	Policy Title: Practice and Procedures MRI Safety
	Date Created: Dec 19, 2019 Updated:

Objective

The objective of the MR Safety policy is to maintain a safe and secure environment for all research participants and personnel.

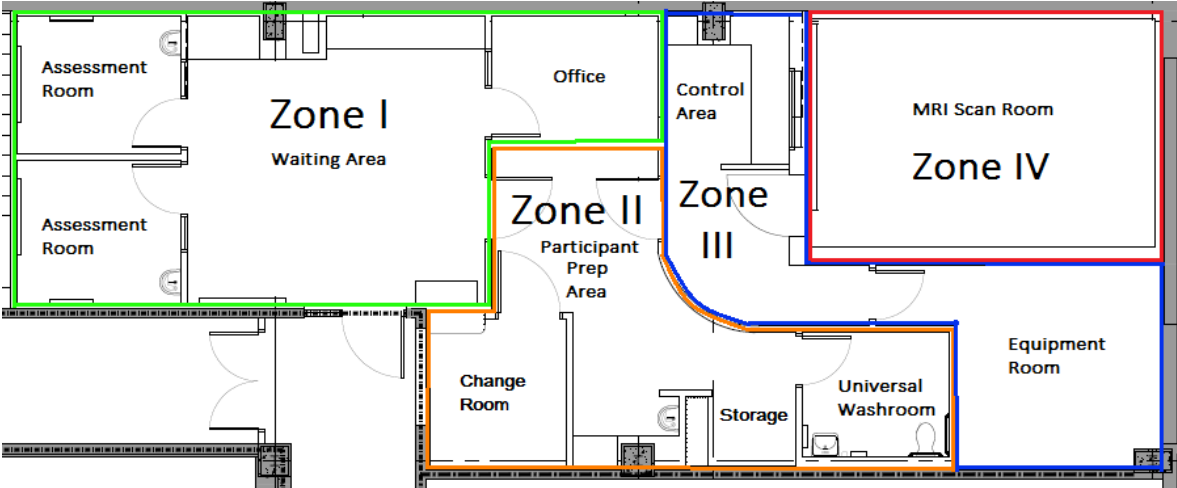
Definitions

Zone I: Readily accessible areas by the general public outside MR environment (waiting room)

Zone II: Area between Zone I and Zone III where individuals are supervised by MR personnel (participant prep area)

Zone III: Restricted transition area between Zone II and Zone IV that is supervised and controlled by MR personnel (control room and restricted waiting area)


Zone IV: Area controlled and strictly supervised by Level Two MR personnel. This is a potentially hazardous area with presence of very strong magnetic fields. (MR Scan Room)



Level Two MR Personnel: Individuals who work in MR environment and have extensive education on MR safety issues that is renewed on a yearly basis (i.e., MRI Technologist, MR Physicist)

Level One MR Personnel: Individuals who work in MR environment that have completed and passed minimum MR safety education (administered by a Senior MRI Technologist certified in MR safety) that is renewed on a yearly basis. (e.g., Clinical Coordinators, Research Assistants, Imaging Analyst)

Authorized non-MR Personnel: Staff that enter the MR environment occasionally and have completed and passed minimum MR safety education (administered by a Senior MRI Technologist certified in MR safety) that is renewed on a yearly basis. (e.g., building-services staff)

	Policy Title: Practice and Procedures MRI Safety
	Date Created: Dec 19, 2019 Updated:

Visitors: Any person other than the MR and non-MR personnel specified above

Access to MRI Unit: The personnel listed above will be provided with electronic and key access to MRI Unit. The MRI Technologist will also have key access to the MR scan room (Zone IV). For emergency access to the MR scan room, a key will be stored in a breakable glass case located in the MR control room

Policy

This policy and procedure must be followed by all Holland Bloorview MR and non-MR personnel pertaining to:

