Health and Safety Services

WELLBEING, SAFETY AND HEALTH

UNIVERSITY OF LEEDS

Management of sources of ionising radiation

Guidance

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- **Introduction – Ionising radiation**

  This guidance gives information on how to implement the Standard for the Management of Sources of Ionising Radiation and covers work with all types of ionising radiation at the University. The management of ionising radiation is covered by strict legislation where compliance is critical.

  Any questions contact the University Radiation Protection Manager (RPM), x34202 or radiation@leeds.ac.uk.

- **Definitions and acronyms for ionising radiation**
  - BAT – Best Available Techniques. The University's environmental permit for radioactive substances specifies that best available techniques are followed to minimise the activity used and to minimise the radiological effects of discharges on people and the environment.
  - HASS – High Activity Sealed Source.
  - Ionising radiation - radiation in the form of particles or electromagnetic waves that have sufficient energy to cause ionisation (produce ions) when they interact with matter. Sources of ionising radiation include radioactive material (both artificial and naturally occurring) and electrical equipment that emits radiation (e.g. x-ray machines).
  - Naturally occurring radioactive material (NORM) – radioactive material that is found naturally in the environment, e.g. uranium, thorium, radon, potassium-40, etc. Work with NORM is covered by this standard when its activity cannot be disregarded for the purposes of radiation protection, e.g. work with material that has levels of radioactivity higher than normally encountered in a working environment. Please contact the RPM for further advice on this.
  - Open (or unsealed) source - radioactive material that is not encapsulated in a manner to prevent it being dispersed, e.g. radioactive material in liquid, solid, powder, gaseous form, etc.
  - RPA – Radiation Protection Adviser
  - RWA – Radioactive Waste Adviser
  - RPM – University Radiation Protection Manager
  - RSC – Radiation Safety Coordinator, usually appointed at a faculty of school level.
  - RPS – Radiation Protection Supervisor, usually appointed at a research group level.
  - RSID – Radioactive Source Inventory Database. This is the University's online system used to control all work with open sources including user registration, training and authorisation; detailed stock and waste records; dose assessments and justification.
    RSID can be found at http://rsid.leeds.ac.uk.
  - Sealed source – a source whose structure is such as to prevent, under normal conditions of use, any dispersion of radioactive material, e.g. material that is encapsulated, laminated, electrodeposited, etc.
  - X-ray equipment – any equipment that is intended to produce x-rays, e.g. x-ray diffraction / fluoroscopy machines, CT scanners, etc.

Statutory notifications, permits and reporting

- **Statutory notifications**

  The University is required to make notifications to the regulatory authorities (HSE, Environment Agency, Office of Nuclear Regulation) regarding work with ionising radiation and if certain incidents occur.

  Notifications are made by Health and Safety Services.

  - The required notification that the University is carrying out work with ionising radiation has been made to the HSE and further notifications are not required unless the nature of work changes significantly.
  - Notifications of incidents will be made as necessary by the RPM – e.g. failure to comply with any of the limitations of a permit; unauthorised use, loss or damage of a source; enactment of emergency procedures during transport, etc.

- **Permits**

  The University is required to apply to the Environment Agency and obtain permits from them to keep and use radioactive material in the form of open and sealed sources and to dispose of radioactive waste.

  Applications are made by Health and Safety Services.

  The current permits for radiation work are as follows:

  - EPR/TB3698DC – permit that allows the University to use radioactive material in the form of open sources and to receive, accumulate and dispose of radioactive waste. The permit specifies the permitted activities, radionuclides, and disposal routes and specifies maximum activity limits for holdings of material and disposals.
  - AD7354/CB7557 – permit that allows the University to use radioactive material in the form of sealed sources. The permit specifies the permitted activities, radionuclides, and maximum activity limits for holdings of sources.
  - BK8036 – permit that allows the University to use 'mobile radioactive apparatus' in the form of certain specified sealed sources.

  Requirements of the Management Standard are to ensure that permit conditions are complied with.

  Any work planned with radioactive material that is not covered by the above permits will require an application to the Environment Agency for either a permit variation or a new permit. An application will have cost and time implications and it is therefore important to discuss any new work plans with the RPM as early as possible.

- **Statutory reporting**

  The University is required to send periodic reports to the regulatory authorities detailing releases of radioactive material into the environment and holdings of certain types of sources and nuclear materials.

  The RPM submits the periodic reports on behalf of the University as follows:

  - Annual Pollution Inventory report to the Environment Agency
  - HASS reports to the Environment Agency
  - Nuclear safeguards inventory reports (monthly and annual) to the European Commission (EURATOM).

