

## IONISING RADIATION CODE OF PRACTICE

### 1. INTRODUCTION

The purpose of this Code of Practice is to avoid hazards to health from ionising radiation, to avoid radioactive contamination, and to ensure safe disposal of radioactive waste.

Non-ionising radiation, as the term suggests, does not ionise the medium it passes through as it does not carry sufficient energy to remove electrons from atoms or molecules. However, non-ionising radiation may still possess sufficient energy to “excite” an atom or molecule by displacing an electron to a higher energy state producing physical effects or accelerating chemical reactions in the process. Near ultraviolet, visible light, infrared, microwave, radio waves, low frequency electromagnetic radiation and static fields are all examples of non-ionising radiation.

This potential for ionisation or excitation, as well as the transfer of energy when the human body experiences radiation, can cause both acute and chronic health effects. However, the effects of exposure to radiation may not be immediately obvious. Symptoms can range from minor burns to cell mutation and cancers.

While populations may be exposed to the different types of radiation as they arise naturally in the environment, the levels typically experienced naturally can be orders of magnitude less than occupational exposures. Therefore, risk assessments must be carefully carried out for all activities involving radiation.

Workers may be exposed to a variety of types of radiation by virtue of where they work and what activities they undertake as part of their job.

Ionising radiation is used in a wide range of equipment, including for:

- Chemical analysis, including crystallography and diffractometry.
- Location of ‘pigs’ (cleaning or separation devices) in pipework.
- Non-destructive testing of structures and pipelines.
- Medical and dental radiography (X-rays).
- Medical therapy.
- Sealed sources for radiography: non-destructive testing (NDT) of welds and pipework.
- Security scanning of baggage.

Naturally occurring radioactive radon gas is found where granite is located and can accumulate in basements and other poorly ventilated areas to a level causing significant exposure. Employers need to consider this both in relation to workplaces and home working. The HSE have published guidance on this and there is also a radon map of the country showing particularly at-risk areas.

## 2. SCOPE

The general duty of care an employer owes to their employees and others who might be affected by the work activities for which they are responsible can be found in ***The Health and Safety at Work Act 1974*** (HSWA).

***The Management of Health and Safety at Work Regulations 1999*** also require that risk assessments be carried out with a view to proper and effective preventive and protective measures being identified and implemented in the workplace. The provisions of this legislation also apply to the exposure of employees to radiation in the workplace.

For ionising radiation in the workplace, the main legal requirement is ***the Ionising Radiations Regulations 2017*** (the Regulations, or IRR).

Workplaces where radioactive substances and electrical equipment emitting ionising radiation are used, or where people work with natural radiation (including work in which people are exposed to naturally occurring radon gas and its decay products), fall within the scope of the Regulations.

The Regulations require employers to keep exposure to ionising radiations as low as reasonably practicable, with exposures not to exceed specified dose limits.

In common with other health and safety legislation, minimisation of exposure should be sought first by means of engineering control and design features. Where this is not reasonably practicable, employers should introduce safe systems of work and only rely on the provision of personal protective equipment as a last resort.

