Risk Assessments for work involving sealed or unsealed sources of ionising radiation

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In comparison with previous legislation (IRR85), there is a much greater emphasis on Risk Assessment in IRR99. Thus, before any new activity involving work with ionising radiation starts the employer is required to undertake a Risk Assessment. *In most instances, Project Supervisors and their research teams will carry out these assessments with advice from the RPS.*

General

Regulation 7 of the Ionising Radiations Regulations, 1999 (IRR99) states that:

(1) "Before a radiation employer commences a new work activity involving work with ionising radiation in respect of which no Risk Assessment has been made by him, he shall make a suitable and sufficient assessment of the risk to any employee and other person for the purpose of identifying the measures he needs to take to restrict the exposure of that employee or other person to ionising radiation".

(2) "A radiation employer shall not carry out work with ionising radiation unless he has made an assessment sufficient to demonstrate that:
(a) all hazards with the potential to cause a radiation accident have been identified, and
(b) the nature and magnitude of the risks to employees and other persons arising from those hazards have been evaluated".

(3) "Where the assessment made shows that a radiation risk to employees or other persons exists from an identifiable radiation accident, the radiation employer shall take all reasonably practicable steps to:
(a) prevent such an accident;
(b) limit the consequences of any such accident which does occur; and
(c) provide employees with the information, instruction and training and with the equipment necessary, to restrict their exposure to ionising radiation".

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Background to the requirements for Risk Assessments

Before commencing a work activity involving ionising radiations, the employer (in this case, the Head of School) has a responsibility to ensure that a Risk Assessment is made which identifies the hazards and evaluates the nature and magnitude of the risk to which both workers and members of the general public could be subjected. *This requirement for a prior Risk Assessment complements the related requirements of Regulation 3 of the Management of Health and Safety at Work Regulations 1997 (MHSWR).*

Under IRR99 therefore, an activity involving work with ionising radiation may not commence until a Risk Assessment has been made. Once the work commences, the Assessment must be recorded, regularly reviewed, and maintained up-to-date where there has been a significant change in the matters to which it relates.

If the intended activity is already covered by a suitable and sufficient assessment undertaken for the purposes of MHSWR, nothing further needs to be done to satisfy Regulation 7(1) of IRR99.

Where the work with ionising radiation was being carried out before IRR99 came into force, and a Risk Assessment had been prepared as required by Regulation 3 of MHSWR, that assessment may need to be reviewed to make sure it remains '***sufficient'*** and ***'suitable'*** under IRR99. The purpose of the Risk Assessment under MHSWR is to help determine what measures should be taken to comply with relevant duties under the 'relevant statutory provisions' which include Health and Safety Regulations such as IRR99. Therefore, any existing assessment may have to be revised.

A suitable and sufficient prior Risk Assessment made, under Regulation 7(1) of IRR99, for any new activities will be sufficient to satisfy the requirements of MHSWR as far as radiation protection is concerned. However, the radiation protection aspects of the work should not be considered in isolation from other Health and Safety considerations since, for example, some control methods for restricting exposure to ionising radiation by using distance and shielding might pose unacceptable risks. Therefore, in order to satisfy both Regulation 7 of IRR99 and Regulation 3 of MHSWR, the Risk Assessment will need to consider the differing radiological and conventional risks associated with alternative techniques under consideration for the work,

Responsibility for undertaking the prior Risk Assessment

The responsibility to undertake a prior Risk Assessment is placed on the Head of School since, for the purposes of this Regulation, a radiation employer is defined as including an employer who **intends** to carry out work with ionising radiation.

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Advice on preparing a Risk Assessment

Depending upon the individual circumstances, the Risk Assessment may be made by the RPS or project Supervisor, acting on behalf of the Head of School. For the purposes of this document, the individual making the Risk Assessment will be termed the "Assessor".

It is important to identify significant risks before the work commences, and the detail of a Risk Assessment should be proportionate to the perceived risk and action required. Activities handled, estimated dose-rates and the likelihood of contamination are all factors that will determine the designation of the work area, and this in itself should act as a guide in assessing the magnitude of the risks. For example, in work involving unsealed radiation sources, if it can be clearly demonstrated that radiation doses to workers are likely to be extremely low, then there is little more to be done other than detailing standard working procedures for that type of work. In many cases therefore, simple generic assessments (e.g. covering several projects) will be acceptable, as long as they can be shown to be suitable and sufficient. The individual researcher should be involved in the assessment process as a means of monitoring their competence in radiation safety.

Given the precautions already taken to practice the principles of 'ALARP', and the record of minimal radiation doses in university teaching and research, the residual risks of most activities using sources of ionising radiation will be very small, and the conclusions of the Risk Assessments should reflect this.