  The requirements for detailed records of radioactive material and disposals are to enable compliance with the reporting requirements.

People

- **People - roles and training requirements**

  The following roles are required to be appointed at University, faculty, school, or group level:

  The list of current post holders can be found at: http://wsh.leeds.ac.uk/wsh/staffcontacts.

Radiation Protection Adviser (RPA)

The University has a statutory duty to appoint a qualified RPA to advise on legal compliance regarding ionising radiation.

The RPA is required to hold a certificate of competence to be an RPA issued by RPA2000 (an assessing body recognised by the HSE) and have suitable experience for an educational and research environment.

In particular the University has a legal obligation to consult an RPA regarding:

- The implementation of requirements as to controlled and supervised areas
- The prior examination of plans and the acceptance into service of new of modified sources of ionising radiation in relation to any engineering controls, design features, safety features and warning devices provided to restrict exposure to ionising radiation.
- The regular calibration of equipment provided for monitoring levels of ionising radiation and the regular checking that such equipment is serviceable and correctly used.
- The periodic examination and testing of engineering controls, design features, safety features and warning devices and regular checking of systems of work provided to restrict exposure to ionising radiation.

Radioactive Waste Adviser (RWA)

The University has a statutory duty to appoint a qualified RWA to advise on compliance with its permit for the disposal of waste.

The RWA is required to hold a certificate of competence to be an RWA issued by RPA2000 (an assessing body recognised by the HSE) and have suitable experience for an educational and research environment.

University Radiation Protection Manager (RPM)

The RPM is part of the Health and Safety Services team, supports all aspects of radiation protection management in the University and monitors legal compliance.

Radiation Safety Coordinator

The Radiation Safety Coordinator (RSC) is appointed at a Faculty, School or Institute level (by the Dean or Head of School) and can be from academic, academic-related or technical staff. The RSC role is required to be written into that person's job description.

Appointments are ratified by Health and Safety Services and nominations are required to be forwarded to the RPM using the nomination form at http://wsh.leeds.ac.uk/download/downloads/id/124/RSC%20appointment%20form.

Training

Training for RSCs satisfies the Health and Safety Executive's seven 'Core of Competence' requirements for Radiation Protection Supervisors (http://www.hse.gov.uk/pubns/irp6.pdf).

To achieve baseline competence an RSC is required to attend the Radman Associates course for RPSs (http://www.radman.co.uk/default.aspx) and receive refresher training every three years.

Role

The RSC oversees radiation work and carries out many of the administrative and practical aspects of radiation safety management in their area; provides assistance and support to Radiation Protection Supervisors (RPS) and radiation users; and liaises with the University Radiation Protection Manager on any radiation safety issues. Duties include:

- Carrying out the practical and administrative aspects of radiation safety management.
- Checking and approving user applications.
- Supervising local induction training and update training records.
- Approving acquisitions of radioactive materials.
- Supervising waste management arrangements.
- Managing the issue and return of radiation dose meters.
- Assisting with the preparation of suitable local rules and advising on their enforcement.
- Monitoring compliance with Local Rules.
- Carrying out periodic workplace monitoring surveys and inspections.
- Implementing contingency / emergency actions when necessary.
- Liaising with and reporting on operational matters to the Radiation Protection Manager.

Further information

http://www.leeds.ac.uk/rps/ionising/RSC.html.

Radiation Protection Supervisor

The Radiation Protection Supervisor (RPS) is generally appointed at a research group level (by the Head of School) and is typically the group leader, research supervisor or line manager. However this may vary depending on the amount and type of radiation work being undertaken in the School.

Appointments are ratified by Health and Safety Services and nominations are required to be forwarded to the RPM using the nomination form at http://wsh.leeds.ac.uk/download/downloads/id/125/RPS%20appointment%20form.

Training

RPSs are required to complete a training module (http://wsh.leeds.ac.uk/wsh/site/flash/ionising/RPS_training) and receive refresher training every three years.

Role

The role of an RPS is to ensure that the arrangements for managing radiation protection are in place for their group and local rules are followed by radiation workers.

Further information

http://wsh.leeds.ac.uk/info/214/ionising_radiation/86/principal_investigatorsradiation_protection_supervisors.

Responsible person for sealed sources

Each sealed source is required to have a nominated person responsible for its safekeeping.

The person is responsible for ensuring that the source is kept securely, used in accordance with local rules, and that Health and Safety Services are informed of any changes to the source's condition, status or location.

