



General Safety	
SOP Number:	105.02
Date:	7-May-2020

CENTRE FOR FUNCTIONAL AND METABOLIC MAPPING

General Safety

1. Introduction

- 1.1 Research involving Magnetic Resonance Imaging (MRI) at high magnetic field strengths present unique hazards to both research subjects and individuals working within and around the MRI system. Consequently, the potential for serious personal injury is present due to the sheer size and strength of the static magnetic field along with the immense flexibility of the research system and associated peripheral hardware.
- 1.2 The static magnetic field in the CFMM MRI facilities is always present. It is essential that everyone entering the facility is aware of the presence of the magnetic field, since we cannot otherwise detect it (i.e. magnetic fields cannot be seen or felt).
- 1.3 The CFMM Core Facility is conceptually divided into four Zones of increasing level of potential risk and access restriction. Due to the inherent hazards associated with the magnetic fields, access to MRI Zones III and IV are restricted to ensure the safety of all patients, subjects, visitors, and staff. All personnel working within Zones III and IV require training,

2. Safety Issues: Medical Implants and Devices

- 2.1 Many medical implants and devices are incompatible with the MR environment and may cause severe injury or death due to heating, movement, or malfunction when exposed to the static, gradient, and RF magnetic fields.
- 2.2 Many medical implants and devices have undergone extensive testing for safety within the MR environment and have been determined to be “Safe”, “Unsafe”, or “Conditional” at a particular magnetic field strength. Anyone with implants or devices deemed “Unsafe” will NOT be permitted to enter Zone IV (magnet room) or proceed beyond the 5 Gauss line of Zone III. Individuals with “Safe” or “Conditional” medical implants may be permitted to enter only upon the approval of authorized Level 2 MRI Personnel (i.e. CFMM Director or MRI Technologists) after they have reviewed all safety information available regarding the particular medical implant/device. Note that medical implants/devices’ safety is manufacturer and model specific, as well as field-strength specific. For further information, see www.mrisafety.com.

3. Safety Issues: Due to High Static Magnetic Field Strengths

- 3.1 High static magnetic fields are always present in the CFMM MRI facilities. These strong magnetic fields pose potential risks to those entering (ie. working, volunteering) the MR environment and therefore must be aware of the potential hazards.



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- 3.2 There are specific medical implants, devices, and objects that are unsafe within the MR environment. Anyone with these implants/devices (as outlined in Section 2 above), may not proceed beyond the 5 Gauss line in Zone III or enter Zone IV unless the object can be safely removed.
- 3.3 Level 2 MRI Personnel are responsible for screening all objects and individuals before they enter Zone IV (magnet room) to ensure that all potentially hazardous objects have been removed.
- Any object has the potential to become a projectile in the MR environment, if it contains ferromagnetic components. All ferromagnetic objects are strictly prohibited from entering Zone IV.
 - No equipment or object should enter or be brought into Zone IV (magnet room) unless it is necessary for the successful execution of the experiment, has been tested for magnetism using the permanent magnet in the control room, and has been approved for entry by Level 2 MRI Personnel.
- 3.4 All metallic objects must be removed from your person before crossing the 5 Gauss line in Zone III or entering Zone IV (magnet room). This includes, but is not limited to, the following objects:
- Hearing aids
 - Dentures
 - Cell phones
 - Keys
 - Coins
 - Credit cards
 - Bank cards
 - Magnetic strip cards (including Western ID cards and LHSC parking tickets)
 - Pagers
 - Eyeglasses
 - Hair pins (including bobby pins, barrettes, clips, hair elastics)
 - Jewellery (including body piercings)
 - Watches
 - Safety pins
 - Paperclips
 - Pens
 - Pocket knives
 - Nail clippers
 - Steel-toed boots/shoes
 - Tools
- 3.5 Any object with ferromagnetic components will be pulled toward the magnet with strong force and has the potential to cause serious injury to anyone in or near the magnet, damage to the MRI system, and/or destroy the object.
- Note that several metals are not ferromagnetic, including titanium, copper, gold, silver, platinum, aluminium, brass, and lead. Although these metals are non-magnetic, their presence within the bore of the MRI may interfere with the normal operation of the



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scanner. All metallic objects must be properly tested and approved for entry by Level 2 MRI Personnel even if they are thought to have no ferromagnetic components.

- 3.6 No large metallic objects may be brought into or near Zone IV (magnet room) at any time. All large metallic objects must remain beyond the 5 Gauss line as marked on the floor in Zone III, unless specifically directed by authorized Level 2 MRI Personnel. Any large metallic object with ferromagnetic properties will fly towards the magnet with great force if allowed too near to the magnet, potentially causing severe injury or death to anyone in or near the magnet and damage to the MRI system.
- If an incident should occur, and someone is pinned to the magnet, trapped, or in a potentially life-threatening situation as the result of a large ferromagnetic object coming too near to the magnet, the Level 2 MRI Personnel (or if this person is pinned, any other MRI Personnel or Research Personnel present) must follow SOP#130: “Emergency Quench”, and apply first responder principles.

4. **Safety Issues: Due to Hardware**

- 4.1 Dangerous and potentially lethal levels of electricity are used in all MRI systems. Therefore, it is important that all individuals working around the MRI systems be aware of the dangers and understand the safety issues concerning electricity. Current-carrying cables, connections, and junction points in the vicinity of the main magnetic field are particularly susceptible to damage due to the extreme Lorentz forces created through the normal operation of the system. Periodically, the effects of prolonged mechanical fatigue may result in breakage, thereby causing electrical arcing, sparking and/or high heat levels before the system can shut down. In these instances there is a high potential for personal injury as well as the possibility of a fire being ignited.
- 4.2 During certain types of MRI data collection, high and potentially dangerous acoustic sound pressure levels (SPL) are generated. Everyone entering the facility must be made aware of this risk and be instructed as to the precautionary measures that must be taken. Any patients, volunteers, or other personnel present in MRI Zone IV during an MRI scan must wear appropriate hearing protection.



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Revision Chronology		
Version Number	Date	Changes
120.01	28 July 2008	First Version
105.02	07 May 2020	Combination of 3T, 7T and 9.4T

CFMM Director Signature:

Date:

07 – May – 2020