Guidance on the Ionising Radiations Regulations 1999 (IRR99)

These regulations came into force on 1st January 2000. A copy of the regulations can be freely downloaded from the following web page:-

http://www.legislation.hmso.gov.uk/si/si1999/19993232.htm

The Association of University Radiation Protection Officers (AURPO) has produced guidance notes for these regulations and these have been posted on the Safety Services website at:

http://www.shef.ac.uk/safety/ir/index.html They can also be found at:

http://www.shef.ac.uk/~aurpo/publns.html

The AURPO guidance adopts a practical approach describing what you need to do in practice to meet the requirements of the regulations rather than just detailing and expanding the regulations themselves. The guidance is divided into seven sections and 13 appendices. The sections cover the following areas which will also be used in this guide:-

1. Getting Started
2. Management of Radiation Protection
3. Risk Assessments
4. Restriction of Exposure
5. Designation and Monitoring of Areas
6. Dose Limitation, Classification and Monitoring of Persons
7. Control of Radioactive Substances, Articles and Equipment

Key aspects of the regulations and guidance notes are detailed below.

Getting Started

Justifying work practices. IRR99 has not covered justification and this is now being covered by requirements under the Radioactive Substances Act 1993 (RSA93). We have tackled this at Sheffield by adding a requirement into the work certificate application form where research supervisors have to make a justification statement.

Authorisation and notification of practices. These requirements are dealt with by Safety Services for the University as a whole. The use of radioactive materials is covered by Registrations and Authorisations issued by the Environment Agency and the use of X-ray equipment is covered by a generic Prior Authorisation issued by HSE. The HSE have been notified of all practices undertaken by the University of Sheffield with ionising radiations. Exemptions from notification (Reg 6 and Schedules 1 and 8) are too low for any university use as they apply to the total quantity held on the premises. (*see also Table 1 at end of this document*)

Management of Radiation Protection

The *Vice-Chancellor* has overall responsibility for radiation safety and all other health and safety matters.

Heads of Department are directly responsible to senior management for work with ionising radiations undertaken in their department. They must have a management system in place within the department to ensure that all the requirements of IRR99 and RSA93 are complied with.

A *Radiation Protection Adviser* (RPA) must be appointed and consulted by an employer whose work involves the use of ionising radiations.

Radiation protection supervisors are appointed by the Head of Department, in consultation with the RPA, in departments where work with ionising radiations is undertaken. The need for more than one RPS in a department will depend upon: the extent and degree of complexity of the work undertaken; the number of controlled and supervised areas and their geographical distribution; and, the number of people working in such areas. For example: in a department where both x-rays and unsealed sources are used, it is unlikely that any one staff member will have an expertise in both fields, so a separate RPS would be required for each field. In large departments with a number of controlled areas or separate store/dispensaries, it may be appropriate to have a RPS responsible for each of such areas. It will be the role of the RPS to monitor compliance with the 'Local Rules' in order to meet the requirements of IRR99. It should be noted that the legal responsibility under the regulations to ensure compliance remains with the employer.

Academic supervisors/work certificate holders have an important role to play in supervising the work with ionising radiations and ensuring that the people working for them are adequately trained.

Radiation workers need to familiarise themselves with: all pertinent local rules; the physical, chemical and biological properties of the radioactive material, or physical properties of other ionising radiations which they propose to use; and the precautions that need to be taken.

Training. The provision of information, instruction and training is seen as most important in ensuring that local rules are observed and that exposure to ionising radiations and possible harm to people is kept to a minimum. Training is provided: centrally (Safety Services - obligatory lecture); at departmental level (DRPS - departmental procedures and checking knowledge of individual); and by academic supervisor (lab procedures and techniques).
Records of training will be kept centrally, at departmental level and by the individual themselves.

Risk Assessments

Before commencing a new work activity involving ionising radiations the employer has a responsibility to ensure that a risk assessment is made which identifies the hazards and evaluates the nature and magnitude of the risks to which both workers and members of the general public could be subjected. These prior risk assessments in relation to hazards posed by work with ionising radiations are covered by our work certificate system.

With X-ray crystallographic equipment there may be alignment procedures which require over-riding of some of the standard design safety features. These procedures should be restricted to named authorised personnel and carefully assessed. A permit to work / scheme of work will need to be drawn up.

What to do in an accident/ incident scenario is an important aspect of risk assessments. Every designated laboratory should have at least simple emergency action plans with key information posted in the laboratory. All radiation workers should be made aware of the action to be taken in the event of an emergency.

