LOCAL RULES FOR OPERATING THE X-RAY ANALYTICAL DEVICES OWNED BY THE FACULTY OF SCIENCE AND ENGINEERING

Ionising Radiations Regulations 1999

Issue	Status	Name	Signature	Date
2	Checked	James Nicholson		13/07/15
	Approved			

WARNING – Unauthorised or improper use of this equipment could lead to serious injury and also represents a serious disciplinary offence. Do not use any X-ray devices if you are unsure about any element of your training, anything in these local rules or any aspect of X-ray operation – consult the Radiation Protection Supervisor (RPS).

1. AMENDMENT RECORD

Issue	Date	Amendments
1	04/11/2014	First Issue
2	13/07/2015	Addition of Handheld X-ray Fluorescence (XRF) Analyser

2. INTRODUCTION

These rules are provided in compliance with the Ionising Radiations Regulations 1999 (reg 17) and the associated Approved Code of Practice and Guidance and apply to the following items:

Device	Location (i.e. building names and room numbers)	Energy
Bruker D8 Advance ECO X-ray Diffractometer	Hartford (304) Room 63	20 - 50 kV with 5 – 60 mA current but max power output 1 kW
Panalytical Minipal 4 X-ray Fluorescence Spectrometer	Hartford (304) Room 63	up to 30 kV.
X-Ray Photoelectron Spectroscopy system:	Hartford (304) Room 65	3 energies available – Mg 1.25kV, Al 1.49 kV, Ag 2.9 kV. Instrument is bespoke, sources are (1) Specs GmbH (Al and Ag monochromator sources) and (2) VG Microtech (Mg and Al twin anode sources).
Phillips CM20 Transmission Electron Microscope	Hartford (304) Room 64	up to 200 kV.
Leo Carl Zeiss) 1455VP Scanning Electron Microscope	Hartford (304) Room 67	up to 30 kV.
Bruker S1 Titan Handheld X-Ray Fluorescence Analyser	Hartford (304) Room 63	50kV

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3. AIMS OF THESE LOCAL RULES

To ensure that work with ionising radiation is controlled so that:

- During normal working, radiation doses to all persons are *as low as reasonably practicable*.
- Precautions have been taken to minimise the risk of equipment failure or other occurrence that may result in significant radiation doses to any person.
- Doses do not exceed those specified in the regulations.
- A risk assessment for the X-ray devices is present in Appendix A.

4. RADIATION PROTECTION SUPERVISORS (RPS)

The RPS is responsible for ensuring that work is carried out in accordance with the requirements of the Regulations and for taking all reasonable steps to ensure that these rules are observed. The following RPS's have officially been appointed by the Vice Chancellor and have completed the following short course delivered by the Appointed Radiation Protection Advisor: 'Radiation Protection Supervisors (X-ray analytical equipment) on 15 October 2014.

Name	Internal Tel No	Out of Hours Contact
James Nicholson	2296	07757811172
Graeme Smith	3922	-

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5. APPOINTED RADIATION PROTECTION ADVISORS (RPA)

External to the University and appointed annually, currently as at 01.10.14:
Radman Associates, Harvey House, Bollington, Macclesfield, SK10 6JR. Tel 01625 576000

6. AUTHORISED STAFF

Only employees who have been trained in the use of the X-ray devices may operate them. Employees authorised to use the equipment are listed on a register displayed near the equipment. Untrained employees/visitors may only operate the equipment under the direct supervision of an RPS. University appointed RPS's (and appointed Radiation Protection Advisors) are, by the nature of their position and training, authorised to use the equipment.

7. AUTHORISED USE

The equipment is installed for demonstration of analytical techniques and research. Alternative uses, whilst not precluded, should be discussed, agreed and risk assessed with the RPS beforehand.

8. GENERAL PRECAUTIONS

- Failure of any safety system or damage must be reported to the RPS immediately as soon as it is detected. In the event of a fault the equipment must be clearly labelled as not in use and must not be used until it has been repaired.
- Before generating X-rays, check that any safety systems present (warning lights, door locks etc.) are functioning.
- Do not tamper with or attempt to override the door / lid interlocks – this could result in exposure to the primary x-ray beam.
- Do not modify or alter in any way a device generating X-rays without prior authorisation from the RPS, RPA and manufacturer.
- Follow all of the instructions given in the manufacturers operating manual.
- Upon discovering they are pregnant, employees working with or near the x-ray units must notify the RPS in writing.

