

# **University of Liverpool**

# **Radiation Protection Office**

# LR1

Part 1: GENERAL LOCAL RULES

# FOR WORK WITH IONISING RADIATIONS

# Revised: June 2025

April 2010	Change reference from RSA93 to EPR2010
Sant 2010	Addition of '50% Rule' – page 6 and 10
Sept 2010	Change reference to 'Registration Certificates' and 'Authorisation Certificates' to 'Permits'
	Addition of the 'Two Year Rule' – page 7
0+2010	Addition of 'Gaseous' waste – page 10
000 2010	Change of guideline maximum solid values in 'Limits' – page 11
	Remove reference to HASS Regulations 2005 – page 3
hune 2012	Removal of references to "Aintree Site"
June 2012	Transport and Contamination monitoring of waste bins – page 12
Sept 2012	Adjusted bin limits on page 11
Feb 2014	Amendments to solid waste disposal section (inclusion of decay store details)– page 11 Amendments to RPO staff contact details – pages 4 and 14 Note that LSTM has its own Permit
April 2015	Addition of RWA appointment – page 5 Staff changes – page 14 Miscellaneous updates
November	Review following introduction of IRR17 and EPR16
2018	Major review of all sections
Feb 2024	New bin collection policy/procedure following EA inspection Removal of RLUBHT permit information Miscellaneous updates
June 2025	Miscellaneous updates

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## 1. LEGISLATION

These Local Rules have been prepared on behalf of the Vice-Chancellor by the University Radiation Protection Adviser (RPA) and state the requirements for compliance with the necessary Legislation. In particular these are:-

## Health and Safety at Work etc. Act 1974

- Section 2(2), regarding general duties of employers
- Section 7, regarding the general duties of employees to take responsibility for their own actions and to co-operate with their employer
- Sections 36(1) and 37, regarding offences due to the fault of other persons or corporate bodies (i.e. Academic Units, Faculties, Senate and Council)
- The Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Order 2001, regarding work on behalf of the employer but outside Great Britain

## Ionising Radiations Regulations 2017 (IRR17)

- Regulation 8, regarding the making of risk assessments prior to the undertaking of work with radioactive materials and ionising radiation;
- Regulation 9, which requires all exposures to be restricted to levels that are as low as reasonably practicable (ALARP);
- Regulation 18, regarding the preparation of local rules and appointment of Radiation Protection Supervisors (RPSs) (www.hse.gov.uk/pubns/irp6.pdf);
- Regulations 28, 29 and 30, which make provision for the management, control and accountancy of radioactive materials;
- Regulation 32, regarding consultation with the RPA and other Qualified Experts when designing new facilities (or undertaking refurbishment work), making proper 'design assessments' and after completion undertaking critical examinations;
- Schedule 4, which requires the 'radiation employer' (both the Vice Chancellor and Heads of the Academic Units) to consult the appointed RPA on matters of radiological protection such as the designation and on-going monitoring of radiation work areas, the refurbishment and construction of radiation facilities, the prior inspection of plans, the use and maintenance of radiation safety features and radiation safety management.

## The Justification of Practices Involving Ionising Radiation Regulations 2004

The 'Justification' regulations, derived from Article 6 of the EURATOM Basic Safety Standards Directive, require all practices using ionising radiation to be justified, and the justification to be approved by the Competent Authority, i.e. the Health and Safety Executive (<u>http://www.legislation.gov.uk/uksi/2004/1769/contents/made</u>).

## **Environmental Permitting Regulations 2016 (EPR2016)**

Schedule 23 requires the University to ensure work is carried out in accordance with conditions made in the University's Permits for the keeping and use of radioactive materials and the accumulation and disposal of radioactive waste. It also enacts the requirement laid down in the EURATOM Basic Safety Standards Directive for the 'Radiation User', (i.e. the Vice Chancellor), to consult a Qualified Expert (i.e. the RPA/RWA) on the application of Best Available Techniques (BAT) for the protection of the environment and 'populations' (e.g. members of the public). (http://www.legislation.gov.uk/uksi/2016/1154/contents/made)

## **Requirements covering High Activity Sealed Sources (HASS)**

Implemented by EPR2016 this regulatory regime ensures the security of High Activity Sealed Sources on civil, nonnuclear sites. This will apply to both HASS and other sealed sources which are a similar level of potential security hazard. It also introduces a requirement for assuming control of orphaned sources that may arise during audit.

