Safe Use of Ionising Radiation
Code of Practice

Reviews and Revisions

Date	Reason	Reviewer	Next review date	Approved by
17/06/2016	New document. Required to set standards	L. Rounds	17/06/2017	E. Pritchard
20/07/2017	Document control	S. Hewes	17/06/2018	E. Pritchard
16/10/2017	Change of RPS	E. Prichard	17/06/2018	E. Pritchard
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23/11/2018	Northumbria logo change	J. Hall	17/06/2020	E. Prichard
29/08/2019	Update following review by University RPO	A. Swinburne	17/06/2020	E. Prichard

Northumbria University
NEWCASTLE

Contents

Introduction

The use of ionising radiation within the University is conditional on the compliance to the regulations detailed below and the conditions within Environmental Permits and this Code of Practice. Failure to comply with regulatory requirements may result in enforcement action or prosecution and may lead to the removal of registrations/consents, as applicable, by the Health and Safety Executive (HSE) and/or removal of Environmental Permits by the Environment Agency (EA).

The applicable regulations are:

- Ionising Radiations Regulations 2017 (IRR17).
- Environmental Permitting Regulations (England and Wales) 2016 (as amended).
- Carriage of Dangerous Goods and Use of Transportable Pressure Equipment. Regulations 2009 (as amended) (CDG 2009).
- The Justification of Practices Involving the Use of Ionising Radiation Regulations 2004 (as amended).
- Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR).
- The Waste (England and Wales) Regulations 2011 (as amended).
- Hazardous Waste (England and Wales) Regulations 2005 (as amended).

This Code of Practice defines the roles and responsibilities and safe working practices to ensure a high standard of radiological protection is in place.

General Principles

The overarching principle of radiation protection for work with ionising radiation is based on the fundamental steps below:

Justification – work with ionising radiation must be justified to demonstrate that the benefits of the use of the radiation outweighs the potential harm. In the UK, the Justification of Practices Involving the Use of Ionising Radiation Regulations 2004 (as amended) outlines pre-justified practises involving ionising radiation. All work with ionising radiation in the University must fall under pre-justified practices, otherwise an application must be made to the competent authority for a new justified practice. Medical research exposures may only be considered justified if ethical approval has been granted.

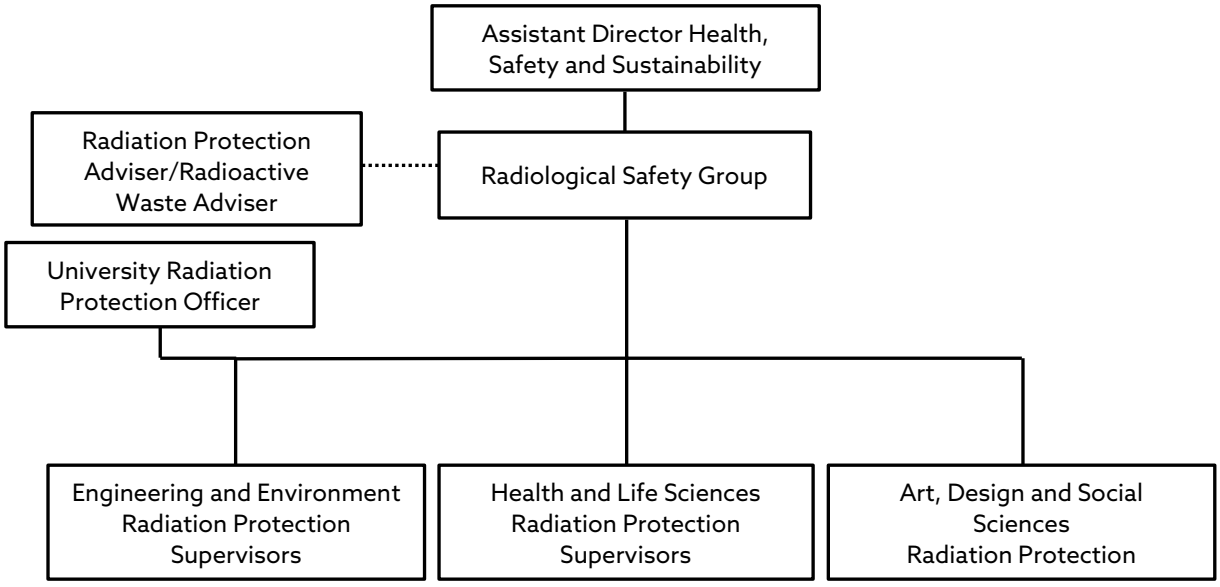
Optimisation – exposure to ionising radiation must be optimised so that the dose received is as low as reasonably practicable. This involves optimisation of the process to minimise dose, e.g. by minimising the activity of radioactive material handled and introducing engineering controls to minimise the dose rates to workers. Under

environmental legislation, this is demonstrated through Best Available Techniques (BAT) and is used to demonstrate that the process minimises the environmental impact (principally the dose to members of the public) of disposals of radioactive waste.