9. DESIGNATED AREAS

Radiation exposure levels around the devices under normal conditions are negligible so:

- It is NOT necessary for any person who enters or works in the area to follow special procedures designed to restrict significant exposure to ionising radiation in that area or prevent or limit the probability and magnitude of radiation accidents or their effects
- Any person working in the area is NOT likely to receive an effective dose greater that 6mSv a year or an equivalent dose greater than three-tenths of any relevant dose limit referred to in Schedule 4 of the IRR 1996 in respect of an employee aged 18 years or above.

Specific Designated Areas have therefore NOT been set out around the X-ray devices operated by the University.

10. CONTINGENCY PLANS FOR INCIDENTS INVOLVING THE X-RAY UNITS

The following procedures must be initiated by the operator in the event of the following accidents:

10.1 Exposure not terminating

Should the x-rays not turn off then power to the unit should be disconnected immediately using either an emergency stop button or at the wall socket.

10.2 Theft or Loss of the Equipment

The Radiation Protection Supervisor must be consulted as soon as it is suspected that the unit has been lost or stolen and an immediate search must be started. The Radiation Protection Adviser should also be informed.

10.3 Any Damage to the Equipment, Including Fire or Mechanical Damage

In the event of mechanical damage X-rays may be emitted through the case of the unit. Immediately disconnect the power supply to the unit. Ensure unit is serviced/repaired by a suitably qualified engineer before further use.

10.4 Overexposure to Ionising Radiation

If it is suspected or known that an employee has received an overexposure to ionising radiation, then they must immediately inform the RPS who will carry out an investigation to ascertain whether an overexposure has occurred. If, as a result of the investigation, it is confirmed that an overexposure has occurred, the RPS will make a detailed record of that investigation, must notify the HSE and should contact the Radiation Protection Adviser for further advice.

11. MAINTENANCE

Requirements and arrangements for each of the X-Ray device for Maintenance i.e.: Planned Preventative Maintenance (Equipment Checks and Servicing), Examination, Inspection and Test and Breakdown / Fault Finding / Repair, are set out in Section 12 Overview of Devices and Management Arrangements. After anyone has carried out maintenance activity they should:

- Record the specific maintained activity in the Maintenance Log Book
- Check the exposure levels around the unit following the guidance set out below for monthly monitoring, using the scintillation counters available, and log the details of check made and levels detected in the Maintenance Log Book
- Equipment Checks

Documented monthly checks on each X-ray device will be made by a trained individual and reviewed by the RPS:

- Count rate monitoring equipment used to measure radiation should be calibrated in accordance with IRR1999 every 12 months.
    - If any test fails, do not continue with further tests.
- Measure background level. At a distance of 3 m from each device check the background level the using radiation monitor. Note this count rate in the log-book.
- Visually inspect each enclosure for signs of mechanical damage. Record result of visual check in log-book.
- Switch each device to the maximum normal settings (kV and mA) and place a test object in the sample chamber. Record the count rate reading around each device.
- Check that warning lights (if present on a device) are working
- Test any interlocked doors and emergency stop buttons. Testing should be carried out by opening a door and attempting to activate the X-rays or activating the emergency stop and trying to activate the X-rays.

