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| Approving Committee/Title of person responsible: Imaging Service Directors | |

## 1.0 Policy Statement

MRI safety procedures consistent with regulatory requirements, and medical center safety policies and procedures will be implemented and maintained for the following safety zones:

1.1 Zone I: General Public
1.2 Zone II: Unscreened MRI Patients & Personnel
1.3 Zone III: Screened MRI Patients & Personnel
1.4 Zone IV: Screened MRI Patients Under Immediate Supervision (Line of Sight) of Level 2 MRI personnel

## 2.0 Purpose

To provide guidelines for the safety of all members and personnel working within or visiting the MRI suite.

## 3.0 Scope/Coverage

This policy applies to all employees who are employed by the following entities (collectively referred to as "[redacted] choose applicable):

3.1 [redacted]

3.2 [redacted]

## 4.0 Definitions

4.1 **MRI Event:** Near miss, accident or injury within MRI Zone IV.

4.2 **Near miss**: An unplanned event that did not result in injury, illness or damage, but had the potential to do so, i.e., ferrous O2 tank entering into MRI Zone IV, patient does not accurately answer MR safety question, etc.

4.3 **Level 1 MR Personnel**: Those who have passed minimal safety educational efforts to ensure their own safety as they work within Zone III, i.e., Transporters, Tele RN's, Imaging Aides, Imaging Assistants, MR Directors, and Clinical Technology.

4.4 **Level 2 MR Personnel**: Those who have been more extensively trained in the broader aspects of MR safety issues and can ensure their own and the safety of others, i.e., MR Technologists and Radiologists.

4.5 **MRI Suite**: Could potentially include MR Zones II, III, and/or IV depending upon the department layout.

4.6 **MR Safe**: An object that poses no known hazards in all MR environments. MR safe can only be applied to objects that are 100% safe to be taken, used, or placed within all MR environments without any risk or potential harm.


4.7 **MR Conditional:** An object that is safe when used in a specific manner within specific MR environments. Most objects will receive this rating. An object with this label warns the user that there are limitations to the usability or to the testing that was performed on it. In other words, the object may have been tested for a 1.5 Tesla system, but not for a 3-Tesla system. The conditions should be included on the object in its packaging, or the accompanying instructions.


4.8 **MR Unsafe:** An object that poses a known threat or hazard in all MR environments.


## 5.0 Provisions/Procedures

5.1 **General Rules for the MRI Suite**

5.1.1 The magnet is always on (Zone IV)

5.1.2 Entry into the MRI Zone IV is only for authorized business and only by approval of the MRI technologist, radiologist, and/or other authorized imaging staff who have completed MRI Level 2 safety training.

5.1.3 Employees, visitors or staff will not be allowed in the magnet area (Zones III and IV) without the appropriate screening, evaluation and supervision.

5.1.4 No patients with unapproved telemetry leads or telemetry monitors shall be allowed entry into MRI Zone IV.

5.1.5 Employees, visitors or staff with Harrington rods, prosthesis, bone or joint pins, or any other potential for foreign ferromagnetic materials will need to be evaluated prior to entering MRI Zone IV.

5.1.6 All ferromagnetic or magnetic items must be removed prior to entering the MRI room (MRI Zone IV). Examples: Watches, cell phones, credit cards, pagers and other electronic devices, wallets, change, rings, pens, keys, buckles, or any other metal object, etc.

5.1.7 All ancillary equipment, i.e., gurneys, wheelchairs, IV poles, patient monitoring devices, blood pressure cuffs, scissors, pagers, or rescue equipment, will not be taken into the MRI room unless they are proven (tested) non- ferromagnetic.

5.1.8 Oxygen tanks must be non-ferromagnetic (aluminum) and will not be placed closer than the end of the MRI imaging table (Zone IV). Plastic airway tubing will be used to reach the patient.

5.1.9 Non MRI-compatible ventilators and portable suction pumps will not be taken into the MRI room (Zone IV).

5.1.10 Equipment must be labeled MR Safe or MR Conditional.

5.1.11 If MRI Conditional, equipment must be managed per the manufacturer's recommendations.

5.1.12 In the event of a near miss or actual event where ferromagnetic objects enter Zone IV, MRI personnel will document the incident on an Electronic Responsible Reporting (eRRF) form, within the appropriate timeframe, per regional policy.

5.1.13 Notify [redacted] Regional Compliance and Regional Imaging of events and near misses.

5.2 **MRI Safety Education and Monitoring**

5.2.1 Basic MRI Safety education approved for all appropriate medical center staff employees, and advanced MRI safety education for Level 2 MRI personnel will be conducted annually.