## Nuclear Safeguards (EU Exit) Regulations 2019

This legislation is intended to prevent the proliferation of nuclear weapons. It requires the University to submit monthly and annual reports of its nuclear materials inventory (including all uranium, thorium and plutonium compounds) to the Office for Nuclear Regulation. All nuclear materials are subject to this legislation and usage,

disposal and holdings must be reported to the Radiation Protection Office on a monthly basis. There are no exceptions for small quantities.

## Nuclear Safeguards Act 2000 (NSA2000) and Nuclear Safeguards (Notifications) Regulations 2004

Section 3 and the 'Additional Protocol' to the Act require the University to make annual returns to the International Atomic Energy Agency on all activities related to the nuclear fuel cycle, including appropriate details of members of research groups engaged in such work: <u>https://www.legislation.gov.uk/ukpga/2000/5/contents</u>

## Non-statutory Guidance

The University Health and Safety Committee has endorsed the guiding principles contained within the Association of University Radiation Protection Officers Guidance Note (good practice guide), 'Working with Ionising Radiations in Research and Teaching' (December 2010).

# 2. HEALTH AND SAFETY EXECUTIVE / ENVIRONMENT AGENCY

## HSE Notification, Registration and Consent

In accordance with IRR17 Regulations 5, 6 and 7, the University has informed the Health and Safety Executive that it uses sources of ionising radiations in the pursuit of research and teaching. Certain practices are subject to Registration with the HSE and certain practices require HSE 'Consent'.

Work with sources of ionising radiations in the University has been justified by the competent authority under the provisions of the 'Justification' regulations. However, workers who intend to use novel applications of radioisotopes, electrical equipment that generates ionising radiation, particle accelerators, or who are involved with projects related to the nuclear fuel cycle, or which may have a nuclear weapons application, must consult the RPA at the beginning of the planning stage.

## **Responsibility for Compliance**

The employer is responsible for compliance with statutory requirements laid down in legislation; in the University the Vice Chancellor is the employer. In practice the employer is guided by the University Health and Safety Governance Committee, established by the University Council, and the RPA.

Compliance with the Regulations is secured through the Heads of the Academic Units, or equivalent, and with the assistance of departmental Radiation Protection Supervisors appointed under Regulation 18 of the IRR17.

In accordance with the requirements of Regulation 16 of the IRR17, through the RPA the University co-operates with other employers such as the local Health Trusts and external contractors where necessary and as appropriate.

## **Environment Agency Permits**

The University holds Permits issued by the Environment Agency to 'keep and use' radioactive material within Academic Units on the main Campus and at Leahurst Campus. The Liverpool School of Tropical Medicine (LSTM) is no longer covered by the University's Campus Permit, but has its own separate Permit containing its own individual limits.

The Permits also cover the 'accumulation and disposal' of radioactive wastes from Academic Units on the main Campus, at Leahurst and within LSTM.

## 3. UNIVERSITY RADIATION PROTECTION ADVISER/RADIOACTIVE WASTE ADVISER

The University of Liverpool has appointed Radiation Protection Advisers (RPA) and Radioactive Waste Advisers (RWA) as named in Section 12.

The duties of the RPA are to advise on compliance with the relevant Regulations and on other Health and Safety matters in connection with ionising radiation.

The duties of the RWA are to advise on compliance with conditions of the Environment Agency Permits to accumulate and dispose of radioactive waste.

## 4. THE UNIVERSITY REGULATIONS AND LOCAL RULES

No persons shall undertake work in the University with material or equipment which produces significant amounts of ionising radiation or non-ionising radiation except with the approval of the Head of the Academic Unit concerned. Any person who undertakes such work, or who may for other reasons be exposed to ionising or non-ionising radiation in the University, must co-operate and participate in the application of any scheme of monitoring or testing which the RPA (as Head of the Radiation Protection Office) may require, and must attend such course of instruction as the Head of the Academic Unit and RPA may require.

'Part 1: General Local Rules' contain the generalised local rules that apply to all radiation users irrespective of their field of activity.

**'Part 2: Contingency Plans'** contain the procedures to be followed in the event of an incident involving radioactive material or equipment generating ionising radiation.

**'Part 3: Departmental Local Rules'** should be prepared by Academic Units outlining localised management controls such as procedures for purchasing unsealed radioactive materials, waste disposal arrangements and rules to safeguard the health and safety of persons engaged in any work with ionising radiation.