Dose Limitation – Dose limits are imposed through legislation which define the absolute limit of tolerable risk.

Roles and Responsibilities

General roles and responsibilities are included within the University Health and Safety Policy. Additional roles and responsibilities are included here. The organisational structure with specific duties for the management of work with ionising radiation is show below.



Assistant Director for Health, Safety and Sustainability

The Assistant Director of Health, Safety & Sustainability is responsible for the appointment of the University Radiation Protection Officer (URPO), the Radiation Protection Adviser (RPA) and the Radiation Waste Adviser (RWA).

Radiation Protection Adviser (RPA)/Radioactive Waste Adviser (RWA)

Provides advice on compliance with the Ionising Radiations Regulations 2017 and the Environmental Permitting Regulations 2016 (as amended).

The RPA/RWA must be consulted on:

- Designation of supervised and controlled areas.

- The prior examination of plans for the installation and acceptance into service of new or modified sources of ionising radiation in relation to any engineering controls, design features, safety features and warning devices to restrict exposure.

- 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 if work provided to restrict exposure to ionising radiation.

In addition, the RPA will provide important advice on:

- Radiation risk assessments.
- Incident investigation.
- Contingency plans.
- Dose assessment.

As well as all other aspects of compliance with IRR17.

The Radioactive Waste Adviser will provide advice on compliance with the Environmental Permitting Regulations 2016 (as amended) and the condition within permits.

Dangerous Goods Safety Adviser (DGSA)

The responsibility of the DGSA are outlined in the Transport of Dangerous Goods Code of Practice. In relation to the transport of Class 7 dangerous goods, the DGSA will advise on the requirements to comply with dangerous goods legislation.

University Radiation Protection Officer (URPO)

The URPO must have suitable knowledge and experience of working with the applicable forms of ionising radiation and must complete a suitable RPS training course on sealed, unsealed and X-ray sources. Refresher training must be completed every 5 years to maintain competency levels.

The URPO must:

- Maintain the role of primary contact with the RPA/RWA.

- Notify or obtain registrations or consents from the Health and Safety Executive for practices and ensure work with ionising radiation is covered by existing notification/registrations/consents.

- Ensure all necessary Permits are appropriate and in place for acquiring, holding, and disposing of radioactive substances.

- Implement, maintain and monitor systems of work to assure compliance with the requirements of legislation and permits.

- Notify regulatory bodies of relevant changes to, or cessation of work with ionising radiation.

- Ensure notification to regulators is made when required.

- Supervise audits and inspections by regulatory agencies and other interested parties.

- Take a lead role in the investigation of incidents involving ionising radiation.

- Submit a summary of disposals and discharges to the Environment Agency for a calendar year within the first month of the following year.

Radiation Protection Supervisors

The RPS must have suitable knowledge and experience of working with the applicable forms of ionising radiation and must complete a suitable RPS training course on sealed, unsealed and X-ray sources, as appropriate. Refresher training must be completed every 5 years to maintain competency levels.

The RPS must:

General

- Ensure that all work with ionising radiation sources in the department is covered by risk assessments, and notify the URPO in advance of any new activities for which a revised or new risk assessment is required.

- Compile and maintain local rules and assist in the implementation of contingency plans.

- Monitor for compliance with locals for work with ionising radiation in the department.

- Review annually the departmental local rules.

- Deputise for the URPO when requested.
- Maintain systems of work within their department to assure compliance with the site requirements of legislation and licences.
- Maintain contact with the URPO.
- Ensure the URPO is notified of any incidents or accidents involving radiation sources.
- Ensure that cover is provided for advice on radiological protection at all times.

Area Designation

- Ensure designated areas are identified and controlled appropriately.
- Consult the URPO with regard to any proposed changes in area designation.

Radioactive Disposals

- Ensure waste is recorded, packaged and stored correctly before collection.
- Ensure wastes are disposed of in accordance with the conditions of applicable permits.
- Maintain records of disposed wastes.

