



## LOCAL RULES FOR X-RAY DIFFRACTOMETERS

Ionising Radiations Regulations 2017

Updated: February 2024

### 1. INTRODUCTION

The local rules apply to work with the single crystal and powder x-ray diffraction equipment. They are the general principles and a description of the means of complying with the Ionising Radiations Regulations 2017 (IRR17) and University Policy Statement (UPS1/12): *Management of Work with Ionising Radiation at the University of Oxford*.

**COMPLIANCE WITH THESE LOCAL RULES BY ALL PERSONS IS MANDATORY**

**IN THE EVENT OF ANY INCIDENT OR ACCIDENT INVOLVING X-RAY GENERATORS, THE APPROPRIATE CONTINGENCY PLAN IN APPENDIX 1 SHOULD BE FOLLOWED**

### 2. CONTACTS

Senior Radiation Protection Supervisor (SRPS):	Dr Adam Hardy	01865 2 75677
X-ray diffraction RPS:	Dr Simon Cassidy	01865 2 72610

The RPSs are responsible for supervising the work with ionising radiation to ensure compliance with these Local Rules.

University Radiation Protection Officer (URPO):	Mr Paul Kayente	01865 270802
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The URPO may be contacted for advice on all radiation protection matters.

### 3. DESIGNATION OF AREAS

Controlled<sup>1</sup> or supervised<sup>2</sup> areas need not be designated during routine use of the x-ray diffraction equipment since inherent engineering controls (incl. shielding & collimation) and safety features (e.g. safety interlock devices) effectively prevent access to the inside of the cabinets where high radiation dose rates exist.

Additional areas may require designation during service and maintenance work by the equipment's service engineers. Arrangements for designation of those areas; restriction of access; and work within them is the responsibility of the service company in cooperation with the department. See section 7.3 to 7.6.

### 4. INVESTIGATION LEVEL

4.1 The University has set a dose investigation level of 1 mSv body dose<sup>3</sup> within a calendar year. The Department

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<sup>1</sup> Controlled areas are areas where radiation safety procedures should be followed because of the potential for access to radiation levels above 7.5 microsieverts per hour (body) or 75 microsieverts per hour (hands).

<sup>2</sup> Supervised areas are those where routine risks of exposure are not significant but would nonetheless benefit from being kept under review should; for example, if more significant exposures are possible in the event of an accident, incident or reasonably foreseeable failure.

<sup>3</sup> The investigation level provides sufficient protection against significant x-ray exposure of the foetus during pregnancy. Consequently, no specific controls are required to protect female workers.

and Safety Office will investigate any cumulative recorded radiation dose in excess of this figure. External whole body exposures above this investigation level are not reasonably foreseeable during x-ray diffraction experiments since accessible radiation dose rates around the equipment do not exceed 1  $\mu$ Sv per hour.

- 4.2 During work where access to the open beam is required, significant partial body exposures (i.e. to the skin and eye) are possible if poor procedures are adopted, potentially even radiation injuries. Such work by University personnel is not covered by these local rules and is not permitted.

## **5. AUTHORISED USE**

- 5.1 Only registered radiation workers who have received appropriate training in radiation safety<sup>4</sup> and have received specific training in departmental procedures and instruction in safe use of equipment by the RPS are permitted to work with ionising radiation.
- 5.2 Before any apparatus that is a potential source of ionising radiation is brought into the laboratory, the written authorisation of the Senior Radiation Protection Supervisor or their approved deputy must be obtained.
- 5.3 The SRPS must be informed of all proposed new work with ionising radiation or changes of methods/techniques. The SRPS will notify the URPO in advance of commencing any new work.
- 5.4 No work with radiation generators should be carried out unless a risk assessment<sup>5</sup> has been carried out.
- 5.5 Users must make no attempt to override or tamper with the cabinet interlocks. Only specifically authorised service engineers who hold the appropriate permit to carry out such work (see Appendix 2 of these rules) are permitted to work within the cabinets with the interlocks defeated; with or without the shutter open.

## **6. PERSONAL PROTECTION**

- 6.1 All persons should take care to ensure that their own and others' exposures to ionising radiation are as low as reasonably practicable.
- 6.2 If you consider that you might have received a radiation exposure *greater than expected*, notify the RPS and SRPS, informing them of the circumstances of the potential exposure e.g. equipment, operating parameters, proximity, duration of exposure etc.

## **7. WRITTEN ARRANGEMENTS FOR X-RAY DIFFRACTION WORK**

### ***Routine experimental use***

- 7.1 Equipment should be operated in accordance with the manufacturer's instructions and user training provided by the Department.
- 7.2 Users must make no attempt to override or tamper with the cabinet interlocks.

### ***Beam alignment***

- 7.3 Use of the equipment and work requiring safety features to be defeated is not permitted, except by authorised and competent equipment service engineers in accordance with documented maintenance procedures. See 7.4 to 7.6.