## 5. DESIGNATION OF RADIATION AREAS

Visitors must be accompanied by a radiation worker into a designated area.

Cleaners must have clear, written instructions from the RPS when entering a laboratory in which there is a radiation area.

Maintenance work on designated sinks may only be carried out after a permit to work has been issued by the RPS.

## **Controlled Radiation Area**

Work utilising certain quantities of unsealed sources, or work with equipment which generates ionising radiation, may require an area to be designated a Controlled Radiation Area. A fume cupboard or similar enclosure in which access is limited to hands only may suffice as a Controlled Radiation Area. The use or storage of certain sealed radioactive sources may also require a Controlled Radiation Area to be designated.

## **Supervised Radiation Area**

An area (which may or may not contain a Controlled Radiation Area) in which access is limited to registered radiation workers only is designated as a Supervised Radiation Area. Non-radiation workers are usually excluded.

In certain situations, in a laboratory within which part is set aside for low-level radiation work, non-radiation workers are permitted to use other facilities within the laboratory and the part in which radiation work is done must be clearly indicated or demarcated.

## 6. GENERAL RULES

## **Radiation Dose Investigation Level**

The whole body radiation dose limit for the majority of workers is 20 mSv per calendar year. It is reasonably practicable for work to be carried out at the University without the need to incur exposures anywhere near this limit. Therefore, under the ALARP (as low as reasonably practicable) principle, the University has a whole body Dose Investigation Level of **2 mSv per calendar year**. This Dose Investigation Level is less than the average annual dose due to background radiation received by all members of the public in the United Kingdom. The extremity dose investigation level is **50 mSv per calendar year**.

All work must be optimised and planned so that a user does not exceed the Dose Investigation Levels; risk assessments must show this. If any worker, in a calendar year, exceeds these levels then an investigation must be conducted in association with the RPA.

## Best Available Techniques (BAT)

There is a requirement in the Permits issued by the Environment Agency to the University for the user to demonstrate that they employ BAT to "so far as is reasonably practicable minimise the amount of radioactive waste which arises from the keeping and use of each registered substance". Essentially, there is a requirement for all users to take all reasonably practicable measures in the design and operational management of their facilities to

minimise the volume and activity of discharges and disposals of radioactive waste, so as to achieve a high standard of protection for the public and the environment.

BAT is applied to such aspects as minimising waste creation, abating discharges and monitoring plant, discharges and the environment. It takes account of such factors as the availability and cost of relevant measures, operator safety and the benefits of reduced discharges and disposals. If the operator is using BAT, radiation risks to the public and the environment will be 'As Low As Reasonably Achievable' (ALARA).

The Vice Chancellor and Heads of the Academic Units are responsible for ensuring that radiation workers comply with University procedures for **Best Available Techniques (BAT).** A BAT assessment form is available from the Radiation Protection Office's website and should be completed for each new experiment or new use of radioactive materials, or if there are significant changes to an existing one.

## Purchase/acquisition of radioactive sources

## (i) Unsealed (Open) Sources

Heads of the Academic Units are responsible for ensuring rigorous procedures are in place to control the purchase of unsealed radioactive materials. These procedures must be documented in **Part 3: Departmental Local Rules**. Suitable procedures will ensure that:

- all orders (purchases and acquisitions) are approved in advance by the RPS, who should sign to confirm that a valid BAT document has been completed for their use and that approval has been given;
- all orders are received at a 'goods inwards' point / stores / designated office(r), where they must be held under secure conditions until collected by an authorised person (a signature will be required for release);
- stock record keeping forms are issued / created for all sources immediately on collection;
- once collected from stores (etc.), sources are transferred to secure areas, where they must be held until they have been disposed of.

#### (ii) 50% Rule

In order to avoid potential breaches of the limits contained in the University's permits, the Departmental RPS must give prior notification to the Radiation Protection Office if there are plans to increase the amount of stock their department usually orders by more than 50%.

## (iii) Sealed (Closed) Sources

Prior to the purchase or acquisition of sealed (closed) radioactive sources, the Head of the Academic Unit must determine the working life of the source, identify a disposal route for the source and earmark funding for ultimate disposal. Disposal costs can be very significant and this must be considered in advance of purchasing the source. A justification case must be prepared, in advance, for each and every purchase or acquisition of a sealed radioactive source and the purchase or acquisition must be approved by the Departmental RPS. The RPO must be consulted for approval well in advance of any proposed purchase or acquisition by completion of the 'Sealed Source Acquisition Form'. Sealed sources should normally be delivered to the Radiation Protection Office for allocation of serial numbers and wipe testing.

