Safety Handbook and Requirements

Low-field MRI Laboratory, Room 118

Mechanical Engineering Department, Imperial College London

This document provides information specific to the Low-Field MRI Laboratory and it is supplementary to the information provided in the [Departmental Safety Code of Practice 2011](http://www.imperial.ac.uk/workspace/mechanicalengineering/internal/safety/Safety_COP_2010.pdf) and on the department web site <http://www3.imperial.ac.uk/mechanicalengineering/safety>.

The conduct of all members of the Department, whether staff, students or visitors, where it concerns the health and safety of themselves or others, is governed by the Health and Safety at Work Act 1974. All members of the Department are responsible for the health and safety of themselves and everyone else.

Contents

[1 HEALTH AND SAFETY 3](#_Toc272826914)

[1.1 Reporting of Accidents and Dangerous Occurrences 3](#_Toc272826915)

[1.2 First Aid Treatment 3](#_Toc272826916)

[1.3 Blood Spillage 3](#_Toc272826917)

[1.4 Eating, Drinking and Smoking in Laboratories 3](#_Toc272826918)

[1.5 Drinking Water 3](#_Toc272826919)

[2 INDUCTION PROCEDURES FOR NEW MEMBERS OF THE DIVISION 4](#_Toc272826920)

[2.1 Low-Field MRI Laboratory Managers 4](#_Toc272826921)

[3 LABORATORY PRACTICE 4](#_Toc272826922)

[3.1 Emergency Access to Laboratories 4](#_Toc272826923)

[3.2 “Housekeeping” 4](#_Toc272826924)

[3.3 Security 5](#_Toc272826925)

[3.4 Storage of Flammable Liquids 5](#_Toc272826926)

[3.4.1 Limits of Quantity 5](#_Toc272826927)

[3.4.2 Type of Storage 5](#_Toc272826928)

[3.4.3 Where to Store 5](#_Toc272826929)

[3.5 Use of Gas Cylinders 5](#_Toc272826930)

[3.6 Liquid Nitrogen 6](#_Toc272826931)

[3.7 Waste Disposal 6](#_Toc272826932)

[3.7.1 Waste Solvents 6](#_Toc272826933)

[3.7.2 Waste or Unwanted Chemicals 7](#_Toc272826934)

[3.7.3 Broken and Waste Glassware 7](#_Toc272826935)

[3.7.4 Chemical Spillages 7](#_Toc272826936)

[3.8 Overnight Running of Apparatus 7](#_Toc272826937)

[3.9 Working Outside Normal College Hours 7](#_Toc272826938)

[3.10 Instruction in the Use of Fire Extinguishers 8](#_Toc272826939)

[3.11 Reporting of Defects 8](#_Toc272826940)

[4 SAFETY INFORMATION FOR OPERATION OF NICHE ORTHO MRI8000 MRI SCANNER 9](#_Toc272826941)

[4.1 Indications 9](#_Toc272826942)

[4.3 Contraindications 9](#_Toc272826943)

[4.4 Warnings 9](#_Toc272826944)

[4.5 Precautions 10](#_Toc272826945)

[4.6 Operator Training 11](#_Toc272826946)

[4.7 Emergency Patient Removal Procedure 11](#_Toc272826947)

# 1 HEALTH AND SAFETY

# 1.1 Reporting of Accidents and Dangerous Occurrences

All incidents that are considered dangerous, whether or not these cause injury, must be reported to your Supervisor and the Technician Head of Division (THoD, Phil Wilson, tel: 47127) who will report to the Departmental Safety Officer (DSO, Ian Wright) as soon as possible after the event.

## 1.2 First Aid Treatment

During Working Hours: In the case of injury the nearest “first aider” should be contacted – please see local lists on lab notice boards under a green heading (changed every six months) - OR telephone the Health Centre (extension 49375 / 49376). Out of Hours: Between 6 p.m. and 8 a.m. and at all times at weekends, first aid assistance can be obtained by contacting the Sherfield Security desk, extension 4444 or with mobiles 0207 589 1000.

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| **In Emergency (Police/Fire/Ambulance) contact Security: PHONE 4444 or 020 7589 1000****(give details of emergency, your exact location, telephone number & name)** |

## 1.3 Blood Spillage

In the event of a spillage of blood do not attempt to clean it up; contact a first aider who will be aware of the correct procedure.

## 1.4 Eating, Drinking and Smoking in Laboratories

Eating, drinking and smoking in the laboratories and workshops is prohibited. Smoking is prohibited in the College.

