COLLEGE OF PHYSICIANS AND SURGEONS OF BRITISH COLUMBIA

Diagnostic Accreditation Program

ACCREDITATION STANDARDS

Magnetic Resonance Imaging Safety

Diagnostic Accreditation Program
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Introduction

The goal of magnetic safety is to protect patients and staff from the potential risks associated with magnetic fields.

Facility design and access restrictions

No.		Description	Risk	Reference	Change
MRS1.0		**THE DESIGN OF THE FACILITY AND ACCESS RESTRICTIONS MINIMIZE THE POTENTIAL HAZARDS AND RISKS ASSOCIATED WITH THE MAGNETIC FIELD.**			
MRS1.1		**Individuals knowledgeable in MRI safety are involved in planning and review of facility design plans for a new MRI installation.** *Guidance: There are many issues that impact MRI safety that are considered during facility planning for a given MRI installation including, but not limited to; cryogen emergency vent locations and pathways; five-gauss lines; siting considerations; patient access pathways; etc. These issues and many others are reviewed with those individuals experienced in MRI facility planning and familiar with patient safety and patient flow considerations prior to committing to construction of a specific facility design. Enlisting the assistance of an architectural firm experienced in this area, and doing so early in the design stages of the planning process, may prove most valuable. Facility plans which incorporate the ACR 4 zone configuration with particular attention to all zone III access restrictions will prevent harm to patients, staff and visitors.*			
MRS1.1.1	**M**	New facility or a net new magnet has incorporated the ACR 4 Zone configuration into their design plans and labels zone III and zone IV. *Guidance: During facility planning for an MRI installation, enlisting the assistance of individuals experienced in MRI facility planning is advantageous for some of the following considerations cryogen emergency vent locations and pathways, five-gauss lines, siting considerations, patient and staff access pathways, sightlines, and adequate emergency resuscitation space.*	H		
MRS1.1.2	**M**	All MRI facilities have signage warning that the magnet is always on affixed to all entrances leading into zone IV.	H		
MRS1.1.3	**M**	New MRI facilities include an emergency exhaust pathway in case of cryogen vent system failure or cryogen gas leak. *Guidance: The emergency exhaust grill should be positioned in the ceiling opposite the entrance to the magnet so that the exhaust fan draws the cryogenic gas away from the exit.*	H		

No.		Description	Risk	Reference	Change
MRS1.1.4	**B**	Magnet rooms are equipped with oxygen sensors so that in the event of a cryogen gas leak staff are alerted to the diminished oxygen levels in the room.	H		
MRS1.1.5	**B**	The MRI facility labels zones I through zone IV within the service area.	H		
MRS1.2		**Access restrictions ensure the safety of patients and all individuals who enter the MRI facility.**			
MRS1.2.1	**M**	All access to zone III and zone IV is restricted from non-MRI personnel.	H		
MRS1.2.2	**M**	Zone III regions are physically restricted from general public access by, for example, key locks, passkey locking systems, or any other reliable, physically restricting method.	H		
MRS1.2.3	**M**	Access controls are in place for all non-MRI personnel (e.g. medical staff who occasionally work in MRI, housekeeping staff, facility maintenance, repair personnel, security staff, etc. and non-MRI personnel called to the facility in the event of an emergency).	H		
MRS1.2.4	**M**	Only MRI personnel shall be provided free access, such as the access keys or passkeys, to zone III.	H		
MRS1.2.5	**M**	In areas of magnetic field hazard where the static field strength exceeds five gauss, warning signage is prominently displayed even in typically non-occupied areas such as rooftops or storage rooms.	H		
MRS1.2.6	**B**	As part of the zone IV site restriction, all MRI installations provide direct visual observation by level 2 personnel to access pathways into zone IV. *Guidance: The MRI technologists are able to directly observe and control, via line of sight or via video monitors, the entrances or access corridors to zone IV from their normal positions when stationed at their desks in the scan control room.*			
MRS1.2.7	**M**	Fringe fields are established. *Guidance: The five-gauss line is used to define the margins for pacemaker safety.*	H		
MRS1.2.8	**M**	There is a predetermined magnetically safe location where full resuscitative efforts are to be performed. If the resuscitation area is within zone III, access to zone IV should be restricted during resuscitation.	H		
MRS1.2.9	**M**	Ferromagnetic equipment and devices brought by the patient are secured in a "ferrous quarantine" storage area, distinct from the storage areas for MR-safe and MR-conditional equipment to ensure they are not inadvertently brought into the MRI room.	H		