- **User authorisation and training**

All radiation users are required to receive appropriate training and be authorised to use radiation as follows:

Open source users

Open source users are required to register for radiation work on the RSID system at http://rsid.leeds.ac.uk and complete:

- an online training module (http://wsh.leeds.ac.uk/wsh/site/flash/ionising/unsealed_training/story.html)
- a practical session at Health and Safety Services (arrangements are made once confirmation of completion of the online module is received).
- a local induction (http://wsh.leeds.ac.uk/download/downloads/id/431/Level%201%20training%20form)

Once all training requirements have been completed a permit to use radiation will be issued by the RPM and that person's RSID account will be activated. Permits are issued on an annual basis and need to be renewed at the start of each academic year.

Sealed source users

Sealed source users are required to complete local training and be added to the list of authorised users attached to the local rules. There is no requirement to register or undergo central training unless high activity sources are handled.

X-ray equipment users

X-ray users are required to complete local training and be added to the list of authorised users attached to the local rules. There is no requirement to register or undergo central training unless high risk activities are undertaken (e.g. beam alignment).

Management of work

- **Best Available Techniques**

The University's environmental permit for radioactive substances specifies that 'Best Available Techniques' (BAT) are used to minimise the activity used and to minimise the radiological effects of discharges on people and the environment.

Complying with radiation protection management arrangements, in particular local rules, satisfies most of these requirements.

In addition groups using open sources are required to justify the use of radioactivity by completing a justification statement on each RSID assessment to show that non-radioactive techniques have been considered and that radioactivity is used because alternative methods are not applicable, have significant risks, require specialist facilities, have significant costs, or have limited sensitivity / specificity / reliability / availability.

- **Dose constraints / ALARP**

  Dose constraints are exposure limits that have been established by the University to limit workers' exposure to ionising radiation. All radiation work at the University is required to be controlled so that the dose constraints are not exceeded.

  The University's dose constraints are:

  - 1 mSv / year whole body dose
  - 10mSv / year extremity dose

  These 'self-imposed' dose limits are much lower than the legal limits for work with radiation (20mSv/year and 500mSv/year respectively) and are at the level required for the protection of persons not working with radiation (e.g. the general public).

  In addition to the above dose limits the University also has a legal obligation to restrict exposure to ionising radiation so that doses are kept as low as reasonably practicable (ALARP).

  Compliance with dose constraints and ALARP is achieved by users following the radiation protection arrangements, i.e. risk assessments, local rules and worker training.

- **Risk Assessments**

  Radiation risk assessments have already been developed to cover work with open sources, sealed sources and x-ray equipment. These are in the form of either generic assessments covering certain types of sources and techniques or specific assessments for particular applications, techniques or equipment.

  Any new radiation sources, applications or equipment will be assessed by the RPM and risk assessments developed in conjunction with the RSC, RPS and users. In the majority of cases a generic assessment is sufficient and no further radiation risk assessment is required.

  Open source users also need to complete dose assessments on the RSID system which use specific data on the radionuclides and activities to estimate potential radiation doses for specific techniques.

- **Group authorisation**

  The group leader is required to discuss requirements for radiation work with the RSC and RPM and receive authorisation to use radioactive material.

  This requirement is to ensure that the planned work comes under the terms of our notified work and the conditions and limitations of our environmental permits.

  For open source work the RPM will set group limits for stocks and waste disposals based on group requirements and permitted limits.

- **Local Rules**

  Local rules specify the key arrangements for restricting exposure to radiation in the group or facility. Each area where open, sealed or x-ray sources are used need to have local rules in place.

  Local rules are based on generic templates and most of the details and instructions will already have been specified. Emergency procedures are detailed in the local rules in terms of a contingency plan for accidents.

  The RPM will supply the local rules template completed with details of the sources, equipment and areas that the local rules apply to and any related limitations such as activity limits for stocks or disposals for that group.

  The RPS then adds any additional instructions for specific techniques that are not already covered by the generic instructions.

Local rules are to be reviewed and updated annually and this will usually be done as part of the annual inspection/audit of groups and facilities by the RPM.

- **Audits and inspections**

  All groups and facilities are audited or inspected by the RPM annually.

  The purpose is to measure the level of compliance against the University standard and environmental permit conditions and to advise and make recommendations on radiation protection arrangements.

  - For open sources this includes a stock inventory check.
  - For sealed sources this includes a leak test of each source.
  - For x-ray equipment this includes a critical examination of each instrument.