## **Management of Sealed Radioactive Sources**

When not being used, sealed radioactive sources must be stored in a lockable, fireproof source store marked with appropriate hazard warning labels. Sources must be accounted for on a regular basis (at least monthly intervals) and also when moved: accountancy records must be kept in order to demonstrate compliance. An online database records all sealed sources and can be used to check sources in and out during use. It is the responsibility of the user to do this, and of the Head of the Academic Unit to ensure that this is done.

## **Management of Unsealed Radioactive Sources**

It is the responsibility of Radiation Protection Supervisors (and the Head of the Academic Unit) to ensure that all stocks of unsealed radioactive materials, and any radioactive waste produced, are accounted for on a monthly basis. Records of stocks and usage must be reported (using the RP2A form) to the **University Radiation Protection Office** within one week of each month end. Where nuclear materials are used, the separate RP2N form must also be completed and returned on a monthly basis, showing the department's complete nuclear material inventory at the end of the month.

It is the responsibility of the user (and Head of the Academic Unit) to ensure that the use of radioactive materials and generation of radioactive waste is recorded 'as it happens' in laboratory log books / record sheets that have been specially created for that purpose.

Unsealed radioactive sources must be held in a suitably labelled and lockable store (fridge, freezer or cupboard), or in a store inside a locked room. Sources must be accounted for on a regular basis, and written records made each time activity is dispensed from a source and when activity is disposed of. Local protocols should provide detailed instruction.

## Risk Assessment / Preparation for new procedure or level of use

Radiation workers must, in consultation with their RPS, prepare a written prior risk assessment for the type of radiation work they are undertaking. Work must be planned and carried out in such a manner that doses are ALARP and the Dose Investigation Levels are not exceeded.

Prior to commencing a new procedure or significantly altering the quantity of radioisotope to be used there **must** be advance consultation with the RPA and the RPS in order that an assessment of the requirements for handling and waste disposal may be made. Work found being performed in contravention of this requirement **will** be terminated until such assessment has been made. A BAT assessment must also be completed in advance.

## Two Year Rule

The 'Two Year' Rule aims to eliminate the accumulation of unused or unwanted radioactive materials at The University of Liverpool.

The RPS must regularly (e.g. monthly) review source usage logs and source inventory lists with a view to identifying any source that has not been used for two years or more. If such a source is identified then either:

- (a) A business case must be drawn up by the RPS which justifies the continued retention of that source, and a copy of this case must be submitted to the Radiation Protection Office, or
- (b) The RPS, in consultation with the Radiation Protection Office, must make arrangements for that source to be disposed of forthwith.

The Radiation Protection Office will submit any business case for justified retention to the Environment Agency inspector for consideration and comment.

## **Hazard Avoidance**

Every individual working with ionising radiation has a primary responsibility to protect themselves and others from any hazards arising from their work. Radiation workers must not expose themselves or others to ionising radiation to a greater extent than is reasonably necessary for the purpose of undertaking the work.

In laboratories where radioactive materials are used there is a potential source of radioactive contamination. Therefore eating, drinking, smoking, application of cosmetics, licking of labels and use of mouth-operated apparatus are forbidden. Laboratory coats and other protective equipment must be used when appropriate and should not be taken outside the laboratory area (unless checked for contamination). They must never be taken into areas where food or drink is served or consumed.

The University will view with particular severity interference with safety devices or warning notices associated with radiation hazards. If safety devices have to be rendered inoperative or warning notices removed for maintenance or other purposes, effective measures, such as a Permit to Work system, must be taken to ensure that no person is inadvertently exposed to hazard as a consequence. The RPA must be consulted in advance.

## Work with radioactive material

- 1. The user shall work in accordance with the General Experimental Procedures detailed in Experimental Procedures below.
- 2. Work with radioactive materials must not take place outside normal working hours unless at least two people are present in the building and written permission has been obtained from the RPS.
- 3. On completion of an experiment (or at intervals not exceeding 1 month for ongoing experiments) using unsealed radioactive material, the user must check the experimental area and surroundings for contamination. The results of such contamination checks are to be recorded in the Contamination Log Book. The technique to be used is set out in section 8. It is the user's responsibility to decontaminate affected areas.