No.		Description	Risk	Reference	Change
MRS1.2.10	**M**	The MRI scan room door is locked during non-operational hours and is not left open except during patient entry and exit.	H		
MRS1.2.11	**M**	Non-MR personnel must be accompanied by, or under the immediate supervision of level 2 MR personnel throughout their stay in zones III or IV.	M		
MRS1.2.12	**M**	Zones of magnetic field hazard (above five gauss) are clearly delineated, even in typically non-occupied areas such as rooftops or storage rooms. Access to these zone III areas is similarly restricted from non-MRI personnel as they would be inside any other zone III region associated with the MRI facility.	M		
MRS1.3		**An evaluation of magnetic safety and image quality is conducted when facility designs are modified.** *Guidance: An evaluation is conducted after a renovation to the MRI room or any structural change to the surrounding areas to ensure the safety of staff, patients and other personnel within the facility.*			
MRS1.3.1	**M**	After a renovation to the MRI room or any structural change to the surrounding areas an assessment of the radiofrequency shielding is conducted.	M		
MRS1.3.2	**M**	After a renovation to the MRI room or any structural change to the surrounding areas an assessment of the gauss line accuracy is conducted.	M		
MRS1.3.3	**M**	After a renovation to the MRI room or any structural change to the surrounding areas an assessment of the magnet homogeneity is conducted.	M		
MRS1.3.4	**M**	After a renovation to the MRI room or modifications are made to the walls or surrounding structures containing the ventilation ducting, an assessment of the cryogen ventilation system integrity is conducted.	H		

Safety screening

No.		Description	Risk	Reference	Change
MRS2.0		**THE ESTABLISHMENT OF THOROUGH AND EFFECTIVE SAFETY-SCREENING GUARDS THE SAFETY OF ALL THOSE PREPARING TO ENTER ZONE III.**			
MRS2.1		**Screening procedures are strictly enforced to ensure safety to all individuals who enter the MRI facility.**			
MRS2.1.1	**B**	Patients are questioned regarding the possibility of claustrophobia in advance of arrival to the MRI service.			
MRS2.1.2	**M**	There are documented screening procedures in place for all individuals who enter the MRI environment.	C		
MRS2.1.3	**M**	Patients are MRI safety-screened on-site at least once by level 2 MRI personnel verbally or interactively.	H		
MRS2.1.4	**M**	The screening procedures take into consideration conscious patients.	H		
MRS2.1.5	**M**	The screening procedures take into consideration unconscious patients.	H		
MRS2.1.6	**M**	The screening procedures take into consideration supporting individuals.	H		
MRS2.1.7	**M**	The screening procedures take into consideration clients and staff.	H		
MRS2.1.8	**M**	Patients and non-MRI personnel with a history of metallic foreign object penetration undergo further investigation.	H		
MRS2.1.9	**M**	There is a process in place to review previous or to request pre-MRI imaging to rule out metallic or other implanted objects that may be contraindicated in an MRI scan.	H		
MRS2.1.10	**M**	The MRI radiologist is involved in assessing any contraindications.	H		
MRS2.1.11	**M**	Patients are prepared for the MRI examination in an appropriate safe zone and moved into the examination room once determined safe to do so.	H		
MRS2.1.14	**M**	Patient weight is accurately measured and documented for determining both SAR limits and gadolinium injection dose.	M		

No.		Description	Risk	Reference	Change
MRS2.2		**MRI screening forms include questions on MRI hazards and contraindications.** *Guidance: Examples of screening forms are available on www.mrisafety.com.*			
MRS2.2.1	**M**	Standardized and detailed screening forms include questions on MRI hazards and contraindications including but not limited to pacemakers.	M		
MRS2.2.2	**M**	Standardized and detailed screening forms include questions on MRI hazards and contraindications including but not limited to aneurysm clips.	M		
MRS2.2.3	**M**	Standardized and detailed screening forms include questions on MRI hazards and contraindications including but not limited to metallic and/or electronic implants.	M		
MRS2.2.4	**M**	Standardized and detailed screening forms include questions on MRI hazards and contraindications including but not limited to metallic foreign bodies.	M		
MRS2.2.5	**M**	MRI safety screening of the patient includes determining pregnancy status.	M		
MRS2.2.6	**M**	Standardized and detailed screening forms include questions on MRI hazards and contraindications including, but not limited to allergies and conditions that require an assessment prior to contrast use (e.g. history/risk factors of kidney disease or dialysis, previous MRI contrast agent allergic reaction, etc.).	M		
MRS2.3		**Device and object screening are effective components of MRI safety.**			
MRS2.3.1	**M**	All facilities have access to a handheld magnet greater than or equal to 1000 gauss to supplement the MRI safety screening practice of the service.	M		
MRS2.3.2	**M**	Handheld magnets are stored securely outside of zone III.	H		
MRS2.3.3	**M**	A handheld magnet is used to assess objects and devices that must be brought into the magnet room and their ferromagnetic status is unknown. The results of the assessment, date, time, and name of the tester are documented.	M		
MRS2.3.4	**M**	The MRI service has the most current Reference Manual for Magnetic Resonance Safety, Implants and Devices or access to a validated online resource (e.g. http://www.mrisafety.com/) as a guide in determining the MRI safety of implanted metallic or electronic devices and foreign objects.	M		
MRS3.0		**SAFETY PRECAUTIONS PREVENT ACCIDENTS AND INJURIES IN THE MRI ENVIRONMENT.**			