- **Accident and incident reporting**

  All significant accidents and incidents are reported directly to the RPS, RSC and RPM as soon as possible so that the appropriate remedial actions can be taken and investigations made.

  Supplementary to this an incident report is required to be completed on the Sentinel accident reporting system (in line with the Accident protocol).

- **Dosimetry and action levels**

  Where there is potential for radiation users to be exposed to levels of radiation above the dose constraints each user will be required to wear personal dose meters to monitor their radiation doses.

  This will usually apply to open source users who use high energy beta or gamma emitting radionuclides and dosimetry is not usually required for sealed source or x-ray users (with exceptions for those using high activity sources or undertaking x-ray alignments).

  All radiation users will be advised whether they are required to wear dose meters when they receive their authorisation permit.

  Dose meters are of two types and are required to be worn and returned as specified in the local rules:

  - Body TLD dose meters: issued and returned on a 3 monthly cycle
  - Extremity TLD dose meters: issued and returned monthly

  All dose meters are issued to local distributors by the RPM and are returned to them.

  Doses above a resolution of 0.1mSv/month are recorded on an individual's dose record.

  Any recorded doses above the action level of 0.6mSv will be investigated by the RPM.

- **Radiation monitoring and monitoring equipment**

  The requirement for radiation monitoring is identified in the risk assessment and local rules. Records of periodic contamination or dose rate monitoring are to be kept as detailed in the local rules.

  Radiation monitoring instruments used for contamination and dose rate monitoring are supplied by Health and Safety Services and are issued to groups on a long-term loan basis.

  Annual checking and calibration of radiation monitoring equipment is a legal requirement and this is undertaken by the RPM.

Facilities

- **Consultation on new facilities**

  The RPM must be consulted on plans for refurbishing or building new radiation facilities. This is to ensure that the standards and safety features needed for compliance with statutory requirements have been included. The University also has a legal obligation to consult its RPA regarding new or modified facilities and this will be done via the RPM.

- **Area registration, approval, designation, access control and signage**

  A database of radiation areas is maintained by Health and Safety Services and all rooms and areas intended to be used for radiation work are required to be registered with the RPM.

  All areas registered for radiation work will then be inspected and approved by the RPM before first being used.

  Three levels of radiation area designation are used by the University (as detailed below) and the designation of a particular area is decided by the RPM based on the levels of radioactive material handled or the accessible dose rates (see 'area designation' procedure).

  Access control arrangements are specified in the 'Authorisation to access restricted locations' protocol.

  Additionally all radiation areas are restricted to entry by those who hold an ionising radiation work authorisation or are otherwise authorised by the RPS.

  Signs for identifying radiation areas are issued by the RPM.

  Radiation area designations:

  - Controlled Area - highly restricted access
  - Supervised Area – restricted access
  - Undesignated Area – limited access

Material and equipment

- **Approval and authorisation of material or equipment**

  All radioactive material and radiation equipment requires approval before being brought to the University as follows:

  - Open sources – an order request is made on the RSID system and then approved by the RSC before material is ordered.
    The group stock limits are set on RSID by the RPM and this process ensures that material that would exceed those limits is not ordered.
  - Sealed sources – approval of the RPM is required before any source is acquired. Email radiation@leeds.ac.uk with details of the source and its intended use.
    This is to ensure that the proposed source is covered by the University's environmental permit and that radiation protection arrangements are in place before it is obtained.
  - X-ray equipment - approval of the RPM is required before any equipment is acquired. Email radiation@leeds.ac.uk with details of the equipment.
    This is to ensure that radiation protection arrangements are in place before x-ray equipment is obtained.

- **Formal checks and examinations of sources and equipment**

  Any new equipment that incorporates either a sealed source or an x-ray generator is required to have a commissioning check by the RPM before it can be used.

The commissioning check incorporates a critical examination that ensures that any safety features and warning devices operate correctly, and that there is sufficient protection from exposure to ionising radiation. For x-ray equipment this includes a check that it complies with the 'Prior authorisation for the use of electrical equipment intended to produce x-rays' issued by the Health and Safety Executive (HSE).

When installed each x-ray instrument is also required to have a critical examination undertaken by the installer that ensures that safety features and warning devices operate correctly and that there is sufficient protection for persons from exposure to radiation. The installer's examination report is then required to be forwarded to the RPM.

In addition sources and equipment are subject to periodic checks as follows:

- Sealed sources
    - A check of the source condition and location is made monthly by the responsible person for the source and reported to the RPM. This is managed by a simple reply to a monthly email prompt from the RPM.
    - Each sealed source is required to undergo an inspection and leak test annually - this is undertaken by the RPM.
- X-ray equipment
    - A critical examination will be completed annually on each x-ray instrument by the RPM or if it is moved or modified.