- Training of all personnel work in or enter the MRI Unit
- Screening of participants and visitors before entering the MRI environment
- Screening of equipment, devices, and objects for safe use in the MRI environment
- Use of hearing protection by personnel, participants and non-participants in a scan room during a scan
- Cryogen Safety
- Emergency procedures
- Incident Reporting

Training and Education

MRI safety training is required of all MR personnel and non-MR personnel who enter the MRI environment (Zone II-IV). MRI Safety training will be developed and administered by the Senior MRI technologist. A MRI Safety Log will be maintained by the Senior MRI Technologist and reviewed on a monthly basis to ensure all MR and non-MR personnel have up to date training records.


Level One MR Personnel and Authorized non-MRI Personnel

Level One MR Personnel and authorized non-MRI Personnel must complete live MRI Safety Training with a post-training quiz score of 75% minimum. Training will be designed to:

- Understand the risks working in an MRI environment
- Understand proper safe work procedures
- Explain the significance of the precautions

Only personnel that have achieved a passing mark may have access to Zone IV. Results are to be documented on the MRI Safety Training log. Follow up training may be done online.

Version 1
Created Dec 19, 2019

	Policy Title: Practice and Procedures MRI Safety
	Date Created: Dec 19, 2019 Updated:

Level Two MR Personnel

Level Two MR Personnel are MRI Technologists and MR Physicists. Level Two MR personnel also include MRI researchers who have received additional training in MRI safety. All Level Two Personnel must complete live MRI Safety Training with a post training level two quiz score of 80% minimum.

Only personnel that have achieved a passing mark may have access to Zone IV. Results are to be documented on the MRI Safety Training log. Follow up training may be done online.

Level One, Level Two and authorized non-MR Personnel entering Zone IV will be required to complete the MRI Screening Form when they start working in the MRI Unit. This is reviewed by Level Two MR Technologist for clearance.

Environmental Services

Environment services personnel **will not** be required to enter Zone IV for housekeeping tasks. Housekeeping tasks in Zone III will be done only when Level Two Personnel is in the MRI Unit. Housekeeping tasks in Zone II can be done without MR personnel in the MRI Unit.

Access Control


Signage

Entry to Zone III will be clearly indicated by MRI signage to warn individuals entering the MRI environment of access limitations and the presence of strong magnetic fields.

Entry to Zone IV will have MRI signage alerting individuals entering the MRI magnet room that 'Magnet is Always On'.

Access Restrictions

- Zone I (waiting area) access has no restrictions
- Zone II access is controlled by physical barrier with card/fob access; Visitors can access only when accompanied by Level One and/or Level Two Personnel
- Zone III access is controlled by physical barrier with card/fob access; Visitors can access only when accompanied by Level One and/or Level Two Personnel
- Zone IV access is controlled by physical barrier with authorized employee key access; Visitors can access only when accompanied by Level Two Personnel

	Policy Title: Practice and Procedures MRI Safety
	Date Created: Dec 19, 2019 Updated:

- Entry into Zone IV will require individuals to pass through FerrAlert Halo II Plus detector. The system located around the scan room door detects and prevents ferromagnetic threats from entering. Only individuals with a green LED halo array illumination on their approach of the scan room door may enter. A yellow LED beacon light warns that a ferromagnetic threat is approaching and red LED halo flashing indicates a major threat is approaching

Personnel authorized for Zone IV keyed access:

- Level Two MR Personnel who have successfully completed the live MRI Safety training
- Non-MR Personnel who have successfully completed the live MRI Safety training

Access keys are stored in secured area and distributed by the Senior MRI Technologist.