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Risk Assessments for work with unsealed sources

The Assessor should be familiar with the properties of all the radionuclides that it is intended to use. The following items will also need to be considered:-

- the frequency of the procedure;
- the likelihood of contamination arising and being spread;
- the degree of any external radiation hazard;
- the degree of any air contamination hazard;
- estimated radiation doses to which anyone can be exposed;
- the results of any previous dosimetry or area monitoring relevant to the proposed work;
- manufacturers guidance relating to storage, dispensing and handling;
- any planned 'Systems of Work';
- the risks associated with different waste streams;
- the suitability of laboratory facilities;
- the effectiveness of general procedures taken to restrict exposure; shielding, containment
- monitoring, protective clothing;
- possible accident scenarios, their likelihood and potential severity;
- the consequences of possible failures of control measures - such as ventilation systems, warning devices - or Systems of Work;

• steps to prevent identified accident situations, or limit their consequences.

Specimen Risk Assessment for Unsealed Sources

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Risk Assessments for work with sealed sources

The Assessor should be familiar with the sources used and the dose-rates associated with them. Normally, high activity sources should be housed in purpose-built equipment or facilities such that the dose-rate to which a worker would normally be exposed would be less than 7.5 μSv.h-1 and usually less than 2.5 μSv.h-1 if reasonably practicable. The Assessor must carry out a survey to establish that the dose-rates outside the equipment are satisfactory. Only those personnel involved in source changing are likely to be subjected to higher dose rates and a significant risk of exposure. The Risk Assessment should therefore focus on these operations which those personnel perform, and an estimate of dose/operation should be recorded (This may not be necessary if this work is contracted to a third party). The following items will also need to be considered:-

• the activity of the source;

• frequency of the procedure;

• the degree of any external radiation hazard;

• estimated radiation doses to which anyone can be exposed;

• the results of any previous dosimetry or area monitoring relevant to the proposed work;

• any planned Systems of Work

• the effectiveness of general procedures taken to restrict exposure; shielding, containment;

• possible accident scenarios, their likelihood and potential severity;

• steps to prevent identified accident situations, or limit their consequences.

Specimen Risk Assessment for Sealed Sources

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Risk Assessments and emergency procedures

Regulation 7(2) of IRR99 requires Employers to assess the work with ionising radiation they intend to undertake for possible radiation accidents. This will normally mean establishing what accident scenarios are possible, their likelihood and their potential severity. Where the work was in progress before IRR99 came into force, the Assessor will need to ensure that any assessment of hazards carried out in compliance with IRR85 remains sufficient under the current Regulations.

The Assessor should therefore evaluate accident scenarios and consider the actions to be taken in emergency situations. Each 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.

Where the work is carried out in a Controlled Area and a radiation accident is reasonably foreseeable (e.g. spillages, fire), then the contingency plan will need to be more detailed, and should be incorporated into the Local Rules. Those workers affected will need to receive appropriate training in implementation of the contingency plan, and rehearsals of the plan should be carried out and recorded.

The assessment of accident hazards should take account of the consequences not only of equipment failures, but also of a breakdown in work systems and predictable forms of unauthorised behaviour by personnel. The scope and comprehensiveness of this aspect of the assessment should match the circumstances. If a particular accident scenario is shown to be either extremely unlikely or trivial in its consequences, then the assessment need go no further.

Once the assessment has identified how an accident could occur, Regulation 7(3) requires the provision of reasonably practicable measures either to prevent its happening, or to limit its consequences. These measures need to be permanent in nature to achieve an ongoing reduction of risk, and are different from the planned actions designed to mitigate an accident once it takes place which are likely to be reflected in the contingency plan. The prevention measures should flow naturally from the analysis of accident causation in the assessment.

The preparation of a Risk Assessment should thus enable the Assessor and Head of School to determine:

• what action is needed to ensure that the radiation exposure of all persons is kept as low as reasonably practicable;

• what steps are necessary to achieve this control of exposure by the use of engineering controls, design features, safety devices and warning devices and, in addition, by the development of Systems of Work;

• whether it is appropriate to provide personal protective equipment and if so, what type would be adequate and suitable;

• whether it is appropriate to establish any dose constraints for planning or design purposes, and if so, what values should be used;

• the need to alter the working conditions of any female employee who declares she is pregnant or breastfeeding;

• an appropriate investigation level to check that exposures are being restricted as far as reasonably practicable;

• what maintenance and testing schedules are required for the control measures selected;

• what contingency plans are necessary to address reasonably foreseeable accidents;

• the training needs of classified and non-classified employees;

• the need to designate specific areas as Controlled or Supervised Areas, and to specify

Local Rules;

• the actions needed to ensure restriction of access and other specific measures in Controlled or Supervised Areas;

• the need to designate certain employees as classified persons;

• the content of a suitable programme of dose assessment for employees designated as classified persons and for others who enter Controlled Areas;

• the responsibilities of managers for ensuring compliance with these Regulations; and

• an appropriate programme of monitoring or auditing of arrangements to check that the requirements of these Regulations are being met.