Staff Safety

- Along with the URPS, provide information, instruction and training to individuals with regard to the application of ionising radiation legislation, controls, and associated potential effects in the working environment.
- Arrange for suitable training for personnel involved with ionising radiation.
- Maintain a record of departmental radiation workers and training received.

Sources and Ionising Radiation Equipment

- Retain records of all sources of ionising radiation in the department and perform accountancy checks on radioactive material at least every month.
- Obtain approval from the URPO for any new sources, or equipment, which produces ionising radiation in operation.

- Ensure that systems are in place for regular area, contamination or equipment monitoring where necessary and maintain and review the records.
- Inform the URPO of any new or relocated sources or equipment, which produces ionising radiation in operation.
- Ensure that maintenance and testing requirements identified during risk assessments are carried out.
- Ensure sources are leak tested or replaced at intervals not exceeding 24 months and records retained.
- Ensure that all radiation monitoring equipment on site is tested at intervals not exceeding 12 months and records retained.

Principle Investigators

- Ensure work with ionising radiation performed by their researchers has a radiation risk assessment/local rules/safe systems of work in place.
- Ensure researchers are registered radiation workers and have undergone suitable training and a record made.
- Supervise work carried out by their researches involving ionising radiation.

Radiation Workers

- Follow the local rules within their work area(s).
- Make full and proper use of the safety and personal protective equipment (PPE) provided.
- Report incidents and defects in equipment and procedures.

Notification/Registration/Consent and Environmental Permits

All work with ionising radiation shall only be conducted if the appropriate notification/registration/consent has been made to/obtained from the Health and Safety Executive (HSE) and for work with radioactive material, an environmental permit has been obtained from the Environment Agency (EA), if appropriate.

Most work with ionising radiation within the University requires a registration, covering work with radiation generators (e.g. X-ray devices) and artificial radionuclides. Practices that require consent from the HSE that may be applicable to the University are:

a. The deliberate administration of radioactive substances to persons and in so far as the radiation protection of persons is concerned, animals for the purpose of medical or veterinary diagnosis, treatment or research.

b. The deliberate addition of radioactive substances in the production or manufacture of consumer products or other products, including medicinal products.

c. The operation of an accelerator (except for electron microscopes and d., e. below).

d. Industrial radiography.

e. Industrial irradiation.

f. Any practice involving a High Activity Sealed Source (HASS), other than included in practices d., e. above.

g. Practices discharging significant amounts of radioactive material with airborne of liquid effluent to the environment.

The keeping and use of radioactive material and the accumulation and disposal of radioactive waste may require Environmental Permits issued under the Environmental Permitting Regulations 2016 (as amended). Permits are issued for sealed and unsealed material and specify the practices that can take place. The conditions within the permits must be followed.

A compliance matrix should be maintained demonstrating the compliance to the permit conditions through procedural control.

Work with some radioactive material can be used under exemptions to the requirement to hold an Environmental Permit, such as the keeping and use of small sealed sources, the accumulation and disposal of sealed sources and the accumulation and disposal of solid radioactive waste. The conditions of the exemptions are outlined in the regulations and must be followed.

The URPO can be contacted for further information, including for consultation with the RPA/RWA as required.

Radiation Risk Assessment

A radiation risk assessment must be carried out prior to all work involving ionising radiation, and must identify the measures required to restrict the exposure of employees

or others to ionising radiation. The Approved Code of Practice (ACOP) to the Ionising Radiation Regulations 2017 identifies the matters to be considered in a radiation risk assessment. The University Radiation Risk Assessment template covers the items to consider.

Restriction of Exposure

All work with ionising radiation must be designed so that exposure is kept as low as reasonably practicable. This may be achieved by eliminating the use of ionising radiation where possible, substituting with a less radiotoxic material and minimising the activity of the radionuclide used.

General

For external radiation, engineering controls such as enclosure and shielding of the radioactive material to reduce the dose rate workers or others are exposed to should be used in preference to increasing the distance from the source and minimising the time of exposure. Shielding should aim to reduce the dose rate to less than 7.5 μSv/h in locations where people work. The dose rate in areas accessible to the public or employees who do not routinely work with ionising radiation should be as low as reasonably practicable

Other engineering controls and safety and warning devices which should be considered include:

- Filtration
- Collimation
- Interlock systems
- Key and locked-key systems
- Visual/audible warning devices

Engineering controls should be used in preference to administrative controls such as work procedures and signage.