5.2.2 The Imaging Services Director (or Designee) will ensure that policies and procedures are followed; training and safety certification for technologists and MRI staff is completed and current; MRI incidents are investigated, documented, and reported as appropriate, and deficiencies corrected. The Imaging Services Director (or Designee) has the authority to immediately cease unsafe activities, or activities that are out of compliance with the medical center's MRI Safety Guidelines policy.

5.2.3 The MRI Safety Committee will meet quarterly to review, develop, and implement an MRI safety culture.

5.3 **Signage**

5.3.1 MRI Zones III and IV shall be clearly marked with the appropriate zone signage.

5.3.2 Zone IV signage shall state that the magnet is always on.

5.4 **Thermal Burns for Adult and Pediatric Patients**

To ensure staff is aware of the potential danger and problems that may occur in using physiologic monitoring equipment, ECG monitors, electrocardiographic electrodes, ECS cables/leads, and pulse oximeters in the MRI unit, the following precautions should be taken:

5.4.1 Use systems that have electrically nonconductive paths (i.e. fiber optic cable and plastic tubing).

5.4.2 Use systems that have high resistance paths (i.e. carbon ECG leads).

5.4.3 Do not loop leads, cables, or coils.

5.4.4 Place the sensor well away from the radio frequency coil and run the cables away from the coil whenever possible.

5.4.5 Check all sensors and cables to ensure that the electrical insulation around them is intact.

5.4.6 See that no other metal surface is in contact with the patient.

5.4.7 Keep the cables off the patient and run them over the blankets whenever possible.

5.4.8 Remove all unused sensors, cables, and surface coils from the MRI system.

5.4.9 Instruct conscious patients to call out or utilize call button or squeeze ball (if applicable), if they experience uncomfortable levels of warming anywhere, especially at the sites of sensor application.

5.4.10 Technologists should periodically check the sites of the sensor locations on unconscious patients.

5.4.11 Use provided pads to insulate the patient from sides of the bore, coils and body parts in contact with each other.

5.4.12 Eye makeup that contains metal can cause eye irritation. Patient shall be instructed to remove makeup before scanning. Patients with permanent eyeliner or other metallic ink tattoos shall be informed about the risk of temporary skin irritation, and instructed to inform the technologist during the examination if irritation occurs, and get medical attention if the irritation persists.

5.4.13 Patients will be required to remove undergarments that have suspected or known metallic fibers or metal objects included in their design, (i.e. X-static: Coolmax/lycra, as examples – refer to article Invisible Metallic Microfiber in Clothing Presents Unrecognized MRI Risk for Cutaneous Burn, published December 15, 2011 as 10.3174/ajnr.A2827).

5.4.14 In the event of an accident, injury, or near miss, MRI personnel will document the incident on an Electronic Responsible Reporting (eRRF) form, within the appropriate timeframe, per regional policy.

5.5 **Acoustic Noise Protection**

5.5.1 Hearing protection is required for patients and staff in Zone IV during scan.

5.5.2 MRI technologist or designee will explain the use of ear plugs to patients and others entering Zone IV for noise reduction.

5.5.3 Regular head phones designated for communication with patients cannot replace the ear plugs. Only specifically designated metal-free head phones for noise protection can be used in place of the ear plugs.

5.6 **Quench Evaluation**

In the event of a quench, the patient's safety is always the first concern. Cryogens leaking into the room may appear as clouds of smoke.

5.6.1 Action to be taken:

- 5.6.1.1 Only trained service personnel may handle cryogens. During cryogen fills, Zone III and Zone IV must be evacuated of all, but trained service personnel.
- 5.6.1.2 If pressure within the room prevents opening the door:
  - 5.6.1.2.1 The window to the control room should be broken
  - 5.6.1.2.2 Ventilate adjacent areas as they may also rapidly fill with cryogen vapor
- 5.6.1.3 Evacuate the patient from the MRI room as quickly and carefully as possible. Reassure the patient of his/her safety while transporting them out of the magnet room to a safer area to prevent asphyxiation.
- 5.6.1.4 Cryogen condensate (on the floor and horizontal surfaces) is extremely cold and may cause thermal injury (frostbite) on contact.

5.6.1.5 Staff entering Zone IV to evacuate the patient, should be careful to maintain space orientation in the room by keeping the exit door in sight.

5.6.1.6 Notify Imaging Director or designee, of the quench. Imaging Director or designee will call Clinical Technology to handle the equipment.

5.6.1.7 In the event of a quench or near miss, MRI personnel will document the incident on an Electronic Responsible Reporting (eRRF) form, and communicate to the appropriate departments (ex: Quality, Risk), within the appropriate timeframe.

5.6.1.8 Restricted access should be maintained.

5.6.1.9 Communicate with first responders regarding the safety status of the magnet and the MRI suite.

5.6.1.10 Notify the Emergency Response Team (ERT)

5.6.1.10.1 ERT will respond to the scene and assist with evaluation of the situation and risks involved and plan clean-up and re-occupation process.

