination.

Section 4 - Roles, Responsibilities and Accountabilities

Possession Licensee

(26) UQ has been granted three Possession Licences for the radiation sources under the Radiation Safety Act 1999 (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.

(27) 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 HSW Division so the process can be completed and QRH be informed of the nomination.

Nominee

(28) 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 Radiation Safety Regulation 2021 (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)

(29) 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 Health, Safety and Wellness Division (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., register of radiation apparatus, 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 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)

(30) 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.

(31) 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 RSO's; and
e. radiation safety training for radiation users.

(32) 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

(33) 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

(34) 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; and
c. Reporting to Queensland Radiation Health and investigating any incidents, as required.

Radiation Safety Officer Network

(35) 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.

(36) 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

(37) 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

(38) All incidents involving a radioactive spill must be reported in UQSafe by the worker or local RSO, and the RPC must also be notified in a timely manner.

(39) This report must contain information on the following:

a. a description of the incident;
b. extent of contamination of work area and to any UQ workers;
c. an estimate of any radiation doses to UQ workers;
d. decontamination operations performed; and
e. actions proposed to be taken to prevent a recurrence.

(40) In some circumstances, it may be necessary to make a report to the statutory authority; this will be coordinated by the RPC and the Health, Safety and Wellness Division.

Section 7 - Appendix

Definitions

Term	Definition
Activity	The expected value of the number of nuclear transformations occurring in a given quantity of material per unit time. The SI unit of activity is per second (s-1) and its special name is the Becquerel (Bq).
Becquerel (Bq)	Is the special name for the SI unit of activity.
Curie (Ci)	Is the old unit of activity 1 Ci = 3.7×10^{10} Bq.
Radiation Protection Consultant (RPC)	A qualified expert appointed by the responsible person to supervise radiation safety activities and to ensure radiation safety. An RPC is deemed to have the authority to implement procedures and to intervene in situations where safety has been or is being compromised.

Term	Definition
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.
Radiation Safety Officer (RSO)	For a radiation practice, means a person who holds a relevant certificate issued under Radiation Safety Act 1999 and who the possession licensee nominee has appointed as the radiation safety officer for the particular 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; and • volunteers and students undertaking work experience.

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