Radioactive material (sealed or unsealed sources) should not be held or manipulated by hand unless the dose to the skin and the risk of contamination is not significant.

When working with unsealed radioactive material, priority should be given to the containment of the material. Where complete containment is not reasonably practicable, consideration should be given to the exposure routes and potential dose in determining the control measure required, e.g. LEV, glove boxes etc.

It is good practice to use lined spill trays for work with unsealed material. Good laboratory hygiene is essential to prevent the spread and inadvertent exposure to radioactive material. All unsealed work areas must prohibit eating and drinking as well as other

hygiene good practice such as prohibition on the use of cosmetics and personal handkerchiefs. Workers should wear long trousers and closed toed shoes.

Personal Protective Equipment (PPE) should be used as the last line of defence. However, it is likely to be required for laboratory work. Any PPE used must be adequate and suitable for the radioactive material handled as well as stored, inspected and maintained correctly.

All areas involved in work with unsealed radioactive material must have suitable washing and changing facilities to restrict the spread of radioactive material.

Dose constraints provide a means of restricting the dose received by a radiation worker for a particular task. Guidance from the HSE suggests it is unlikely that dose constraints will be appropriate for the work typically performed by the University. A dose constraint for members of the public is likely to be appropriate. It is common industry practice to establish a dose constraint of 0.3 mSv per year for a particular practice and this dose constraint will be adopted by the University when assessing the potential dose to a member of the public.

Maintenance and Inspection

All physical control measures (such as shielding, ventilation, safety features, warning devices etc.) and radiation generators e.g. X-ray generators must be examined and maintained through formal programmes defining their frequency and nature determined through the risk assessment process taking into account advice from the RPA and the manufacturer. A record of the examination and maintenance must be made and retained for at least two years after the subsequent test.

Contingency Plans

Where a radiation risk assessment identifies potential radiation accidents (where immediate action is required to prevent or reduce exposure), contingency plans must be developed to respond to the accident and tested/rehearsed where appropriate. It is a legislative requirement that if a contingency plan is enacted, that it is reported internally through the University incident reporting system and investigated.

Designation of Radiation Areas

When working with ionising radiation, it may be necessary to designate radiation areas. Designation of area is one of the matters to consider during a radiation risk assessment and should be made in consultation with the URPO and RPA.

Controlled Areas

Controlled areas are designated for higher risk activities where special procedures are required to restrict dose. Typically this would involve higher levels of external radiation,

the potential to spread contamination or the need to prevent or closely supervise access to the area to people unconnected to the work.

Any controlled area must be under the control of the University and must be delineated appropriately and signed, unless this is not reasonably practicable.

Supervised Areas

A supervised area is a lower risk radiation area where conditions must be monitored and reviewed to ensure a controlled area is not required. A supervised area should have appropriate warning signage.

Where temporary controlled and supervised areas are designated, a log must be kept detailing:

- Time, date, the area designated and the area designation.
- The person designating the area.
- The date and time of de-designation.

Appointment of Radiation Protection Supervisors

At least one radiation protection supervisor must be appointed by a faculty working with ionising radiation, to supervise the work carried out in the faculty. The appointment should be in writing and include the scope of the appointment.

Local Rules

Local rules must be prepared for all controlled and supervised areas.

Local rules must contain:

- A dose investigation level.
- Identification or summary of contingency plans.
- Name(s) of appointed RPS(s).
- Identification, description and designation of the area.
- Work instructions or a summary of the instructions which can include references to supporting documentation.

Local rules can also be expanded to include other important information on work practices such as monitoring, personal dosimetry etc. The URPO in the first instance and the RPA can provide further information.

Monitoring of Designated Areas

Area monitoring is mandatory inside and outside designated radiation areas. The nature and frequency of the monitoring (dose rate or contamination) is dependent on the work

activity and must be considered as part of the risk assessment process. A radiation monitor suitable for the radiation and monitoring method must be used. Advice should be sought from the URPO and RPA.

A record of monitoring designated areas must be kept by the Faculty for a minimum period of two years. Records should include:

- Time.
- Date.
- Place of monitoring.
- Confirmation of appropriate designation.
- Indication of radiation levels including background.
- Details of the monitor used including serial number.
- Name of the person monitoring.

A radiation monitor used for monitoring designated areas must be periodically examined, tested and maintained (typically known as calibration). The period between calibrations should be determined during the risk assessment, but must not exceed 12 months and must be performed by a suitably qualified person. A calibration certificate must be provided and retained for a minimum of two years. A copy of the certificate should be provided to the URPO.