### ***Service engineers***

- 7.4 Visiting service engineers must provide copies of method statements, systems of work for any work they intend to undertake on the x-ray equipment. This documentation should state clearly the hazards associated with the work; whether any safety features will be compromised and what actions will be taken to restrict their own or Oxford personnel exposures.

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<sup>4</sup> See section 4.4 and appendix 6 of University Policy S1/12.

<sup>5</sup> A generic risk assessment has been prepared for routine work with x-ray diffractometers (RSID7). See ionising radiation guidance pages on the Safety Office website. Further task-specific assessments will be required for matters outside the scope of this assessment e.g. specific maintenance procedures.

- 7.5 Before work is allowed to commence, the departmental RPS should be provided with confirmation that any of the requisite control measures identified by the information supplied in 7.4 have been implemented. The handover document in Appendix 2 of these local rules should be used.
- 7.6 Prior to leaving site, the service engineers should leave the equipment and all safety systems in full working order and must provide confirmation that they have done this before the equipment may be put back into general use.

## **8. ROUTINE MONITORING & SAFETY CHECKS**

- 8.1 The continued function of cabinet safety interlocks and warning devices should be checked at monthly intervals and the results recorded.
- 8.2 Measurements should be made and recorded monthly of radiation dose rates around each cabinet (for the periods of use, instrument downtime must be recorded in the log book).
- 8.3 Failures of safety devices or unexplainable increases in dose rate should be reported to the SPRS. The equipment should be taken out of service until the equipment service engineers have carried out the necessary remedial work and the equipment has been declared safe to return to service.
- 8.4 Further to the above checks, in the event that any safety feature or warning device is found to have failed to function during routine operations, it should be taken out of service until the equipment service engineers have carried out the necessary remedial work and the equipment has been declared safe to return to service.

## **9. CONTINGENCY PLANS**

Contingency plans for reasonably foreseeable incidents are contained in Appendix 1.

## APPENDIX 1: CONTINGENCY PLANS

The likelihood of incidents which would result in a significant risk to members of staff, emergency services personnel or members of the public is very low. However, in the event of an incident, the actions detailed in these contingency plans should be followed to ensure that radiation exposures are as low as reasonably practicable.

**Nothing in this plan precludes action which needs to be taken to save life or assist an injured person. However, where such action is required in the presence of high radiation dose rates, this should be done under radiation protection supervision where possible.**

When implementing any contingency plan, a record of names of all persons involved, their locations with respect to radiation sources in the laboratory and times of exposure should be kept to enable an assessment of doses to be made.

Specific contingency plans are provided for the following reasonably foreseeable incidents:

1. Equipment faults/failures
2. Personal exposures
3. Fire in the building
4. Breakdown of controls

**Note:** In the event of an emergency, actions assigned to the SRPS in these plans may need to be undertaken by the RPS. Also, actions assigned to the URPO in these plans may need to be undertaken by a person deputising for them. If the URPO is unavailable then the emergency call-out list should be used to obtain assistance.

### 1. Equipment faults/failures

For example, loss of shielding, failure of safety features (interlocks, warning lights), errant beams, beam termination failure etc.

- In the event of any safety-related equipment faults, remove the power supply and do not re-use the equipment until service engineers have corrected the fault.

### 2. Personal exposures

- Anyone who considers they may have received a significant radiation exposure should notify the RPS and SRPS as soon as possible.
- The exact details of the exposure (operating parameters, distances, exposure times, part of body, witnesses etc) should be recorded.
- The URPO should be notified forthwith. Following notification, an investigation of potential exposures will be undertaken by the URPO and SRPS.

### 3. Fire in the building

- On hearing the fire alarm, follow normal fire procedures for the laboratory.
- If the fire has affected the part of the building in which the radiation generators are situated, it must be assumed that the equipment may have been damaged. The advice of the URPO should be sought prior to reusing the x-ray generators.

### 4. Breakdown of controls

The RPS should notify the SRPS of any breakdown in procedural controls whether or not they resulted in significant radiation exposure. For example, the use of x-ray sets by unauthorised/non-registered staff. The SRPS should investigate all notified incidents to review whether existing procedures remain sufficient. The advice of the URPO should be sought.

**APPENDIX 2: PERMIT TO WORK WITH INTERLOCKS DEFEATED**

<b>1.</b>	<b>WORK TO BE CARRIED OUT</b>			
	Person requesting permit:			
	Work to be carried out:			
	Have you read the local rules, including the written arrangements for beam alignment?			Yes / No
	Signature:		Date:	
<b>2.</b>	<b>AUTHORISATION</b>			
	Name of (S)RPS issuing interlock override key:			
	Signature:		Date:	
<b>3.</b>	<b>COMPLETION OF WORK</b>			
	Have all safety features been returned to their original state?		Yes / No	
	Has correct operation of all interlocks and warning lights been confirmed by testing?		Yes / no	
	Maximum dose rate around accessible surfaces of equipment during routine use?		microsieverts per hour	
<b>4.</b>	<b>RETURN OF INTERLOCK OVERRIDE KEY</b>			
	Signature of (S)RPS on receipt of key:		Date:	

**Copy of completed form to be retained for 2 years**