- 4. The minimum quantity of radioactivity compatible with the objectives of the experiment should be used. Work should be carried out carefully and tidily.
- 5. Disposal of radioactive waste may only be made via an authorised route. For details see sections 10 and 11 (Radioactive Waste). Records must be kept of the use of all radioactive materials including solid, liquid and gaseous waste disposals in the log book or on the record sheets retained for that purpose.
- 6. A laboratory coat, safety glasses or face shield and disposable gloves must be worn when handling radioactive materials. Disposable gloves should be discarded as radioactive waste into the labelled waste bin. Paper handkerchiefs should be provided for personal use and should be discarded into the radioactive waste bin. With regards to contaminated lab coats, an estimate should be made of the activity of which radioisotopes are present before they are placed in a suitably labelled plastic bag and disposed of in the solid radioactive waste bin.

## **Experimental Procedures**

- 7. Experimental work should be carried out over a lined, suitably labelled spill tray, in an area of the laboratory marked and set aside for the purpose.
- 8. Radioactive and non-radioactive work should be kept separate as far as possible.
- Consideration should be given to the provision of control measures in order that exposure of persons can be kept as low as is reasonably practicable before manipulating any articles containing or embodying radioactive material.
- 10. Hands should be washed and hands and clothing should be monitored (where possible) before leaving an active area, even for short absences.
- 11. Lab coats used for radioactive work must not be worn into any area where food or drink are stored, prepared or consumed. Ideally lab coats used for radioactive work should not be used for other work.
- 12. Eating, drinking, smoking and application of cosmetics is forbidden in a radiation area.
- 13. Cuts or breaks in the skin (particularly on hands and forearms) should be covered by waterproof plasters before commencing work in a radiation area.
- 14. Pipetting radioactive materials by mouth is strictly forbidden.
- 15. All containers of radioactive material should be clearly labelled, indicating the nuclide, total activity, compound, specific activity, and reference date so that the containers can be properly stored (locked source cupboard or fridge), handled or disposed of and are accessible only to registered radiation workers. The term "container" will apply to any item that contains radioactive material (this will include all items from stock bottles to Eppendorf vials). An exception to this may only be made for items which are not being retained but are for disposal immediately after counting, such as gel plates and scintillation vials.
- 16. When storing radioactive materials shielding sufficient to reduce accessible dose rates to less than 2.5  $\mu$ Sv/hr must be provided.
- 17. So far as is reasonably practicable, no unsealed radioactive substance or any article containing a radioactive substance should be held in the hand or directly manipulated by hand. Any article or material with a surface dose rate of 0.1 mSv/hr or greater must be manipulated with forceps or other remote handling equipment. If the dose rate is 0.5 mSv/hr or greater at the surface the article should be suitably shielded and locked away and the Departmental RPS should be informed as soon as possible.
- 18. Any material or articles used in decontamination procedures should not be used for any other purpose. When not in use for decontamination procedures such cleaning equipment should be labelled and stored in an area set aside for the purpose.
- 19. Any experimental equipment used with radioactive material must be labelled as such, and not used for any other type of work unless decontamination can be demonstrated.

## 7. PERSONAL MONITORING

It is the responsibility of radiation users to wear radiation dosemeters when issued. A Personal Radiation Monitoring Badge Policy is available from the Radiation Protection Office.

In general, persons who are exposed to more than 10 MBq of gamma emitting and high energy beta-emitting radioisotopes (energies greater than 0.3 MeV) in Supervised Areas will be required to wear whole body and wrist monitoring badges. Some workers will also be required to use finger dosimeters in the form of rings or finger stalls. Dosemeters must be exchanged and returned for read-out as specified by the RPO (usually at 2 monthly intervals).

Those working with sealed sources or with X-ray generating equipment should consult the RPO to assess personal monitoring requirements.

## 8. WORKPLACE MONITORING

Workplace monitoring is undertaken to confirm that radiation dose rates to which any person could be exposed are acceptable, and that there is no removable radioactive contamination. It is the responsibility of radiation users to monitor their immediate work environment in a systematic manner, using an appropriate monitor, i.e. before commencing work, during work, and on completion of their work. A record that monitoring has been carried out must be made and retained. Any radioactive contamination must be cleaned up immediately.

