

University of Cambridge
DEPARTMENT OF MATERIALS SCIENCE & METALLURGY

LOCAL RULES FOR THE X-RAY AREA

These "Local Rules" are issued under the guidelines of the Ionising Radiation Regulations 1999 and Code of Practice.

The overall objective of these rules is to ensure that any dose to any person in the X-ray area is as low as reasonably achievable and less than 2 mSv per annum.

1. Definitions

- 1.1. The University's Radiation Protection Adviser (RPA) is Ms Libby Yates (network **66354**) email ly215@cam.ac.uk
- 1.2. Radiation Protection Supervisors (RPS's) in the Department of Materials Science & Metallurgy:
 - Local Radiation Protection Supervisor for the X-ray area:
Mr. Wayne Skelton-Hough (network **34352**, e-mail wrh23@cam.ac.uk)
 - Senior Radiation Protection Supervisor:
Prof Jason Robinson (network **61051**, email jjr33@cam.ac.uk)

Note: Problems/inquiries should initially be referred as soon as possible to Mr. Skelton-Hough

- 1.3. Supervised Area: Laboratory -1_009 (The X-ray Lab) is designated as a supervised area.
- 1.4. Controlled Areas (Enclosures)
When the X-ray shutter is open the following are defined as Controlled Areas:
Enclosed Equipment - the space within the interlocked PVC/lead-glass/steel cabinets of any of the X-ray machines
- 1.5. Monitors
Monitors, calibrated through the University Safety Office, are available to check for any possible radiation leak. Note that the response of these monitors is dependent on the wavelength (energy) of the radiation. The Geiger counters are calibrated and can give an estimate of the dose equivalent (in mSv). These counters are more sensitive to harder (short wavelength / high energy) radiation. The scintillation counter is very sensitive (particularly to softer radiation) and it has a larger probe. Thus this is useful for leak checking but has no certified calibration.

2. Normal Operations

- 2.1. No-one may work in the X-ray area until he/she has received appropriate training in the use of the equipment and general safety procedures. This training is arranged through Mr. Skelton-Hough or Ms Vickers.
- 2.2. In normal use the level of ionising radiation in the laboratory does not, and must not be allowed to, exceed background levels (i.e. the normal level inside the building).
- 2.3. Lights local to each instrument must be visible to indicate that
 - a) the X-ray tube is energized (usually says "X-rays ON")
 - b) the X-ray shutter is open.
- 2.4. All equipment must be properly interlocked so that
 - a) the X-ray shutter cannot be opened until the enclosure is closed
 - b) any intrusion into a controlled area causes the X-ray shutter to close and/or the generator to shut down.
- 2.5. Workers must deliberately
 - a) shut the enclosure before opening the X-ray shutter
 - b) check that the X-ray shutter is closed before opening the enclosure

On some of the newest equipment the shutter is opened/closed by the software, with an additional manual override. However, points 2.5 a) and b) should still be carried out.

Do not use the interlocks as a means of closing the shutter.

- 2.6. Shutters and interlocks must **not** be overridden in normal use.
In the event of a clearly defined need to override the safety circuits, the procedure for working in a Controlled Area (section 3) must be followed.
N.B. Only designated persons are permitted to work in Controlled Areas. It is forbidden for anyone else to override any safety device, interlock or shutter.
- 2.7. When all or part of, the shielding or an enclosure has been removed and subsequently refitted, radiation checks must be carried out to ensure proper fitting of the shielding or enclosure.
- 2.8. If an X-ray tube is changed to harder radiation (e.g. Mo K α), radiation checks must be carried out.
- 2.9. A record of monitoring (2.7 and 2.8) must be kept.

3. System of Work in a Controlled Area (Enclosures)

- 3.1. Only the following persons are permitted to work in Controlled Areas:

Wayne Skelton-Hough & Mary Vickers

They may also give permission for X-ray engineers to override safety circuits.

- 3.2. A light or other warning should indicate that the safety circuit has been overridden.
- 3.3. Work in a controlled area, e.g. alignment, must only be carried out when there is no reasonable alternative. Alignment should be carried out at the minimum usable voltage and current.
- 3.4. Only one shutter may be open during alignment.
- 3.5. The worker should have a reasonable estimate of the radiation hazard within the Controlled Area. If in doubt consult the Department's coordinating RPS or the University's Radiation Officer or one of the RPA's (see 1.1, 1.2, 1.3).
- 3.6. Finger and/or body badges should be worn when working in a controlled area.
- 3.7. The worker must keep his/her body behind the protective shielding as much as possible.
- 3.8. When the work has been completed the Controlled Area must be immediately returned to normal operating conditions with safety circuits operational.
- 3.9. A Controlled Area must never be left unattended with safety circuits overridden.

4. Risks

- 4.1. Anyone who thinks she may be PREGNANT is advised to consult either the Departmental Safety Officer (contact reception on 34300), or the University Occupational Health, network 36594, before embarking on work using X-rays.
- 4.2. In a crystallographic laboratory, the most common accidents are irradiation of fingers or eyes during alignment. Fingers in the main beam for a few moments could receive a serious X-ray burn, which would require hospital treatment. Radiation can cause cataracts in the eye and increased likelihood of cancer.
- 4.3. Substantial doses to the whole body can cause cancer or sterility.

5. Contingency Plan

Anyone who thinks that they may have been irradiated should immediately inform Wayne Skelton-Hough or Nathan Cliff during normal working hours and University Security on 31818 at other times.

- 5.1. If you think that there is a safety risk associated to any machine in the X-ray area you should:
 - a) close the shutter
 - b) securely close the enclosure
 - c) immediately inform Wayne Skelton-Hough or Nathan Cliff
 - d) inform the next user verbally and by placing a notice on the machine