If a School undertakes a number of very similar activities involving ionising radiation, then a generic assessment would be acceptable, provided it encompassed the range of risks that are likely to be encountered.

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Recording the Results of the Risk Assessments

All Risk Assessments should be recorded, but this does not mean duplication of existing procedures. It should, for example, already be standard practice to draw up guidelines in the form of:

• a protocol;

• working instructions;

• Local Rules for each project or item of equipment.

These guidelines should reflect the results of the Risk Assessment, detailing any action necessary to reduce exposure, and ***should constitute evidence of a Risk Assessment having been undertaken.*** They may need only slight modification to meet current regulatory requirements. This record, which may be in paper or electronic form, will represent an effective statement of the risks the work presents, and should lead the Head of School to take the necessary actions to protect employees and others exposed to ionising radiation.

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Review and Revision of the Risk Assessment

Regulation 3(3) of MHSWR requires review of the Risk Assessment if there is reason to suspect that it is no longer valid, or if there has been a "significant" change in the work activity However, in most cases it will be prudent to review the validity of the Risk Assessment and the correctness of its conclusions periodically, as part of standard Health and Safety management practice. The results of such reviews should be recorded. In general, the frequency of a review should be determined by the nature of the work, the degree of risk, and the extent of any likely change in the work activity.

One way in which an Assessor might decide that an assessment is invalid is through checking the results of personal dosimetry or area monitoring. These results could indicate a breakdown in controls and so highlight the need for a formal review of whether the procedures in place are satisfactory. A "significant" change in the work activity may include such matters as:

• the introduction of a radioactive source of a much higher activity, or a source which emits a different type or quality of radiation;

• alterations to engineering controls or safety features (e.g. to shielding or containment);

• human factors, (e.g. those arising from staff turnover).

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Restriction of exposure

Many design features must be incorporated in radioisotope manipulation procedures to reduce radiation exposure. Shielding and containment are of particular importance and the general philosophy is that all radiation doses should be kept "as low as is reasonably practicable" (The ALARP principle). This means that it is not merely necessary to keep within the dose limits, but to keep as far below these limits as is practicable. Engineering controls and design features have to be augmented by written Systems of Work, and protective clothing ("personal protective equipment") in order to restrict exposure. The dose limit to women declared pregnant is also contained in this section. Note that a pregnant woman is only legally pregnant when she has informed her employer **in writing** and after this time the foetus is restricted to a radiation dose of 1 mSv (see also below).

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Personal protective equipment and the maintenance and examination of engineering controls etc

The employer must supply these types of protection (laboratory coats, latex gloves as a minimum) where it is necessary and ensure that there is a suitable maintenance routine. Facilities must be provided for the storage of protective clothing.

Contingency plans

The Risk Assessment must identify "reasonably foreseeable" hazards, and a contingency plan (or plans) must be made to deal with the hazard if it occurs. Details of these plans have to be included in the School Local Rules (see below) and, where "appropriate" rehearsed at suitable intervals.

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Radiation Dose Limits under the Ionising Radiation Regulations 1999

The radiation dose limits are detailed in schedule 4 of the regulations. It is highly unlikely that a university worker will receive greater than 1/10 of any dose limit under normal working conditions.

The effective dose limit in any calendar year is:-

for employees aged 18 years or over - 20 mSv;

for trainees aged under 18 years - 6 mSv;

for any other person - 1 mSv.

Dose limits for individual organs and tissues

Without prejudice to the effective dose limit, the equivalent dose limit for skin, hands, forearms, feet and ankles in any calendar year is:-

for employees aged 18 years or over - 500 mSv;

for trainees aged under 18 years - 150 mSv;

for any other person - 50 mSv.

The dose to skin shall be averaged over 1 cm2.

Dose limits for the lens of the eye

The dose limit for the lens of the eye in any calendar year is:

for employees aged 18 years or over - 150 mSv;

for trainees aged under 18 years - 50 mSv;

for any other person - 15 mSv.

Dose limit for the abdomen of a woman of reproductive capacity

The dose limit for the abdomen of a woman of reproductive capacity who is at work, is the equivalent dose from external radiation resulting from exposure to ionising radiation averaged throughout the abdomen of **13 mSv** in any consecutive three month interval.

Dose limit for the abdomen of a pregnant woman

The dose limit for the abdomen of a pregnant woman who is at work being the dose equivalent from external radiation resulting from exposure to ionising radiation averaged throughout the abdomen, shall be **1 mSv** during the declared term of pregnancy.