#### **Contamination Monitoring Methods**

#### Tritium (H3)

Swabs used with liquid scintillation counting are essential as tritium cannot be detected with hand-held monitoring equipment. A small swab of cotton wool held in a pair of forceps should be dampened in water or alcohol then wiped over the test area. It is recommended that an area of approximately 10cm x 10cm area is swabbed with each swab. The swab is dropped into a scintillation counting vial. The counting vial is then loaded with suitable scintillant and counted in a suitable scintillation counter. The results should be analysed to determine the activity of the swab. It is generally assumed that only 10% of available contamination is picked up by a swab. Thus, if the swab area is 10cm x 10cm, the result is divided by 10 to obtain the activity per unit area. Efficiency of the counter should also be considered although this may already be accounted for in the results obtained. The liquid scintillation counter should be calibrated using a 'standard sample' prepared by putting a known activity of H3 into a counting vial together with a blank swab and scintillant.

#### C14 and S35

Swabs may be used as described for H3.

Alternatively a radiation monitor with suitable Geiger-Muller tube may be used. A conversion table from counts/second to contamination level is supplied below. Malfunctions must be immediately reported to the RPS.

#### **Other Beta Emitters**

A radiation monitor with suitable Geiger-Muller tube may be used. A conversion table from counts/second to contamination level is supplied below. Malfunctions must be immediately reported to the RPS.

#### **I125 & Other Gamma Emitters**

A radiation monitor with suitable scintillation probe may be used. A conversion table from counts/second to contamination level is supplied below. Malfunctions must be immediately reported to the RPS.

All results of contamination monitoring (including where no contamination is found) must be noted in the log book set aside for the purpose. Decontamination is required for contamination greater than 30 Bq/cm<sup>2</sup> at any point inside spill trays and greater than 3 Bq/cm<sup>2</sup> in places other than spill trays (benches, floors, walls, sink and draining board, other surfaces) measured above background level. For decontamination procedures see document **Part 2: Contingency Plans** 

## **Portable Contamination Monitors**

## **Battery Check**

Before monitoring ensure that the battery has sufficient charge. On the meter there is a battery check indication, (either a red mark or a green band depending on the model of the monitor). Turn the switch to the first position ('batt check').

If the meter reading is below the mark or lower end of the green band then the battery needs replacing. If the meter reading is above the mark or lower end of the green band then leave on 'batt check' for a few seconds and watch the meter reading. If the reading slowly decreases there is insufficient charge for performing a contamination check and the batteries must be replaced.

## Annual calibration

All portable monitors must be subject to an annual functional test or calibration. Please contact the department RPS or the Radiation Protection Office to arrange for this.

## Monitoring

Having checked that the battery contains sufficient charge, turn the switch to the second position. The contamination calibrations for monitors in use around the University are shown in the tables below. Check that the monitor you are using is correct for the radiation to be detected.

The figures shown are approximate counts per second (c.s<sup>-1</sup>) meter reading for a contamination level of 3.7Bq cm<sup>-2</sup>.

Gamma Radiation - using scintillation monitor with 42A or 44A probe

PROBE TYPE		42A	44A
	Co-57	3	10
	Cr-51	1	2
	I-125	4	13

Beta Radiation - use end-window Geiger-Muller tube

PROBE TYPE		Type E	Type EP15
	C-14, S-35	3	9
	Rb-86	6	18
	P-32	5	15

## 9. PERSONNEL

## **Radiation Workers**

## Registration

All University personnel working with radioactive sources or X-rays are required to register with the University Radiation Protection Office before commencing work using the online registration database (see https://radpro.liverpool.ac.uk). The application will require approval first by the departmental RPS and then by a member of the RPO. The RPS must be consulted before commencing work with radioactive materials.

When users change their work protocol (change of radionuclide, increased or decreased activity, move of department, etc.), they must inform the Radiation Protection Office who will advise whether the user registration needs to be amended.

Each user must bear in mind that it is their duty to protect themselves and others from the hazards associated with radioactive sources and ionising radiation.

## Training

The University is required to provide, or make arrangements for the provision of, appropriate information, instruction and training for radiation workers, managers and supervisors, ancillary workers, etc.

Workers are required to attend whatever training course or practical training sessions are deemed appropriate by the Departmental RPS and the RPA, or to demonstrate to the RPA that they are competent to work. Refresher training must also be attended as appropriate.

A Basic Radiation Protection seminar is given twice a year by the RPA. More specific 'localised' training should be given by the Departmental RPS and/or the Laboratory Supervisor. This may be given as part of 'on the job training'.