- **Statutory records**

Full detailed records are required to be kept for every radioactive source or item of x-ray equipment.

- Open sources – details of the source are entered on the RSID system at the ordering stage and any subsequent aliquots removed and disposals made are recorded on RSID. Training on the use of RSID is given to all open source users as part of the local induction.
- Sealed sources – full details of the source are supplied to the RPM when seeking approval and this is stored on a central database maintained by Health and Safety Services. Details of source status and location are required to be kept up to date on the database and any changes notified to the RPM.
- X-ray equipment - full details of the equipment are supplied to the RPM when seeking approval and this is stored on a central database maintained by Health and Safety Services. Details of equipment status and location are required to be kept up to date on the database and any changes notified to the RPM.

- **Secure storage of material**

All radioactive material is required to be stored safely in a secure location, i.e. in a locked laboratory that has limited or restricted access.

The RPS or responsible person (for sealed sources) supervises the safe storage of material.

Further instructions on storage requirements are detailed in the local rules.

- **Marking of material**

All radioactive material is required to be clearly and legibly marked with the word 'Radioactive', the ionising radiation symbol (trefoil), and identification information such as the RSID source or aliquot number (for open sources), or the sealed source ID, serial, and type numbers.

Waste material is required to be clearly marked by placing it in the appropriate waste bag marked with the RSID bag number as detailed in the local rules.

- **Waste and redundant sources**

  Disposals of radioactive waste and redundant radioactive sources are subject to strict conditions and limitations that are specified in the University's environmental permits.

  - Open sources – waste is to be minimised and kept within the limits specified for each radionuclide / route in the group's local rules. Further details of waste routes, methods and instructions are detailed in the local rules.
  - Sealed sources – all redundant sources are to be transferred to Health and Safety Services for disposal. Contact the RPM to arrange this.
  - X-ray equipment – redundant x-ray equipment can be disposed of via the electrical / hazardous waste routes as specified in the University's waste protocol.

  Instructions for compliance are detailed in the local rules.

- **Transport**

  The transportation of radioactive material on the public road has complex legal requirements, e.g. packaging, consignment documentation, carrier licensing, driver training, etc.

  Any plans for the transport of radioactive material off campus are required to be discussed with the RPM and the transport operation can only be undertaken with the direct involvement and control of the RPM. In some cases this will mean transfer of the material to Health and Safety Services for packaging and consignment.

  Only exempt consignments or excepted packages may be transported by University personnel. Radioactive material not in these categories are to be transported by an approved courier for Class 7 dangerous goods

  Please refer to the Transport of radioactive material procedure for further information.

The guidance for the specific requirements for open sources, sealed sources and x-rays are included in the sections above and summarised in Appendix 1.

Appendix 1

Summary of management requirements by type of radiation source

For all types:

- Appoint an RSC for the Faculty or School who is required to complete training requirements.
- Appoint an RPS for the group who is required to complete training requirements.
- Identify rooms required, register areas with RPM and receive approvals.
- Complete local rules (supplied by RPM).
- Follow the local rules and training whilst working.

In addition for open sources

- Receive group authorisation to use radioactive material from the RPM.
- Users are required to register on RSID, complete specified training and receive a work permit.
- Complete a dose assessment on RSID for each radionuclide and technique.
- For each source to be acquired enter an order request on RSID and receive approval from the RSC before placing an order.
- Keep full up to date records of stocks, aliquots, and disposals on RSID.
- Keep records of periodic contamination monitoring.
- Do not transport any material off-site without the explicit knowledge and approval of the RPM.

In addition for sealed sources

- For each sealed source notify full details of the source, planned location and responsible person to the RPM and receive prior authorisation from the RPM before acquisition.
- Do not use sealed source equipment for the first time until a commissioning check and critical examination has been carried out by the RPM.
- Users receive local training and authorisation to use sources.
- Confirm source status and location monthly to the RPM.
- Do not transport any source off-site without the explicit knowledge and approval of the RPM.

In addition for x-rays

- For each item of x-ray equipment notify full details of the equipment, planned location and responsible person to the RPM and receive prior authorisation from the RPM before acquisition.
- Do not use equipment for the first time until a commissioning check and critical examination has been carried out by the RPM.
- Users receive local training and authorisation to use equipment.
- Keep records of periodic dose rate monitoring.