## 1.5 Drinking Water

There is a special supply for drinking water. All drinking fountains and taps marked 'Drinking Water' which are situated in most cloakrooms and some corridors, supply potable water.

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| **Do not drink the water supplied to the laboratories** |

# 2 INDUCTION PROCEDURES FOR NEW MEMBERS OF THE DIVISION

On arrival in the Applied Mechanics Division, all new staff, students and academic visitors are given copies of the College Safety Policy Statement and the Departmental Safety Policy which they are required to read before being allowed to start work. All new students and lab-active RAs are required to attend the Department’s safety course which is usually held in October. All persons entering College premises, after that time, will receive safety induction by the Departmental Safety Officer, Mr Ian Wright or his deputy; RAs will be by inducted by Claire Soulal.

## 2.1 Low-Field MRI Laboratory Managers

The primary regulators of safety in the Division are the Laboratory Managers. These are currently as follows:

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| **Dr Mike Ristic****Mechatronics in Medicine Laboratory Manager****Room 743, Ext: 47048** |

In addition, matters of safety within Dynamics & NDT are dealt with by:

**Philip Wilson Technician Head of Division 47081**

For further assistance with safety issues please contact:

**Ian Wright Departmental Safety Officer 47043**

# 3 LABORATORY PRACTICE

## 3.1 Emergency Access to Laboratories

The doors to the laboratories should be left unlocked when users are working inside. Keys to the doors into all laboratories are held in the office of the THoD.

## 3.2 “Housekeeping”

A tidy laboratory is much safer than one full of clutter; good housekeeping is essential for a safe environment. Keep passageways clear. Fire doors should not be locked, bolted or obstructed. Electrical cables should be off the floor, and cable ducting should be used where necessary.

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| **No person may carry out hazardous work in a laboratory** **without a second person being present** |

 Laboratory doors should be left unlocked when users are working inside.

## 3.3 Security

Regrettably thefts do occur in College from time to time. Please do not bring valuables to College if at all possible. Always make sure your room is locked when you leave it, even for a short time and restrict access to those working in the lab. Lock away wallets, handbags etc if you are leaving your room.

## 3.4 Storage of Flammable Liquids

There are legal requirements governing the storage of flammable liquids; some of the more important points are as follows:

### 3.4.1 Limits of Quantity

The COSHH assessments restrict amount of flammable liquids kept in store. The cost of the disposal of excess liquids will be met by the Division and this is considerable. Any operations involving the storage or use of large quantities of flammable liquids should be discussed with the Technical Head of Division.

### 3.4.2 Type of Storage

By law containers of flammable liquids of greater than 500 ml capacity must be stored in approved, fire resisting storage cabinets or cupboards when not in use. The cupboard should be suitably labelled. Signage is examined by College Safety Unit, Ian Gillett, in general. Flammable liquids may be stored in fume cupboards only if they are contained in a suitable steel cabinet.

### 3.4.3 Where to Store

Flammable liquid storage cabinets should not be sited in those parts of the laboratory where there is a high rate of movement of personnel. They should also be sited away from gas cylinders and ignition sources, e.g. naked flames and high temperature surfaces.

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| **All flammable substances should be kept apart from oxidising agents** |

## 3.5 Use of Gas Cylinders

All cylinders should be secured, individually, to a rigid support using an appropriate clamp. Always keep the number of gas cylinders in the laboratory to a minimum and return empty or unwanted cylinders to the Stores.

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| Keep cylinders away from stocks of flammable liquids and ignition sources  |

Do not clamp cylinders to the front of a fume-cupboard as they restrict the airflow, invalidating the classification of the cupboard. After use, always close the valves and depressurise the regulator. Be especially careful when using oxygen cylinders and make sure that the regulator is in the unpressurised position before opening the cylinder valve. Several explosions have occurred as a result of perforation of the regulator diaphragm, when opening oxygen cylinders with the regulator in the pressurised position. For guidance on the use, handling and storage of gas cylinders refer to the Imperial Spectrum website, Health and Safety, Guidance Note 027: ‘Safe Handling, Use and Storage of Compressed Gases (January 2002)’. Refer also to the British Oxygen Company's book "Safe under Pressure", which is available in the Library.