Items not to bring or wear into the MRI scan room

- ANYTHING in your pockets
- Metallic objects
- Metal jewelry (face and body piercing items should be removed)
- Watches, electronic devices
- Hair accessories
- Eye glasses
- Metal on or in clothing (metal buttons, snaps or trimming, underwire bras, belt buckles, metallic fibers)


Screening

A MRI screening form available on the Common Network Drive E:\MRI Unit\FORMS\HB MRI Screening form.pdf is required for all individuals for entry into Zone IV. Review of the MRI screening form by the MRI technologist or Level Two MR Personnel is required for Zone IV entry. Participants are to be accompanied at all times by authorized MR personnel. Level One, Level Two and authorized non-MR personnel may be granted access only after completing MRI screening and the safety program when they begin to work in the MRI Unit. Completed screening forms and personnel MRI safety training log are also to be securely kept on file. Personnel access is reviewed annually.

Screening of Equipment, Devices and Objects

All equipment, devices and objects that are to be used in the MRI scan room require testing by MRI technologist or documentation to confirm its safe usage within strong magnetic fields and radio frequencies. Any electronic or medical equipment to be used in the scan room must be deemed MRI safe and labelled appropriately.

Version 1
Created Dec 19, 2019

	Policy Title: Practice and Procedures MRI Safety
	Date Created: Dec 19, 2019 Updated:



MRI Safe Equipment that needs to be stored in Zone III must be labelled with green MRI safe labels. Storage of non-MRI safe equipment that must be in Zone III need to be must be in a separate area or secured permanently.




Non-MRI safe equipment must be clearly labeled with red non-MRI safe labels to prevent entry into Zone IV magnet room. No equipment is permitted inside the five gauss line that is not deemed to be MRI safe. Equipment that is questionable with regards to paramagnetic or ferromagnetic properties is to be tested by Level Two MR Personnel using hand held magnet.

Hearing Protection

Background noise associated with MRI operation can reach significant levels. In the scan room during scanner operation, the highest levels of acoustic noise are created by the magnetic field gradient that depends on sequence scan parameters. Acoustic noise levels may reach 85 to 130 decibels in the scan room but remain at lower levels due to noise insulation in the control room to stay within limits of workplace safety standards.

Legislation

Ontario Regulation 851 section 139 states employers must ensure that workers are not exposed to a sound level greater than an equivalent sound exposure level of 85 dBA in an 8 hour time period and clearly visible warning signs shall be posted at every approach to an area in the workplace where the sound level regularly exceeds 85 dBA. Hearing protection provided, such as ear plugs or ear muffs must be worn by individuals that must be in the scan room during a MRI scan.

	Policy Title: Practice and Procedures MRI Safety
	Date Created: Dec 19, 2019 Updated:

Cryogen Safety

Background

To obtain the super conduction needed for MRI, cryogens in the form of liquid Helium is used. Liquid helium is kept at extreme cold temperatures of up to -270°C and has a subzero boiling point. It can cause burns or frost bite on direct skin contact. Oxygen can be liquefied by liquid helium creating fire hazard and when converted to gaseous form, has a high rate of expansion. The high rate of expansion can displace air and create a risk of asphyxiation.

Helium filling of the MRI scanner is to be performed by authorized external personnel only when needed. The dewars of liquid helium for filling is stored in designated areas of the hallway in the MRI Unit. If venting from the dewars is excessive, it is to be moved out of the MRI Unit to a safe storage area.

Staff who will be working around cryogens will require training on:

- The hazards associated with cryogens
- Safe handling procedures
- Emergency procedures

Training records are to be documented by the Senior MR Technologist.

Emergency Procedures

In the event of an emergency in the MRI Unit please refer to specific MRI Emergency procedural policies.

Incident Reporting

Any potential or actual safety events/incidents involving participants, families or personnel in the MRI Unit are to be reported in accordance with Holland Bloorview's Safety Event Incident Reporting Policy by submitting through Meditech in the Quality Risk Management (QRM) module.

References

ACR Guidance Document for Safe MR Practices: 2013. JOURNAL OF MAGNETIC RESONANCE IMAGING 37:501–530 (2013)

Shellock, F. G., Magnetic Resonance Procedures: Health Effects and Safety, Pre-Magnetic Resonance Procedure Screening, 2009