Where an area is not required to be designated, it may still be appropriate to perform radiation monitoring to confirm the non-designated status and/or to ensure the effectiveness of engineering controls e.g. around installed X-ray generators. The period between monitoring should be determined through risk assessments but should not exceed 12 months.

Radiation Workers and Classification

All radiation workers must register with the URPO, including details of their classification status.

Any worker who receives or is likely to receive a dose greater than 6 mSv/year must be classified. The likelihood and severity of any accidental exposure must also be taken into account. The classification of workers should be determined during the risk assessment process and the cumulative dose that may be received during multiple tasks should also be considered. The URPO and RPA should be consulted when determining the need for classification.

Any worker who is classified must be 18 years old or over, wear appropriate person dosimetry provided by an Approved Dosimetry Service (ADS), receive medical surveillance annually, be deemed fit to work by an Relevant Doctor and overseen by Occupational Health. Health records will be managed through HR/Occupational Health.

Any worker who is not classified is a non-classified worker and must only work in supervised and controlled areas under suitable written arrangements, to minimise the dose received and ensure classification is not required. These written arrangements should be incorporated into local rules, including the method of monitoring their dose.

Dosimetry

Non-classified workers must have a suitable form of dose assessment when working in controlled areas. The dose received must be recorded and retained for at least 2 years.

Classified workers must be provided with a suitable personal dosimetry, provided by an ADS, which must include all significant components e.g. skin, lens of the eye where required. The approval must be for both the personal dosimeters and dose record keeping. The ADS must retain classified worker dose records for at least 30 years from when the record was made or until the worker would have attained the age of 75.

Dose assessment and recording is required when outside workers (classified and non-classified) work in University controlled areas. Classified outside workers must be in possession of an outside workers passbook which must be completed by the URPO upon completion of the work.

It may be appropriate to use an alarming electronic personal dosimeter where there is exposure to external radiation. The dosimeter must provide an appropriate response to the radiation type and expected dose rates. Electronic personal dosimeters are not provided by an ADS and would need to be worn in addition to the ADS personal dosimeter for classified workers.

The URPO/RPA must be consulted on the use of dosimeters and the procedure for outside workers entering designated areas.

Control of Radioactive Material

Sealed sources must be used in preference to unsealed material. In all cases, the article used to contain the radioactive material must be suitable to prevent leakage.

Radioactive material requiring a permit may only be used within the locations specified within the permit. Any transfer off site must be approved by the URPO in advance (this does not include waste).

Ordering and Receipt of Radioactive Material

The ordering of any source of ionising radiation must be approved by the relevant Faculty/Department RPS. It must be verified prior to ordering, that a suitable notification/registration/consent or permit is in place and that holding the material will not breach any limits.

The courier must deliver the package directly to a suitable dedicated acceptor. The Faculty must have a procedure for acceptance of the package/source including a visual inspection of package/paperwork and monitoring to ensure that the correct source activity has been delivered and there is no leakage of material. Record keeping requirements are outlined in the Source Records and Accountancy section.

Any package not meeting the acceptance criteria must be quarantined and the Faculty/Department RPS informed immediately. The RPS should seek further advice from the URPO/DGSA.

Marking of Sources

All radioactive sources must be marked with a unique identification number, the word 'Radioactive' and the ionising radiation trefoil where reasonably practicable.

Source Records and Accountancy

Each radioactive source must have an associated record. The record must contain:

- The unique identification number of the source.
- The radionuclide.
- The date on which the source was received.
- The activity on the day of receipt.
- The location, updated as the source is moved.
- If it is removed from the premises/disposed of, the date of removal, the activity on that date and the name and address of the person to whom it was transferred.

Records for unsealed sources must include suitable methods to account for the usage of the material, including identification of sub-stocks/experiments, their location, activity and a record of their accumulation as waste and disposal.

Accountancy checks must be made and recorded on all radioactive material at regular intervals not exceeding one month. A full inventory check must be performed annually.

Any discrepancies in records must be reported to the Faculty RPS and the URPO immediately.

Records must be legible and if amended, amended in such a way that all information remains legible or retrievable. Amendments to records should be made as soon as reasonably practiable after the change is made and should at least be made on the same day as the change.

All records must be retained until notified in writing by the Environment Agency that they can be disposed of.