No.		Description	Risk	Reference	Change
MRS3.1		**All ancillary equipment intended to be taken into the MRI scan room is clearly identified.** *Guidance: Particularly with regard to non-clinical and incidental equipment, current products marketed with ill-defined terminology such as "non-magnetic," or outdated classifications such as "MRI-compatible," are not to be presumed MR safe. Similarly, any product marketed as "MR safe" but with metallic construction or components are to be treated with suspicion. Objects intended for use in zone IV, including non-clinical incidental products such as stepping stools or ladders, which are not provided with manufacturer or third-party MRI safety test results under the new ASTM criteria, are facility tested.*			
MRS3.1.1	**M**	The ancillary equipment intended to be taken into the scan room has clear and appropriate MR safe or MR conditional safety labels. *Guidance: No equipment or devices are brought into the MRI environment unless it is proven to be MR safe or MR conditional. The safety of "MR conditional" items is verified with the specific scanner and MRI environment in which they will be used.*	H		
MRS3.1.2	**M**	All equipment used for sedation and monitoring, resuscitation, and anesthesia and monitoring are MR safe or MR conditional, operational and readily available.	C		
MRS3.1.3	**M**	Floor markings indicate the safe location of the MR conditional equipment. *Guidance: For example, physiological monitoring device performance and safety may be impacted if they are too close to the magnet.*	H		
MRS3.1.4	**M**	Mechanisms are in place to prevent MR conditional equipment within the magnet room from being displaced beyond their conditional field limits. *Guidance: To prevent the displacement of MR conditional equipment within the magnet room equipment may be tethered or permanently affixed. For example, an MRI power injector conditional to 100 gauss may be tether so it cannot be moved closer to the magnet and beyond a 100 gauss fringe field.*	H		
MRS3.1.5	**M**	There is a clearly marked, readily accessible MR conditional or MR safe fire extinguisher physically stored in zone III or zone IV.	H		
MRS3.1.6	**M**	All conventional fire extinguishers not tested and verified MR safe or conditional are restricted from zone III.	H		

No.		Description	Risk	Reference	Change
MRS3.1.7	**M**	No equipment or devices are brought into the MRI environment unless it is labelled to be MR safe or MR conditional. The safety of "MR conditional" items is verified with the specific scanner and MRI environment in which they will be used through the manufacturer's specifications.	H		
MRS3.2		**Patient safety is monitored before, during and after an MRI examination.**			
MRS3.2.1	**M**	Except for emergent coverage, there will be a minimum of two MR technologists or one MR technologist and one other individual with the designation MR personnel in the immediate zone II through zone IV MR environment whenever patients are in the MR environment. During this time, the two MR personnel must be able to directly communicate within earshot of each other.	H		
MRS3.2.2	**M**	When seated at the console, the technologist can directly view the patient within the magnet bore or via a monitor system.	M		
MRS3.2.3	**M**	Mechanisms are in place to ensure patient communication during the examination.	M		
MRS3.2.4	**M**	For superconducting systems, adequate hearing protection is provided to all individuals remaining in the scan room during the examination.	H		
MRS3.2.5	**M**	Methods are in place for managing patients with claustrophobia, anxiety and emotional stress.	M		
MRS3.2.6	**M**	The MRI system consists of a detachable MRI transport table or MRI conditional transfer device for emergency transport of the patient from the scan room.	H		
MRS3.2.7	**M**	When it is necessary to initiate emergency resuscitation in the MRI room, it is only performed by screened individuals using MR-safe or MR-conditional equipment.	H		
MRS3.2.8	**M**	All MRI facilities perform drills at least annually, to rehearse and refine emergency response protocols to protect patients, MRI staff, and responders.	M		
MRS3.3		**Equipment is safety monitored and maintained.**			
MRS3.3.1	**M**	The MRI system produces a warning and abort scan when RF power deposition limits are exceeded.	H		
MRS3.3.2	**M**	There is adequate ventilation in the equipment (e.g. gradient and RF amplifier) and cryogen storage room.	H		

