

Aspects of Regulatory Guidance applicable to Work with X-rays.

Prior Authorisation (Reg 5, IRR99)

There is now a requirement for work involving accelerators or electrical equipment intended to produce X-rays to be subjected to prior authorisation. The HSE have made this requirement as straightforward as possible and have issued generic authorisations covering these practices (copies attached). Providing the conditions of the relevant generic authorisation can be complied with no further action is required. If, however, the conditions cannot be complied with then one needs to apply to the HSE for an individual authorisation. It is not envisaged that this should be necessary in the context of university research. Note that the use of x-rays for routine analytical work and for veterinary work are exempt from the requirements of prior authorisation.

Restriction of Exposure (Reg 8, IRR99)

The general duty to restrict exposure covers both the decision to work with ionising radiation and the selection of the source of ionising radiation. One of the first considerations is whether the risk can be avoided by choosing an alternative technique not involving ionising radiation. But any alternative should not present other risks of a greater magnitude.

Having chosen to use x-rays consideration should be given to minimising the risk by the use of appropriate beam filtration, effective collimation and careful choice of operating voltage and beam current.

Where reasonably practicable, work involving exposure to external radiation should be done in a room, enclosure, cabinet or purpose-made structure which is provided with adequate shielding. In other cases, adequate local shielding should be used as far as reasonably practicable. Shielding, including beam collimation, will normally be adequate if designed to reduce dose-rates below $7.5\mu\text{Sv/h}$. If the device is designed for use in public areas or where there is continuous access to the working area by employees or others not directly involved in the work, the shielding should be designed to reduce dose-rates to the lowest level that is reasonably practicable. In this case the dose-rate should be so low that it is unnecessary to designate the area around the device as a supervised area.

In many cases, shielding will either form part of the equipment (eg covers, shutters and collimators) or an enclosure around the device (eg a room or purpose-made structure).

Fluoroscopic devices should be provided with viewing facilities that do not permit direct vision of the fluoroscopy screen.

Exposure Controls

Where control systems permit, interlocks or trapped key systems should be provided and properly used where they can prevent access to high dose-rate enclosures. They should be fitted so that the control system will ensure an exposure:-

- a) cannot commence while the access door, access hatch, cover or appropriate barrier to the enclosure is open;
- b) is interrupted if the access door, access hatch, cover or barrier is opened; and
- c) does not recommence on the mere act of closing a door, access hatch, cover or barrier.

Normally, it should be reasonably practicable to design control units for x-ray generators to prevent unintended and accidental exposure. To avoid any possible confusion, control switches usually need to be labelled clearly and unambiguously.

Effective interlock devices should be designed and installed in such a manner that if they fail to operate correctly no exposure of people can occur.

Where there is a risk of significant exposure arising from unauthorised or malicious operation of x-ray generators employers should make use of equipment that has been fitted with locking-off arrangements to prevent its uncontrolled use.

The initiation of exposures should be under key control, or by some equally effective means, so as to prevent unintended or accidental emission of a radiation beam. Where key-operated devices are provided, arrangements will be needed to ensure that keys are only available to authorised employees.

Warning Devices

Sources of ionising radiation which can give rise to significant exposure in a very short period of time should be fitted with suitable warning devices which, except in the case of diagnostic radiology:-

- a) indicate for an x-ray generator when the tube is in a state of readiness to emit radiation and give a signal when the useful beam is about to be emitted and a distinguishable signal when the emission is under way unless this is impracticable;
- b) for x-ray generators are designed to be automatic and fail-safe, ie if the warning device itself fails the exposure will not proceed.

The radiation employer should make sure that warning signals can be seen or heard by all those people who need to know the status of the radiation equipment for protection purposes.

Automatic warning devices should be reasonably practicable for most x-ray generators. If it is considered not reasonably practicable for all warning devices to be fail-safe, daily checks that such devices are working may suffice in the short term. Where a visual device relies on a single bulb, it may be sufficient to modify the device to use two bulbs.

Safe Systems of Work

The engineered safety features should, so far as reasonably practicable, be supported by systems of work to be followed by employees and other people when present in the vicinity of the x-ray equipment. In circumstances where a person working with ionising radiation could receive an overexposure in a relatively short time, for example several minutes or less, these systems of work should normally be formalised. This may involve the issue of a 'permit-to-work' that allows strict management control over the conditions in which work will proceed, how it will be done, and how it will be supervised.

It is crucially important that that detailed safe systems of work are produced for work on equipment in which any of the engineered safety systems have been disabled. Close supervision of the work may be necessary. Examples include the setting up and alignment of x-ray optics equipment.

Maintenance of Controls (Reg 10, IRR99)

All active engineering controls and design features, safety features and warning devices should be properly maintained and subjected to a regime of examination and test at suitable intervals.

'Maintenance' means 'maintained in an efficient state, in efficient working order and good repair'. All physical control features should continue to perform as originally intended. It may not be reasonably practicable to ensure at all times that complex enclosures or safety devices are in an efficient state and in efficient working order. In such cases, where failures are revealed, eg during the examination and tests, the employer should either cease that work with ionising radiation or take other effective action to restrict exposure until the enclosure or device is restored to efficient working order.

The effectiveness and performance of the active engineering controls would normally be assured and checked when any acceptance test is done, before the equipment is first put into use. The periodic tests and inspections can be seen as repeating a sample of the original acceptance tests.

The radiation employer should be satisfied that the person undertaking the examination or test has appropriate competence in order to ensure that the examination or test is sufficiently thorough. The frequency of these periodic tests might be about once per year or more frequently depending upon circumstances. The employer might consider:-

- a) the possible dose implications of a failure;
- b) the reliability of the control measure;
- c) the doses likely to be received by staff while carrying out any examination or test.

Sufficient records should be kept of these examinations and tests to enable the radiation employer to identify which controls, features or devices have been examined or tested, what action is required to maintain them and when the next examination or test is due.

The radiation employer would normally retain details such as the date and nature of the test and the name of the person carrying it out. The details could be held in paper or electronic records. The records could take the form of a general maintenance log.

In addition to the formal tests it is advisable to regularly carry out visual checks of all active control measures used to prevent or restrict exposure. For safety-critical features, these visual checks should be carried out on a daily basis.

Critical Examination by Installer/ Erector (Reg 31(2), IRR99)

Where a person erects or installs x-ray equipment they should undertake a critical examination of the installation to ensure that:-

- a) the safety features and warning devices operate correctly; and
- b) there is sufficient protection for persons from exposure to ionising radiations.

The installers or employers RPA should be consulted with regard to the nature and extent of the critical examination.

The installer should provide the radiation employer with adequate information about proper use, testing and maintenance of the equipment.

The critical examination may be carried out following erection or installation, during commissioning, or as part of trials prior to normal use, and may require co-operation between the various employers involved. The duty to ensure that the critical examination is carried out rests with the employer who erects or installs the article, not the user. This remains the case even if the critical examination is carried out, by agreement, during final trials under the supervision of the user's own RPA.