RPS training courses are held at least annually on the main campus, for both new and current RPSs. All currently appointed RPSs must attend the course as a refresher every 5 years.

A Training Log must be maintained indicating the nature of training given to each worker. A template is available from the RPO website. The RPS should also ensure that training details are updated in the online worker database.

## **Contractors, Maintenance and Cleaning Staff**

Cleaners must have clear, written instructions from the RPS before entering a laboratory in which there is a radiation area.

The Maintenance Staff and Contractors must obtain written permission before working in any laboratory or on any service associated with a laboratory in which work is carried out with radioactive substances or ionising radiation. The University operates a permit-to-work system for this purpose and, before work is carried out, a permit must be completed by an authorised person in the department or service.

#### **Pregnant Radiation Workers**

A pregnant radiation worker should immediately notify their Radiation Protection Supervisor and the University's Occupational Health Service.

Work at the University is subject to a Dose Investigation Level which has been derived to secure the protection of the foetus/child where the expectant/breastfeeding mother is undertaking work of a 'normal' or routine nature. However, the RPS should review the nature of the work to ensure that expectant/breastfeeding persons are continuing to work in a safe manner, that suitable facilities for shielding external radiations and for minimising the consequences of a spillage remain available and in good condition. A risk assessment must be produced in conjunction with the RPA.

The pregnant worker is advised to read the HSE publication 'Working Safely with Ionising Radiation' (www.hse.gov.uk/pubns/indg334.pdf).

#### **Undergraduate Students**

Experimental work involving sources of ionising radiation that is undertaken by undergraduate students must be strictly limited and controlled. The laboratory instruction sheet for each experiment should include a description of the potential hazards and the precautions to be taken, and should form the written system of work for that experiment.

Undergraduate students must never be permitted to dispense radioactivity.

Further information may be found in the Guidance Notes for Use of Ionising Radiation in Undergraduate Teaching issued by Radiation Protection Office.

## 10. RADIOACTIVE WASTE (MAIN CAMPUS, LEAHURST and LSTM)

## **Permitted Disposal Limits**

The University's maximum disposal activity for each type of waste is shown in each permit. The permitted limits given for each disposal route are the maximum total disposal activity for all Academic Units covered by each permit (e.g. the whole main campus). They are **NOT** the permitted limit for each Academic Unit.

## 50% Rule

In order to avoid potential breaches of the limits contained in the University's permits, the departmental RPS must give prior notification to the Radiation Protection Office if there are plans to increase the amount of waste their department usually disposes of (by any route) by more than 50% of their departmental baseline (Ref: Baselines document available from the Radiation Protection Office).

#### Gaseous

Gaseous waste is generally not produced in any significant amounts. Nevertheless, for highly volatile radioactive materials, such as tritiated water or certain radio-iodine compounds, every effort must be made to estimate and record discharges via fume hood vents.

## **Aqueous Liquid**

Accumulation of aqueous waste is not permitted on the main University campus. Accumulation of certain aqueous waste is permitted at Leahurst and LSTM and the RWA can provide advice on this.

Aqueous liquid waste must only be disposed of down designated sinks which will be labelled with an appropriate warning sign. The tap should be turned on sufficient to give a gentle (i.e. non-splashing) flow of water. The aqueous waste may then be slowly poured into the flow, care being taken to avoid splashing which could contaminate areas surrounding the sink. The flow of water from the tap should be allowed to continue after the waste has been poured in order to flush the waste away. The date, isotope and activity must be recorded on the appropriate log sheet as soon as possible after making the disposal.

## **Non-Aqueous Liquid**

Non-aqueous liquid waste, usually organic scintillant contained in plastic scintillation counting vials, must not be disposed of via the drain; it must be disposed of by transfer to a specified incineration contractor. Bins of such waste will be collected from laboratories by the RPO for onward disposal from the central radioactive waste store.

Organic liquid waste may be accumulated in laboratories for a maximum of 3 months. It must be stored in a designated yellow 30 litre bin (issued by the Radiation Protection Office) in a designated area with a maximum of 40 MBq per bin.

If non-aqueous waste other than in scintillation counting vials requires disposal, the Radiation Protection Office must be informed in advance as the radioactive waste contractor will need to be consulted.

For each bin, an individual Waste Container Declaration Form must be completed giving details of its contents (details required are date, unique bin reference number, radioisotope, activity of each radioisotope on the date of completion of the form and the name and volume of each organic liquid contained in the bin). The outside surfaces of all bins must be checked for contamination using a suitable method and the results recorded on the declaration form.