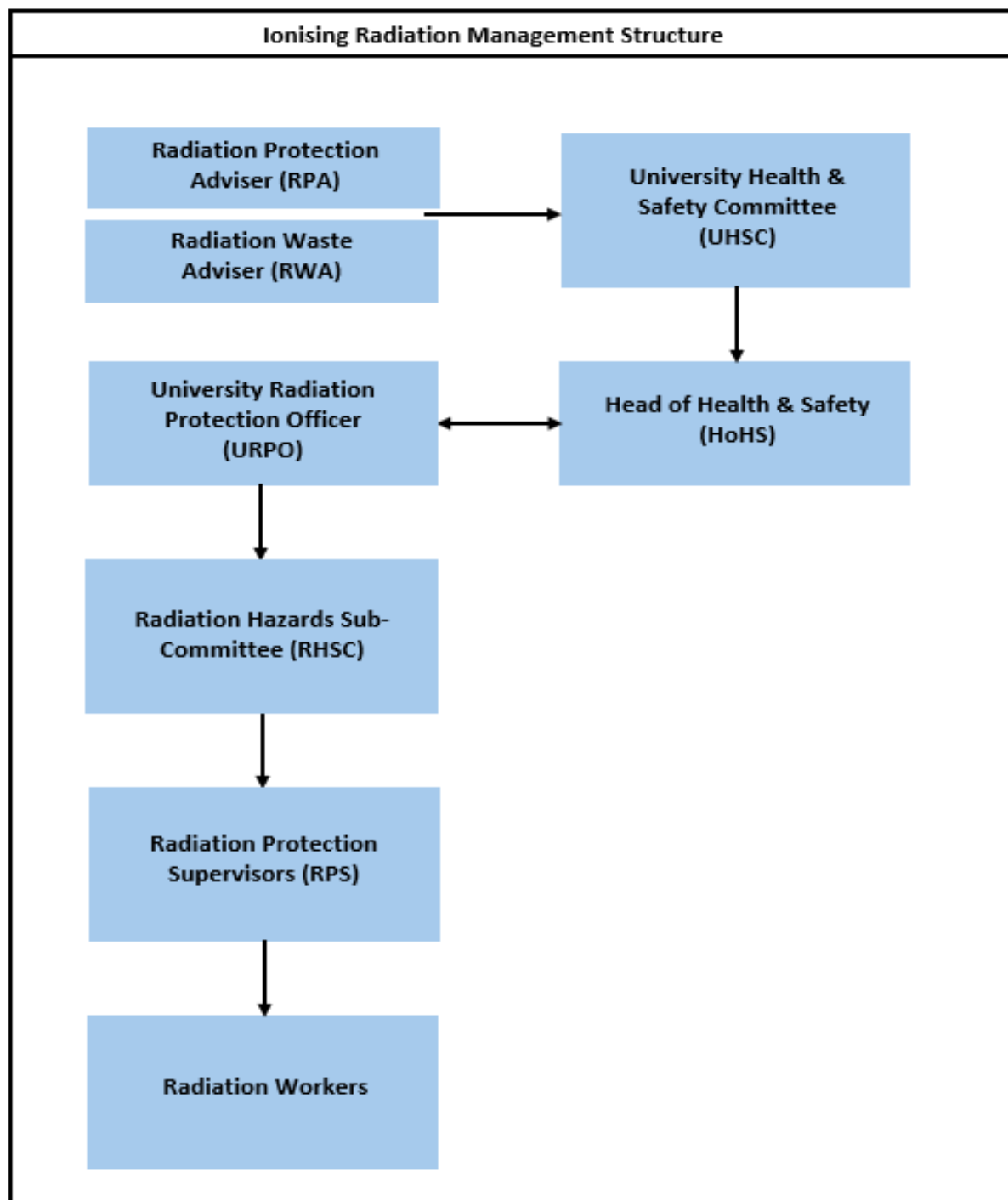
Under the Regulations employers must undertake a risk assessment before they start any new activity involving ionising radiation.

There are a number of Regulations controlling radioactive waste. ***The Environmental Permitting Regulations 2016*** as amended remain in place and are enforced by the Environment Agency. The Environment Agencies also enforce most of the provisions in ***the High Activity Sealed Radioactive Sources and Orphan Sources Regulations 2005*** with the exception of high activity sealed radioactive sources that are kept, used, accumulated and disposed of on nuclear licensed sites, where the HSE is the regulatory authority for Great Britain.

***The Ionising Radiation (Medical Exposure) Regulations 2017*** (as amended) relate to radiation employers undertaking diagnostic medical exposures and are primarily designed to protect patients but also cover workers.

*The Justification of Practices Involving Ionising Radiation Regulations 2004* lay down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation, and they are the responsibility of the Department of Environment, Food and Rural Affairs.

### 3. GOVERNANCE STRUCTURE



## 4. ROLES AND RESPONSIBILITIES

### 4.1 Radiation Protection Adviser (RPA)

IRR Regulation 14(1) requires the University to appoint an RPA. The role of the RPA is to provide advice on the observance of the Regulations and on other health and safety matters in connection with ionising radiations. The University has appointed Radman Associates.