## 3.6 Liquid Nitrogen

All liquid nitrogen users must be aware of the properties and hazards and be fully trained in the local departmental procedures for usage, storage and transportation before they engage in handling the substance. Refer to the Imperial Spectrum website, Health and Safety, Guidance Note 015: ‘Storage, Use and Transportation of Liquid Nitrogen within College Premises (September 2000, revised January 2004)’. Users should check with the THoD to establish whether a risk assessment for the handling and use of liquid nitrogen has been completed for the laboratory in which they are working. If not, a risk assessment must be completed prior to starting any work using liquid nitrogen. Pressurised vessels and dewars containing liquid nitrogen should not be accompanied in lifts. The THoD must be notified in advance and will arrange safe transport with the lift engineers. All the technicians are trained in manual handling.

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| **Pressurised vessels and dewars should NOT be accompanied in lifts** |

## 3.7 Waste Disposal

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| **NO CHEMICALS MAY BE PUT INTO THE DRAINS OR PLACED IN THE DOMESTIC WASTE BINS It is ILLEGAL to dispose of organic solvents down the drains** |

### 3.7.1 Waste Solvents

Waste solvents should be stored in special polythene containers marked either "Chlorinated" or "Non-Chlorinated". Empty containers can be obtained from the THoD. When full, the THoD should be contacted to arrange for the disposal of the containers. Waste solvents mixed with more than 10% water or acid should be stored in glass Winchesters.

### 3.7.2 Waste or Unwanted Chemicals

These should be given to the Technician Head of Division who will arrange for them to be put in the Departmental Chemical Store or for their safe disposal.

### 3.7.3 Broken and Waste Glassware

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| **DO NOT PUT GLASS OR SYRINGE NEEDLES IN THE DOMESTIC WASTE BINS** |

'Sharps' i.e. syringes, scalpel blades, glassware that cannot be cleaned etc., must be put in special waste containers that can be obtained from the THoD. When full, the THoD should be contacted to arrange for the disposal of the containers. Clean, broken glass may be placed in a clearly labelled box and left for the cleaners to take for re-cycling.

### 3.7.4 Chemical Spillages

In the event of a chemical spillage contact Technical Head of Division, Phil Wilson, 47127.

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| **ALL MERCURY SPILLAGES MUST BE PROPERLY DEALT WITH****- CONTACT THE THoD (PHIL WILSON)** |

## 3.8 Overnight Running of Apparatus

Any experiment or piece of apparatus that is left running overnight must be notified to the laboratory manager. An 'Overnight Running' notice must be displayed near the apparatus indicating the shutdown procedure. Blank notices can be obtained from the Technician Head of Division, Phil Wilson.

## 3.9 Working Outside Normal College Hours

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| **NO ONE MAY CARRY OUT EXPERIMENTAL WORK ALONE UNLESS THE WORK HAS BEEN DECLARED NON-HAZARDOUS AND AUTHORISED BY HIS OR HER SUPERVISOR AND THE LABORATORY MANAGER** **A second person must be in the same laboratory at all times** |

Please Refer to “**Building and Laboratory Access**” doc on the Mech Eng Safety website. http://www3.imperial.ac.uk/mechanicalengineering/intranet/safety

Any out of hours work in the laboratories must be authorised by the user’s supervisor and the laboratory manager. Forms are available from the THoD, Phil Wilson. A new form must be authorised for every day of out of hours working. The completed form must be displayed by the entrance to the relevant laboratory. The user must be accompanied by another person in the laboratory at all times. For Lone Out of Hours Working Basic Guidelines, refer to the Imperial Spectrum website, Health and Safety Manual, Personal safety, Working alone and Guidance Note 023: Lone Working (June 2001).

Only personnel with a valid security pass, 'swipe card', may enter or leave the Department out of hours.

Access to the Department outside normal working hours is available from 07.00 to 18.30 Monday to Friday. Outside these times and at weekends, access to the Department is via a swipe card. Everyone must leave the building by 23.00 hrs. College Closure Periods: During the College closure periods at Christmas and Easter access is only allowed to members of the Department with a valid security pass.

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| **No experimental work is allowed during College closure periods** **without the permission of the Head of Department** |

## 3.10 Instruction in the Use of Fire Extinguishers

All technician staff are required to attend training in the use of fire extinguishers. Fire safety for laboratory users is covered in the Departmental safety lecture. Training courses for laboratory users in the use of fire extinguishers are available via the Safety Unit, see Imperial Spectrum website.

## 3.11 Reporting of Defects

Any building defects, e.g. broken lights, dangerous ceiling tiles, defective fume cupboards, dangerous floors, etc., should be reported immediately to the Technician Head of Division or direct to the Facilities Management Customer Services Centre extension 48000 or email fm.csc@imperial.ac.uk. The Facilities Management CSC is for building defects only and not rig defects.