As soon as a bin is sealed and ready for collection, a copy of the declaration form must be sent to the Radiation Protection Office so that collection can be arranged. Bins will not be collected without a correctly completed form. See also the section below 'Bin Collection from Labs by RPO'.

## Solid

## Very Low Level Solid Waste (VLLW)

Solid waste of activity less than 40kBq per item (or 400 kBq per item for waste containing tritium and/or carbon-14) may be disposed of in waste containers emptied by Local Authority contractors provided that the total activity does not exceed 400 kBq/0.1 m<sup>3</sup> (or 4 MBq in total for waste containing tritium and/or carbon-14). This is known as 'Very Low Level Waste' (VLLW). There must be no indication of radioactivity in this type of waste when it is disposed of – all warning labels, tape etc. showing the word 'radioactive' or the trefoil symbol must be removed or completely defaced.

## **Decay Storage of Short-Lived Radionuclides**

Solid waste containing short-lived radionuclides (having a half-life less than 30 days) may be stored for decay until the activity has fallen below the VLLW levels given above. Such waste must not be stored for longer than the periods shown in the following table:

Location	Radionuclide	Maximum storage period
Main campus / LSTM	All with half-life < 30 days	3 months
Leahurst	Technetium-99m	7 days
	All others with half-life < 30 days	3 months

## Solid waste containing beta/gamma-emitting radionuclides

Other solid waste, excluding waste containing alpha-emitting radionuclides, nuclear materials and sealed radioactive sources, may be accumulated in laboratories for up to 3 months in designated yellow 60 litre bins (issued by the Radiation Protection Office) for disposal. On disposal from the University the maximum activity per bin allowed is 40 MBq of beta/gamma-emitting radionuclides.

For each bin an individual Waste Container Declaration Form must be completed giving details of its contents (details required are date, unique bin reference number, radioisotope and activity of each radioisotope on the date of completion of the form). The outside surfaces of all bins must be checked for contamination using a suitable method and the results recorded on the declaration form.

As soon as a bin is sealed and ready for collection, a copy of the declaration form must be sent to the Radiation Protection Office so that collection can be arranged. Bins will not be collected without a correctly completed form. See also the section below 'Bin Collection from Labs by RPO'.

## All other solid waste

If solid waste other than above, including all waste nuclear materials (uranium, thorium or plutonium), waste sealed sources and alpha-emitting waste, is to be generated, the RPA must be consulted in advance. Such waste must be kept separate from other waste. The departmental RPS must be informed and will arrange collection by the Radiation Protection Office for disposal. This category of waste can only be disposed of via a specialist authorised disposal service contractor and there will be a charge for waste of this category. Charges can be very significant and this must be considered at the planning stages of all work.

## **Bin Collection from Laboratories by RPO**

Solid and organic liquid waste must only be stored in bins in laboratories for a maximum of three months. This is the maximum time allowed and bins should routinely be sent to RPO as soon as they are sealed and ready for collection.

The date that the first waste item is put into a bin must be recorded by the RPS and noted on the bin itself. Regardless of how much waste is in the bin, the RPS must seal the bin and request a collection from the RPO within 3 months of the date referred to above.

The declaration date on the Waste Container Declaration Form will be the point in time from which 'accumulation' of waste begins with reference to the University's radioactive waste permit conditions. The RPS must record this date on the form.

The RPO will collect the bin and transfer to the central waste store to await the next waste consignment for incineration.

# **11. TRANSPORT OF RADIOACTIVE MATERIALS**

Compliance with the statutory requirements for the transport of radioactive materials is extremely complex and beyond the scope of this document. All persons wishing to transport any radioactive material either to or from the University must discuss their requirements with the RPA sufficiently far in advance to allow time for arrangements to be made. A specialist courier service, packaging, labelling and paperwork is likely to be required and there will be a cost associated with this.

Waste that is transferred to the RPO must be packaged and labelled in accordance with regulations. Most waste packages will be treated as 'Excepted' or 'Exempt' packages, and must be accompanied by a consignment note. Any waste packages must be checked before collection for external contamination and declared to be clear before the waste can be collected.

# **12. RADIATION SAFETY CONTACTS**

## University Radiation Protection Advisers (RPA)

Oliver Lodge Laboratory	Phone e-mail:	0151 794 3467
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