Restriction of Exposure

There is a duty to keep all exposures from ionising radiations as low as reasonably practicable (*alarp*). *Dose constraints* can be used to plan to keep radiation exposures below a given level. The average radiation exposure/ employee in universities is <0.1mSv/y and no individual at Sheffield has received an annual dose in excess of 1mSv in any year for the past 20 years. A dose constraint of 1mSv/y will therefore be applied to all personnel working with ionising radiations at Sheffield University. This

means that we should be able to treat men and women the same and still observe the dose constraint to the foetus of 1mSv for the declared term of a pregnancy.

The *external hazard* shall be controlled by use of appropriate shielding, distance and time and by using the minimum quantities of radionuclide needed for an experiment.

The *internal hazard* shall be controlled by adopting good working practices, minimising the quantities of material used, using radioactive materials of low radiotoxicity and having good contamination control.

Designation and Monitoring of Areas

Three types of area can be described - controlled, supervised and non-designated areas.

A *controlled area* is required where special procedures are required in order to restrict doses to less than 6mSv/y or if any one in an area is likely to receive such doses.

A *supervised area* is required where doses could exceed 1mSv/y or where working conditions need to be kept under review to ensure that designation as a controlled area is not required.

Areas which do not require official designation because the doses which personnel are likely to receive are less than 1mSv/y are referred to as *non-designated areas*.

More detailed information on the criteria for designating areas can be found on page 13 of the AURPO guidance and in Appendix 3 to the AURPO guidance notes.

There are requirements for *monitoring* of designated areas and of non-designated areas, in order to demonstrate that the areas are correctly designated. Monitoring undertaken to demonstrate compliance with the regulations must be recorded - guidance on this is given in the work certificate conditions.

Monitor testing - monitoring instruments used under the regulations must be thoroughly examined and tested at least once every year.

Dose limitation, Classification and Monitoring of Persons

The *dose limits* for workers over the age of 18 have been revised as follows:-

whole body exposure	20 mSv/y
lens of the eye	150 mSv/y
skin and extremeties	500 mSv/y

The limits for trainees (16-17) are 3/10ths of the above limits. The whole body limit for members of the general public is 1 mSv/y. There is a special limit for female workers of reproductive capacity and this is 13 mSv in any 3 monthly period. Female workers should be told of the enhanced risk to the foetus of work with unsealed sources of phosphorous and calcium radionuclides. They should be reassured though that taking care and following good working practices should mean that the pregnancy will not interfere with their work. (Additional guidance material is available for pregnant workers.)

No work at Sheffield requires the people involved to be '*classified*' radiation workers. This only applies to people likely to receive doses in excess of 6 mSv/y.

All people who work with penetrating radiations are issued with whole body dosimeters in order to demonstrate that dose limits are being complied with and that people are correctly designated. People

who work with P-32 or hard beta-gamma emitters may be issued with finger rings to measure extremity doses. Records of the doses that non classified people receive must be kept for at least 2 years and be made available for people to inspect their record.

Control of Radioactive Substances, Articles and Equipment

Proper *storage* of radioactive materials is a key requirement of IRR99 and RSA93. Radioactive sources, sealed and unsealed, must at all times except when actually in use or while being moved, transported or disposed of, be kept in suitable containers in a suitable store. Containers should prevent dispersal of the radioactive material. Containers must be appropriately labelled and suitable for the purpose, having particular regard to shielding, containment and the potential hazards likely to be encountered. Stores should be appropriately labelled and provide weather protection (if necessary), resistance to fire, security, ventilation and appropriate shielding. Shielding should ensure that the dose-rate outside the store does not exceed 7.5 uSv/h and if practicable less than 2.5 uSv/h. The correct temperature of storage is very important to avoid decomposition of many radiochemicals and the importance of this must be stressed to users.

Accounting records. To meet the requirements of both RSA93 and IRR99 we must keep up to date accurate records of all sealed and unsealed sources. There needs to be a clear means of identification and records kept of the date of receipt, activity on that date, whereabouts of source and the activity and date of disposal /removal and the means of any disposal. Records of disposal need to be kept for a minimum of 4 years. A monthly check should be made on the whereabouts of all sealed sources and for unsealed sources a monthly return should be made, by the DRPS to the Safety Services Office, of stocks held and disposals made in the previous month. The loss of any source must be reported immediately to Safety Services. If this loss is confirmed a report has to be made to the authorities.

Leak Testing. All sealed sources must be leak tested at least once every 2 years. This task is performed by Safety Services.

Movement and Transport Commonsense packaging is all that is required for movement on the employer's premises. The containment system used should not create a spillage if the material is dropped and shielding should be sufficient to protect the carrier. Transport should be carried out in accordance with the 2002 Transport Regulations (S.I.2002 No.1093). *See separate transport guidance notes.*

Sources cannot be loaned or given to another establishment without first confirming that the receiving establishment is authorised to use the material.