Leak Testing

All sealed sources must undergo a periodic leak test, where appropriate, following manufactures advice or conforming to ISO 9978:1996, in which the pass/fail threshold is 200 Bq. The period between leak tests should be determined through risk assessment but should not exceed two years for sources that are within their recommended working life. A direct test of the source is preferred, however an indirect test is permissible where it is not reasonably practicable or not justified on radiation protection grounds.

The recommended working life of a sealed source is typically provided by the manufacturer. The recommended working life does not usually exceed 15 years. A source approaching the end of its recommended working life should be reviewed with the view of it being replaced or examined by the manufacturer or supplier. If it is determined that the source is safe to use, a time limit on its further use should be set and the frequency of leak testing increased. Environment Agency expectation is that a source should not be used for longer than twice its recommended working life and that leak testing should be performed at least annually on sources exceeding their recommended working life. Where a recommended working life has not been provided, periodic reviews of the condition of the source must be made and the frequency of leak testing determined.

A record of leak test must be retained for at least two years after the disposal of the source or the record is superseded by a new test. The record should include:

- Identifications of the source.
- Date of the test.
- Reason for the test.
- Methods of test.
- The pass/fail criteria.
- Numerical results of the test.
- Result of the test (pass/fail).
- Any action taken if the source failed the test.
- Name and signature of the person carrying out the test.

Storage and Security

All radioactive material (including waste) must be stored securely with access to authorised users only. Adequate key control is required to prevent unauthorised access.

The store should provide suitable weather and fire resistance and sufficient shielding in storage containers or the store itself to keep the external dose rate as low as reasonably practicable. Stores may require designation as controlled or supervised areas, both inside and outside the store. HSE guidance recommends a dose rate of less than 2.5 μSv/h around the outside of the store.

The store should have adequate ventilation if there is a risk of airborne radioactive (or chemical) contamination.

Radioactive material that is not in direct use should be returned to its store. Only items directly related to the handling and shielding of the radioactive material should be placed in the store.

The store should be marked with the ionising radiation trefoil and the words 'Radioactive Material'.

Accumulation and Disposal of Waste

All radioactive waste must only be accumulated and disposed of in accordance with the relevant permit or exemption conditions. The University must maintain a Best Available Technique Document detailing the measures taken to ensure that processes have been optimised to minimise the environmental impact.

A record must be kept detailing the date that accumulation as waste commenced and the date and route of disposal. Where waste is transferred to another party, the record must include the name and address transferee. A transfer note must also be made.

A disposal log must be maintained for the disposal of unsealed material to drain. Disposal limits must not be exceeded.

Transport of Radioactive Material

Transport of radioactive material should be minimised. Transport by foot around the same building or between buildings must be in a suitable container providing secondary containment and adequate shielding.

Transport by vehicle is regulated under dangerous goods regulations – see the Transport of Dangerous Goods Code of Practice. The Dangerous Goods Safety Adviser must be consulted prior to shipment.

Carriage on public transport is not permitted.

Information, Instruction and Training

Anyone who uses ionising radiation must receive adequate information, instruction and training.

Anyone appointed as RPS must attended a radiation protection supervisor training course covering the types of sources to be used, e.g. sealed, unsealed, X-rays etc. Refresher training must be undertaken at least every 5 years.

Users of sources of ionising radiation must attend ionising radiation awareness training as well as specific information, instruction and training for of the risk assessments, local rules and safe systems of work that must be followed for their work. Refresher training must be undertaken at least every 5 years.

A record of all training must be made and retained.

Outside workers entering University designated radiation areas must be provided with information, instruction and training on the risk assessments, local rules and safe systems of work that must be followed in the area.

Monitoring Review, Notification of Occurrences and Reporting

The local RPS has responsibility for monitoring the compliance to this code of practice for their area. The URPO has responisibilty for the periodic audit of compliance to this code of practice. The RPA/RWA will conduct an annual audit of regulatory compliance.

Certain occurrences must be reported to the relevant regulator e.g. HSE, Environment Agency or the Police. These include:

- Suspected or known overexposures.
- Major releases of material above threshold levels.
- Loss or theft of radioactive material.
- Breaches in holding and/or disposal limits.
- Malfunciton of equipment or process that has caused or may cause a source to be damaged or lost.

All radiation incidents must be reported immediately through the University incident reporting system so that any situation requiring notification can be identified by the URPO and reported to the regulator by the required method e.g. the Environment Agency required written notification within 24 hours.

Annual reports must also be sent to the Environment Agency for pollution inventory reporting and Category 5 sealed source permits by the RPO.