# 4 SAFETY INFORMATION FOR OPERATION OF NICHE ORTHO MRI8000 MRI SCANNER

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| **This safety information must be read carefully by all users** **before operating the Niche Ortho8000****All users must be familiar with the information provided in Niche Ortho 8000 User Guide.****A copy of User Guide must be available in the laboratory at all times.** |

## 4.1 Indications

This MRI device produces data that:

* correspond to the distribution of nuclei exhibiting nuclear magnetic resonance,
* depend upon NMR parameters (spin-lattice relaxation time (Tl), spin-spin relaxation time (T2), density of nuclei, flow velocity and chemical shift),
* when interpreted by a trained physician, can yield information that can be useful in the determination of a diagnosis.

## 4.3 Contraindications

* The device is contraindicated for patients who have electrically, magnetically or mechanically activated implants (for example, cardiac pacemakers), because the magnetic and electromagnetic fields produced by the MR device may interfere with the operation of these devices, and
* Scanning patients with intracranial aneurysm clips is contraindicated unless the physician is certain that the clip is not magnetically active.

## 4.4 Warnings

* There is a risk of scanning patients with implanted surgical clips or other ferromagnetic materials (which the magnetic field may dislodge) or engaged in occupations or activities which may cause ferromagnetic implants,
* There is a risk of scanning foetuses and infants (for whom data establishing the safety of the device are lacking),
* There is a risk to patients and other persons that might result from the inadvertent introduction of ferromagnetic materials into proximity with the magnet (which may forcefully attract them). You are advised to ensure that all ferromagnetic objects are excluded from the security zone provided by the RP screened room. This room should be locked when unattended.
* There is a risk to persons with cardiac pacemakers or other implanted electronic devices who enter a zone where the magnetic field exceeds five gauss.
* There is a risk to decompensated cardiac patients, febrile patients, and patients with impaired ability to perspire.
* There is a risk of scanning patients with permanent (tattoo) eye-liner or who are wearing facial make-up (which may contain ferromagnetic particles)
* There is a risk of scanning patients suspected of having embedded conductive or magnetically active fragments in or near the eye.

## 4.5 Precautions

* Precautions must be taken when scanning patients who have a greater than normal potential for cardiac arrest.
* Precautions must be taken when scanning patients who are likely to develop seizures, or claustrophobic reactions.
* Precautions must be taken when scanning patients who are unconscious, heavily sedated or confused and with whom no reliable communications can be maintained.
* It is recommended that the user should establish an appropriate plan for treating outside the magnet's influence, a person who requires emergency assistance (because the safe and effective use of electronic or other metallic emergency equipment may be impossible near the magnet).

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| ***Important Safety Information*****Under no circumstances should operating personnel attempt to gain access to the electronics rack, desk pedestal or any of the electronic circuitry contained on or inside the screened room. This involves risk of serious injury or death as high electrical voltages are present inside the equipment.** |

## 4.6 Operator Training

It is recommended that all technologists who will acquire images using the MRI system must have been fully trained in MRI either as part of their formal registration qualification or through another equivalent professional qualification. All technologists must read and study the information contained in this user guide and should also study the help section of the Windows XP operating system and attend appropriate courses on musculoskeletal imaging which provide grounding in the choice of images sequences and the possible causes of image artifacts. Training on operation of the system and all safety features will be provided after system installation.

## 4.7 Emergency Patient Removal Procedure

1. Press either the Red emergency stop button located at the scanner head or at the imaging console.
2. Unplug the receiver coil from the connector on the magnet enclosure (only connector present)
3. Remove the patient and coil assembly together by pulling the chair carefully backwards taking care to ensure the patient's leg or the RP coil are not trapped.
4. If the patient is ambulatory, remove the RP coil and lead the patient to safety outside the MRI suite as quickly as is practical.
5. If the patient is non-ambulatory, transfer the patient to a non-magnetic gurney or wheelchair and remove the patient from the MRI suite as quickly as is practical.
6. If, through an extreme failure of safety procedures, the patient for any reason becomes trapped to the magnet by ferromagnetic material it will be necessary to lift the material away from the patient using an a1uminum bar levered carefully on the magnet pole face. A suitable a1uminum release bar is located close to the entrance of the screened room and is marked as emergency toolkit. Quickly release the patient and follow the procedure described in 1 - 5 above to remove the patient from the MRI suite seeking emergency treatment as necessary.