Notification of Certain Occurrences The release to atmosphere (in excess of any internal limit) or the spillage of significant quantities of material (stock bottle containing MBq quantities) must be reported to Safety Services so that an investigation can be carried out and the HSE/EA notified, as appropriate, if the release/spill is confirmed. Similarly if it is believed that significant quantities (Reg 30(3) col 5 of Schedule 8) have been lost or stolen then Safety Services must be informed immediately. They will be responsible for notifying the authorities if this is found to be necessary. (*See Table 1 below for extracts from Schedule 8 to IRR99 giving details of notification levels for the HSE - NB EA notification levels vary but are much lower.)*

A *critical examination* must be carried out by an RPA for any new item of equipment that emits ionising radiations. Although this is primarily the manufacturer's responsibility, the university may be asked to carry this out on their behalf.

There are special regulations that govern the use of *equipment/radioactive substances used for medical exposures*. Please contact Safety Services if you require details of these.

Table 1 Common Radionuclides from Schedule 8 of IRR99

	Regulation 6 and Schedule 1		Regulation 30	
Radionuclide	**Concentration for notification Bq/g**	**Quantity for notification Bq**	**Quantity for notification of release or spillage Bq**	**Quantity for notification of loss or theft Bq**
Tritium	$1\ 10^{6}$	$1\ 10^{9}$	$1\ 10^{12}$	$1\ 10^{10}$
C-14	$1\ 10^{4}$	$1\ 10^{7}$	$1\ 10^{11}$	$1\ 10^{8}$
C-14 dioxide	$1\ 10^{7}$	$1\ 10^{11}$	$1\ 10^{13}$	$1\ 10^{12}$
Na-22	$1\ 10^{1}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
Na-24	$1\ 10^{1}$	$1\ 10^{5}$	$1\ 10^{11}$	$1\ 10^{6}$
P-32	$1\ 10^{3}$	$1\ 10^{5}$	$1\ 10^{10}$	$1\ 10^{6}$
P-33	$1\ 10^{5}$	$1\ 10^{8}$	$1\ 10^{11}$	$1\ 10^{9}$
S-35	$1\ 10^{5}$	$1\ 10^{8}$	$1\ 10^{11}$	$1\ 10^{9}$
Cl-36	$1\ 10^{4}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
Ca-45	$1\ 10^{4}$	$1\ 10^{7}$	$1\ 10^{10}$	$1\ 10^{8}$
Cr-51	$1\ 10^{3}$	$1\ 10^{7}$	$1\ 10^{12}$	$1\ 10^{8}$
Fe-55	$1\ 10^{4}$	$1\ 10^{6}$	$1\ 10^{11}$	$1\ 10^{7}$
Fe-59	$1\ 10^{1}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
Co-57	$1\ 10^{2}$	$1\ 10^{6}$	$1\ 10^{11}$	$1\ 10^{7}$
Co-60	$1\ 10^{1}$	$1\ 10^{5}$	$1\ 10^{10}$	$1\ 10^{6}$
Ni-63	$1\ 10^{5}$	$1\ 10^{8}$	$1\ 10^{11}$	$1\ 10^{9}$
Zn-65	$1\ 10^{1}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
Rb-86	$1\ 10^{2}$	$1\ 10^{5}$	$1\ 10^{11}$	$1\ 10^{6}$
Sr-90	$1\ 10^{2}$	$1\ 10^{4}$	$1\ 10^{9}$	$1\ 10^{5}$
Tc-99m	$1\ 10^{2}$	$1\ 10^{7}$	$1\ 10^{13}$	$1\ 10^{8}$
Cd-109	$1\ 10^{4}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
In-111	$1\ 10^{2}$	$1\ 10^{6}$	$1\ 10^{11}$	$1\ 10^{7}$
I-125	$1\ 10^{3}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
I-131	$1\ 10^{2}$	$1\ 10^{6}$	$1\ 10^{10}$	$1\ 10^{7}$
Cs-137	$1\ 10^{1}$	$1\ 10^{4}$	$1\ 10^{10}$	$1\ 10^{5}$
Ra-226	$1\ 10^{1}$	$1\ 10^{4}$	$1\ 10^{7}$	$1\ 10^{5}$
Th-232 sec	$1\ 10^{0}$	$1\ 10^{3}$	$1\ 10^{6}$	$1\ 10^{4}$
U-238 sec	$1\ 10^{0}$	$1\ 10^{3}$	$1\ 10^{6}$	$1\ 10^{4}$
Am-241	$1\ 10^{0}$	$1\ 10^{4}$	$1\ 10^{6}$	$1\ 10^{5}$

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