### 4.2 Radiation Waste Adviser (RWA)

The EPR require the appointment of an RWA. The role of the RWA is to provide advice on compliance with the Permit conditions issued under the EPR. The University has appointed Radman Associates.

### 4.3 University Radiation Protection Officer (URPO) (see also Appendix 1)

The URPO is appointed by the Council on the recommendation of the Safety Committee and is responsible to the Head of Health and Safety for all aspects of the safe use of ionising radiations within the University. No work involving ionising radiations may be carried out unless it has been authorised directly by the URPO or indirectly through a Radiation Supervisor (RPS). The URPO is an *ex-officio* member of the Safety Committee, and reports to the committee on all radiation matters.

### 4.4 Radiation Protection Supervisors (RPSs) (see also Appendix 2)

Under the Ionizing Radiation Regulations 2017 there is a requirement for Radiation Protection Supervisors to be appointed to control and supervise work with the ionizing radiation. The Head of School or Director of Research Institute in which work with ionizing radiation is undertaken must ensure, in consultation with the URPO or Head of DOHS, that one or more suitable Radiation Protection Supervisors (RPS) are appointed. Each RPS will have a designated area of responsibility within their School or Research Institute. The RPS shall be an *ex-officio* member of the School Safety Committee and of the Radiation Hazards Sub-Committee.

### 4.5 Radiation Workers

All persons who work with sources of ionising radiation must complete a registration form (obtainable from the RPS) before starting radiation work for the first time.

If the nature of the work being carried out changes from what is registered, the registered user must notify the change to their registering RPS and have the change noted.

The RPS forwards the form to the URPO and the radiation sub-committee. When the registration has been granted, the RPS will be notified of the approval and the user's name will be added to an approved user list. Work cannot commence until the worker receives confirmation of registration from the URPO.

The radiation worker must be familiar with the IRR, ACOP and Guidance, and with this Keele SOP, and must sign an agreement on the registration form to observe the SOP and any special

instructions given by the RPS. New radiation workers must complete the Radiation Protection Awareness training course located on Leaning Pool before commencing radiation work. Every three years after first registration all registered radiation workers will be required to attend the Radiation Protection Awareness course again as refresher training.

Those radiation workers needing to use a controlled area (see section 3A) will be asked for further information about their procedures and will be assigned a maximum time that they can spend in such areas. Any worker who is thought likely to receive a dose equivalent more than the dose limit of 6 mSv/year will be classified (IRR Regulation 20). However, since it is the University's policy to keep dose equivalents below 1 mSv/year, classification will only be considered in exceptional circumstances.

All radiation workers have a legal obligation to reduce the exposure of all persons to a point which is as low as reasonably practicable. (ALARP)

All persons working with radiation must notify (in writing) their RPS immediately if they learn that they are pregnant or if they are breast-feeding.

Those persons wishing to work outside of Keele University may need to have an individual examination by an appointed doctor before commencing such work. If this is considered necessary, the Head of Health & Safety should be consulted.

***Courses of action to be taken by radiation workers who are unhappy about an aspect of radiation safety.***

*It will normally be possible to resolve problems relating to the use of ionising radiations by discussion with the RPS. If, however, this does not prove possible then the following lines of action should be taken (in the order given).*

- (i) Consult the URPO or Head of Health & Safety*
- (ii) Have the problem discussed at a meeting of the School Safety Committee through your Health & Safety Local Officer (HASLO)*

**4.6 University Health and Safety Committee (UHSC)**

The HSSC, which meets three times a year, is responsible (amongst other matters) for advising the University Executive Committee (UEC) and Council on all matters relating to the safe use of ionising radiations. The Radiation Hazards Sub-Committee (RHSC) reports to HSSC.