12. OVERVIEW OF DEVICES AND MANAGEMENT ARRANGEMENTS

Device	Location of Device and Maintenance Log Book (I.e. Building Names And Room Numbers)	Safety Systems Present	Details Of Manufacturers Operating Manual Inc. Where To Access It	Requirements and Arrangements For:				Other Notes
				PPM: Equipment Checks (undertaken by Trained University Staff)	PPM: Servicing (undertaken by Service Engineers	Breakdown / fault finding / repair (undertaken by manufacturers / contractors)	Examination / inspection / testing (undertaken by manufacturers / contractors)	
Bruker D8 Advance ECO X-ray Diffractometer	Hartford (304) Room 63	Interlocks Shielding Emergency Stop	Available next to instrument	Monthly monitoring and recording by RPS or trained deputy.	Bruker (Service Contract)	Bruker	Bruker	
Panalytical Minipal 4 X-ray Fluorescence Spectrometer	Hartford (304) Room 63	Interlocks Shielding	Available next to instrument	Monthly monitoring and recording by RPS or trained deputy.	Panalytical	Panalytical	Panalytical	
X-Ray Photoelectron Spectroscopy system	Hartford (304) Room 55	Vacuum vessel Interlocks	Available (for individual components) next to instrument	Monthly monitoring and recording by RPS or trained deputy.	Specialist engineers only (X-ray and vacuum equipment)	Specialist engineers only (X-ray and vacuum equipment)	Specialist engineers only (X-ray and vacuum equipment)	
Phillips CM20 Transmission Electron Microscope	Hartford (304) Room 64	Interlocks Shielding Emergency Stop	Available next to instrument	Monthly monitoring and recording by RPS or trained deputy.	ISS Group Services Ltd (service contract)	ISS Group Services Ltd	ISS Group Services Ltd	
Leo Carl Zeiss) 1455VP Scanning Electron Microscope	Hartford (304) Room 67	Interlocks Shielding Emergency Stop	Available next to instrument	Monthly monitoring and recording by RPS or trained deputy.	ISS Group Services Ltd (service contract)	ISS Group Services Ltd	ISS Group Services Ltd	
Bruker S1 Titan Handheld X-Ray Fluorescence Analyser	Hartford (304) Room 63	Password Protected; proximity detector	Available next to instrument	Monthly monitoring and recording by RPS or trained deputy.	Bruker	Bruker	Bruker	Second-hand instrument purchased from ACAL (May 2015), inspected by RPA July 2015.

13. LOCAL RULES ANNEX A: TRAINED AND AUTHORISED STAFF

A completed copy of this sheet detailing the authorised persons should be displayed near the machine. Staff should not sign this sheet until they have been trained, having understood these local rules. RPAs and RPSs are, by the nature of their position and training, authorised to use the equipment.

Name	Signature	Equipment	Date of Training	RPS Signature
Graham Smith		XPS, XRD, SEM, TEM		
Alice Gillett		SEM, XRD		
Chi Ho Ng		SEM, XRD		
Chris Andrews		SEM		

14. LOCAL RULES ANNEX B: GENERAL RISK ASSESSMENT FORM

Ref No.

Site	Area/Department	Task	Assessor	Date of Assessment	Reason
Thornton Science Park	Faculty of Science & Engineering	X-ray Analysis	James Nicholson	~~04/11/14~~13/07/15	Initial Risk Assessment

Task	Hazard	Consequence	Persons at risk	Existing Controls	Severity	Likelihood	Risk Rating	Additional Controls methods	Subsequent Risk Rating	Review Date
Normal operation of X-ray unit.	Leakage X-ray beams	Exposure to ionising radiation – possible short and long term health effects.	Operator	-Monthly integrity checks. -Fully shielded enclosures -Written operating procedures -Training, -Signage -Maintenance procedures - Controlled Area is designated for portable XRF analyser: an area extending 5m from the end window, 2m in diameter	3 1	1 3	3 3	None		13/07/16
Theft	X-rays – main beam and leakage	Exposure to ionising radiation – possible short and long term health effects.	Thief and members of the public	-Equipment in building with full security system and restricted access. -Size and weight or equipment makes theft unlikely. -Portable XRF Analyser stored in locked cupboard when not in use; key held by RPS. - XRF Analyser is password protected; password held by RPS.	3	1	3	None		13/07/16
Fire/ Mechanical damage	X-rays – leakage from damaged housing	Exposure to ionising radiation – possible short and long term health effects.	Operator	-Unit condition checked before being powered up. -Access restricted to trained authorised persons. -Disconnect power to make safe.	2	1	2	None		13/07/16

Severity	Likelihood	Risk = Severity x Likelihood

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1	Minor	1	Unlikely	
2	Major	2	Likely	
3	Severe (Death/Major Harm)	3	Certain	

Audit carried out by:	James Nicholson	Signed:		Date:	13/07/15