No.		Description	Risk	Reference	Change
MRS3.3.3	**M**	Cryogen vent systems are visually inspected annually or following a quench to identify any stressed or worn pipe sections, loose couplings, fittings or supports. This also ensures that the discharge point is protected from weather damage and animals which may cause occlusions.	M		
MRS3.3.4	**M**	Helium dewar storage in patient areas is prohibited and when stored in staff areas is not left unattended for an extended length of time.	H		

Safety education

No.		Description	Risk	Reference	Change
MRS4.0		**THE MRI SERVICE HAS A COMPREHENSIVE MAGNETIC SAFETY PROGRAM.**			
MRS4.1		**There is an MRI safety manual with policies and procedures.**			
MRS4.1.1	**M**	There are policies and procedures for responding to a fire within the scan room when MRI staff are present and after hours when MRI staff are absent.	M		
MRS4.1.2	**M**	Evacuation quench provisions for superconductive magnets include a clearly marked quench-activation device.	C		
MRS4.1.3	**M**	Evacuation quench provisions for superconductive magnets include evacuation procedures for patients and staff.	M		
MRS4.1.4	**M**	Evacuation quench provisions for superconductive magnets include a fail-safe ventilation path for quenched helium.	H		
MRS4.1.5	**M**	Evacuation quench provisions for superconductive magnets include written protocols for the rescue of patients and staff when gaseous helium does not vent out of the scan room and displaces oxygen.	M		
MRS4.2		**Ongoing safety education is provided to MRI personnel.**			
MRS4.2.1	**M**	There is a designated MRI safety officer who has undergone training and education through an MRSO course.	M		
MRS4.2.2	**M**	Non-MRI personnel required to work within zone III are provided with MRI safety education and training. *Guidance: The MRI safety officer should make arrangements to ensure MRI safety is included in the orientation of new staff working within zone III, such as housekeeping, and security.*	M		
MRS4.2.3	**M**	MRI technologists undergo an annual review of MRI safety policies and procedures established by the facility.	M		
MRS4.2.4	**M**	MRI technologists undergo an annual review of emergency shutdown procedures for quenching the main magnetic field and electrical power shutdown.	M		
MRS4.2.5	**M**	MRI technologists undergo an annual review of policies and procedures to deal with an inadvertent magnet quench.	M		

No.		Description	Risk	Reference	Change
MRS4.2.6	**M**	MRI technologists undergo an annual review of policies and procedures for rescue of a person involved in an MRI accident.	M		
MRS4.2.7	**M**	There is documented completion of on-going MRI safety education and training provided at regular intervals for non-MRI personnel working within zone III.	M		
MRS4.3		**Education is provided to non-MRI personnel who may come in contact with the magnet.** *Guidance: For the safety of firefighters and other emergent services responding to an emergent call at the MRI facility, it is recommended that all fire alarms or other emergent service response calls originating from or located in the MRI facility are forwarded simultaneously to a specifically designated individual from among the facility's MRI personnel. This individual, if possible, is on- site prior to the arrival of the firefighters or emergent responders to ensure that they do not have free access to zone III or zone IV. The facility might consider assigning appropriately trained security personnel, who have been trained and designated as MRI personnel, to respond to such calls. In any case, all MRI facilities arrange to prospectively educate their local fire marshals, firefighters' associations, and police or security personnel about the potential hazards of responding to emergencies in the MRI suite. It is stressed that even in the presence of a true fire (or other emergency) in zone III or zone IV; the magnetic fields may be present and fully operational. Therefore, free access to zone III or zone IV by firefighters or other non-MRI personnel with air tanks, axes, crowbars, other firefighting equipment, guns, etc., might prove catastrophic. See also magnetic safety accreditation standard MRS1.2.3.*			
MRS4.3.2	**M**	MRI Safety education is provided to municipal emergency response staff on a regular basis so that it may be included in the orientation of new staff and for ongoing training. *Guidance: It is recommended that MRI safety education or educational materials are updated or provided to municipal response every three years or less.*	M		
MRS4.4		**There are established processes to continually assess hazards and incidents to improve the safety of the service.**			
MRS4.4.1	**M**	MRI safety policies and procedures are reviewed by the medical leader and MRI safety officer annually and revised as necessary.	M		
MRS4.4.2	**M**	There is an assessment of any and all adverse events, MRI safety incidents or "near incidents" that occur in the MRI service.	M		

No.		Description	Risk	Reference	Change
MRS4.4.3	**B**	Incidents (e.g. projectiles, equipment malfunctions, failure to complete examinations due to patient distress, etc.) are reported to the medical leader in a timely fashion and used in continuous quality improvement efforts.			

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