**4.7 Radiation Hazards Sub-Committee (RHSC)**

The RHSC meets twice a year. It is responsible for giving detailed advice to the Safety Committee on all matters relating to ionising radiations; its membership consists of the URPO (Chairman), all RPSs, the Head of Health & Safety. Matters arising will also be considered by the RPA's who will be invited to the RHSC.

## 5. APPARATUS AND MATERIALS

### 5.1 X-ray Machines, Sealed Radioactive Sources, Small Neutron Generators (see below), Electron Microscopes and other high voltage apparatus operating at more than 5,000 volts.

Permission to acquire these items and to use them in the University must be obtained from the RPS, the URPO and the Head of School and at least 28 days prior notification must be given to the HSE.

A sealed source is one in which the radioactive material is permanently sealed either into or onto a container, such that under normal circumstances no leakage can take place.

Sealed sources are to be inventoried and documented to easily reflect their Category Status as per the permits provided by the Environment Agency.

Radioactive powders, liquids, or gases in fragile containers, or in capsules with thin windows are not counted as sealed sources and may not be used except in a radiochemical laboratory.

A small neutron generator is one producing not more than  $10^7$  neutrons per second uniformly distributed throughout the whole  $4\pi$  solid angle around the source.

### 5.2 Neutron Generators either producing more than $10^7$ neutron/sec or producing neutrons in a beam of less than 1 radian solid angle.

Written approval for the use of these items must be obtained from the URPO, and the Radiation Hazards Sub-Committee must be informed.

### 5.3 Research with Radionuclides

Permission to carry out such research must be obtained from the RPS and the URPO who will seek specialist advice (e.g. from Public Health England (PHE) and the RPA in cases of doubt. Research with radioactive materials must not be carried out by unaccompanied workers or outside normal laboratory hours unless the RPS has given specific written approval for the work.

The amount and nature of the radionuclides which the University is authorised to hold is defined in the Registration Certificate issued by the Environment Agency. A new Registration Certificate may be necessary if radionuclides are used in larger quantities.

The RPS must authorise the purchase of each batch of radionuclides and be informed of its arrival. The URPO will seek information concerning the amounts of radioactive materials used and stored, from each RPS at regular intervals, to ensure that the conditions of the University's registration are being met.

## 5.4 Unsealed Radioactive sources for use in undergraduate laboratories.

All undergraduate experiments involving ionising radiations require prior approval from the RPS. Undergraduate experiments involving unsealed sources also require prior approval of the URPO or Head of Health & Safety unless no more than 100 kBq of H-3 or C-14 are used. In general, experiments involving not more than 1 MBq per week of H-3, C-14, I-125 or P-32 will be approved immediately if the URPO or Head of Health & Safety is satisfied that appropriate laboratories and supervision are available, that the radionuclide is in a form that does not constitute a special hazard and that the procedures are sufficiently standard. The URPO will report to the RHSC each year on the experiments so approved.

For experiments involving non-standard procedures or radionuclides other than those listed above, or activities greater than 1 MBq per week the URPS may need to seek specialist RPA advice. The RHSC must be informed in advance of the experiment being adopted. In such cases notification of the intention to introduce the experiment must be given to the URPO by the end of the second term in the year preceding the one in which the experiment is to be introduced.

## 6. LABORATORIES

### 6.1 Classification of Laboratories

All laboratories in which sources of ionising radiations are stored and/or used must be designated based on the relevant dose which a radiation worker is likely to receive if they spent the whole working year in that area. The decision on which category is appropriate is based on the provisions of IRR Reg 17.

CATEGORY	effective dose mSv per year
Controlled	> 6
Supervised	< 6, > 1
Registered	< 1

Access to both controlled and supervised areas must be limited. In the case of supervised areas, the RPS will decide who may enter the area. In the case of controlled areas access will be restricted to named persons entering the area for specified periods of time (usually less than 50 hours per annum). A record must be kept of the time spent in a controlled area and this will be kept on the radiation record of the radiation worker. The RPA will be consulted to decide who may enter the controlled area and will draw up systems of work for such persons.

Currently there are no permanent controlled areas within the University. The Anatomy Suite in the David Weatherall Building will on occasions adopt a controlled area or supervised area depending upon the activity.

## **6.2 Monitoring of Laboratories**

Any laboratory in which sources of ionising radiation are regularly stored or used must be regularly monitored for contamination and stray X-radiation (as appropriate) according to a monitoring scheme approved by the RPA. A written record of this monitoring must be kept and regularly submitted to the RHSC online records. (IRR Regulation 20).

## **6.3 Radioactive Materials (Storage)**

Radioactive Materials (including waste) must be kept in a suitable receptacle and only be stored in authorised locations. Such material must have a label indicating the radionuclide, its activity, chemical form, and any other hazards. (IRR Regulation 30).

## **6.4 Radioactive Waste**

Radioactive Waste must be stored as directed by the RPS and shall not be disposed of by anyone except the RPS or a competent person authorised to dispose of it. It must be appropriately labelled. It shall be disposed of in accordance with agreed disposal schemes. The URPO or Head of Health & Safety will ensure that the terms of the University's Disposal Certificate are being met by seeking disposal information at regular intervals from the RPS.

## **6.5 Laboratory Equipment and Methods**

All Schools in which sources of ionising radiation are used must produce general local rules which are included in the school safety handbook. In addition, special local rules must be provided to cover all experimental procedures. All experimental work must be carried out in accordance with agreed local rules.

Three rules of general applicability are:

- (i) under no circumstances should radioactive liquids be boiled, violently agitated, sonicated, or have gas bubbled through them in open vessels in the laboratory.
- (ii) when wearing protective gloves care must be taken not to risk transfer of activity to door handles, taps, light switches, apparatus etc. If apparatus must be handled when wearing rubber gloves, this must always be done with a paper towel. Damaged gloves must be discarded and treated as radioactive waste if necessary. Never leave the laboratory wearing these gloves.
- (iii) any transfer of radioactive materials from one laboratory to another must be carried out in a proper transfer vessel.

**6.6 Instructions on the following topics must be displayed prominently inside all laboratories where radioactive sources are used.**

- (i) The Emergency Procedure as specified in the Local Rules
- (ii) The general rules in 3E above and all Local Rules relating to procedures carried out in the laboratory.

**6.7 Labelling of Laboratories**

All supervised and controlled areas must be labelled on the door with:

- (i) the status of the laboratory.
- (ii) a list of the radionuclides and approximate activities inside the laboratory.
- (iii) a list of persons permitted to enter the area.
- (iv) any conditions relating to access.
- (v) who to contact in an emergency.

**6.8 Cleaning and maintenance of laboratories**

The cleaning and maintenance of laboratories in which radioactive sources are used must not be arranged without the prior approval of the RPS (or a competent person who has been authorised by the RPS), who must monitor the room and ensure that it is safe for the University's cleaners, maintenance staff or service engineers to work in it.

**7. DOCUMENT CONTROL INFORMATION**

<b>Document Name</b>	Ionising Radiation Code of Practice
<b>Owner</b>	Head of Health and Safety, Legal, Governance & Compliance
<b>Version Number</b>	1.1
<b>Approval Date</b>	23 July 2024
<b>Approved By</b>	University Executive Committee (UEC)
<b>Date of Commencement</b>	25 July 2024
<b>Date of Last Review</b>	05 March 2025
<b>Date for Next Review</b>	05 March 2028
<b>Related University Policy Documents</b>	Health and Safety Policy
<i>For Office Use – Keywords</i>	

## APPENDIX 1

### **The University Radiation Protection Officer (URPO) and Head of Health & Safety are responsible for:**

- i. authorizing work with neutron generators and with radionuclides.
- ii. stopping work with ionising radiation within any work area in the University when this work is not in accord with the Ionising Radiation Regulations 2017 or with the University Regulations.
- iii. ensuring that members of the University receive advice on any aspect of the safe use of ionising radiation.
- iv. ensuring that the terms of the EPR Permits are met and obtaining, when necessary, revised Permits.
- v. arranging for the storage of dose records in the RHSC archive.
- vi. keeping a central register of all equipment involving ionising radiation and of all radioactive material and requesting information at appropriate intervals from each RPS in connection with equipment and material acquired or disposed of.
- vii. circulating to the RPS information concerning radiation matters received from outside sources.
- viii. ensuring that work area emergency procedures and special regulations concerning radiation are available to the RPS in other work areas.
- ix. organising with the RPA at appropriate intervals a tour, by the Radiation Hazards Sub-Committee, of all work areas containing radiation work.
- x. notifying the Fire Service annually of the location of all radioactive materials.
- xi. notifying all appropriate external organisations (e.g., Public Health England, the Environment Agency and the Health and Safety Executive) in the event of any accident.
- xii. assisting in dealing with any radiation emergency in any work area in conjunction with the RPA.
- xiii. arranging with the PHE, EA, or other appropriate body for any special radioactive disposal and for the checking of monitors and other equipment when appropriate.
- xiv. authorising, with the appropriate RPS, undergraduate work involving unsealed sources (other than experiments involving no more than 100 kBq of H-3 or C-14) following advice from the RPA.
- xv. organising inspections by the Environment Agency and by the Health & Safety Executive and police when required to do so.
- xvi. attending meetings of the University Health and Safety Committee and presenting a report at every third meeting.
- xvii. acting as Chairperson of the Radiation Hazards Sub-Committee.
- xviii. making revisions of the University Regulations for the use of Ionising Radiations when appropriate.
- xix. arranging that there is an adequately trained person who can act as deputy during any extended absence from the University.
- xx. arranging annual training courses for new radiation workers and other courses throughout the year as deemed necessary.
- xxi. Liaising with the RPA as necessary to ensure legal compliance.

## APPENDIX 2

### The Radiation Protection Supervisor (RPS) is responsible for:

- i. authorising all work involving ionising radiation.
- ii. obtaining advice for radiation workers on any aspect of the safe use of ionising radiation.
- iii. stopping any ionising radiation work which is not in accord with the Ionising Radiation Regulations 2017.
- iv. reporting on radiation safety matters to the School's Safety Committee.
- v. deciding which experiments with unsealed sources contain more than a minimal hazard and arranging that such experiments are not carried out.
  - *outside* normal working hours unless the RPS or a deputy who knows the emergency procedure is present in the building.
  - *during* normal working hours unless the RPS or a deputy who knows the emergency procedure can be contacted at any time.
- vi. notifying the URPO when the upgrading of certificates seems necessary.
- vii. keeping a complete record (including amount and date) of all radioactive material acquired and disposed of.
- viii. providing the URPO and Head of Health & Safety with information about equipment and material acquired and disposed of when requested and notifying the URPO when a substantially larger amount of radioactive material than usual is about to be acquired or disposed of.
- ix. providing the URPO and Head of Health & Safety with a list of emergency procedures and special regulations concerning radiation.
- x. taking part at the appropriate interval in a tour of all Schools or Research Institutes containing radiation work.
- xi. arranging appropriate medical tests for all personnel involved in work with ionising radiation.
- xii. issuing and arranging inspection of film badges or other personal radiation monitors where appropriate and keeping a permanent record of radiation exposure of all workers including off site placements.
- xiii. arranging suitable instruction for all persons working with ionising radiation.
- xiv. obtaining, in the event of an accident, medical assistance, notifying the URPO and Head of Health & Safety and decontamination the radiation user and the laboratory involved in the accident.
- xv. assisting in dealing with any radiation emergency in the University.
- xvi. authorising, with the URPO and Head of Health & Safety, all undergraduate work.
- xvii. disposing of all radioactive material and ensuring that non-contaminated isotope containers are defaced prior to their disposal as conventional laboratory waste.
- xviii. carrying out regular monitoring and where necessary decontaminating laboratories and ensuring that monitoring equipment is adequate, annually tested and in good working order.
- xix. arranging with the agreement of the Head of School and the URPO and Head of Health & Safety, that there is an adequately trained person who can act as deputy during any extended absence from the University.
- xx. providing material for dealing with spillage and decontamination events.