5.6.1.10.2 If ERT evaluation indicates, a Code Triage may be activated.

5.6.1.11 When the helium quench is complete and re-occupancy approved by the ERT, the MRI lead will evaluate the cryogen levels.

5.6.1.12 The lead will notify the Imaging Director of the anticipated down time.

5.6.1.13 Staff-initiated quench of the magnet only when the object held against the MRI scanner poses an imminent threat of injury or death, such as if a patient or staff member is pinned between the object and the magnet. Note that quench is a potentially dangerous procedure and essential precautions must be taken before and after quenching the magnet.

5.7 **MRI Technologists**

5.7.1 MRI technologists are responsible for the safety of Zone III and Zone IV.

5.7.2 MRI technologists must be free of implanted devices or materials that could be adversely affected by the magnetic field.

5.7.3 Prior to entering Zone IV, the patient is to change into a [redacted]-approved, MRI-safe, metal-free garment (such as gowns, paper shorts and tops).

5.7.4 All patients and visitors must be wanded with handheld metal detector, even if the MRI suite has a ferrous detection system in place.

5.7.5 Hearing protection is required for patients and staff in Zone IV during scan.

5.7.6 Keep the door to the MRI room (Zone IV) closed at all times.

5.7.7 After hours, the door to the MRI suite shall be locked.

5.7.8 The MRI suite shall not be left unlocked and unattended during business hours.

5.7.9 Patients shall be visually monitored at all times while in Zone IV.

5.7.10 Maintain two-way audio access to the patient during scanning procedures.

5.7.11 Ensure that regular PMs will be performed to ensure optimal magnet performance.

5.7.12 All discrepancies in equipment performance will be reported to Clinical Technology and the department manager.

5.7.13 Annual physicist evaluations will be arranged with Clinical Technology.

5.7.14 Pregnant MRI technologists and Imaging Director should refer to *Pregnant Technologists and Healthcare Workers* Safety Information at www.MRISafety.com

5.8 **Nursing Staff and Physicians**

5.8.1 May enter the MRI room (Zone III and IV) in the performance of their duties and during patient care activities only after all metallic items have been removed and screened by MRI Technologist, to include being wanded with a MRI hand held metal detector prior to entering Zone IV. All non-MRI staff will be wanded, regardless if the MRI suite has a ferrous detection system in place.

5.8.2 Only the patients' non-ferromagnetic, MR safe and MR conditional monitoring equipment designed for the MRI environment will be used.

5.9 **Patients and Visitors**

5.9.1 Patients and visitors will not be allowed in the MRI area (Zone III & IV) unless escorted and screened by an MRI technologist, radiologist, or other trained Level 2 MRI personnel.

5.9.2 All patients having an MRI procedure will complete and sign an MRI Safety Screening form before being allowed into Zone III.

5.9.3 Any question answered YES will be investigated and resolved before the patient is allowed into Zone III.

5.9.4 MRI patients will remove all outer clothing and footwear and will be provided with [redacted] MRI safe approved metal free garment (such as gowns, paper shorts and tops).

5.9.5 Transdermal Patches

5.9.5.1 The MRI department will screen for transdermal patches for outpatients and inpatients as follows:

5.9.5.2 Outpatients

5.9.5.2.1 Outpatients will be screened for transdermal patches verbally over the phone during the scheduling process.

5.9.5.2.2 Patients who have questions regarding the temporary removal of the transdermal patches during the MRI exam shall be referred to their provider.

5.9.5.2.3 On the day of the exam, if the patient presents with a transdermal patch, the patient will be asked to remove it prior to entering Zone IV of the MRI scanner. At the end of the exam, the patient will be informed they may apply a new patch as per further instructions by their ordering provider.

5.9.5.2.4 The patches will be disposed of in a designated pharmaceutical waste bin.

5.9.5.3 Inpatients

5.9.5.3.1 If a patient arrives in the MRI department with a medication patch on, the licensed provider (RN or MD) will remove the patch.

5.9.5.3.2 Patches on an inpatient shall not be removed without an MD order to do so.

5.9.5.3.3 MRI technologists or non-nurse personnel shall not remove transdermal patches.

5.9.6 Piercings

5.9.6.1 The MRI department will screen and ensure that all ferromagnetic piercing(s) are removed prior to entering Zone IV of the MRI Scanner.

5.9.6.2 If patients will not or cannot remove their ferromagnetic body piercing(s), the technologist will contact the appropriate providers (ie: referring physician or radiologist) who will determine MRI exam risk versus benefits, or for further exam instructions.

5.9.6.3 If it has been determined by the provider that the MRI exam is necessary:

5.9.6.3.1 The technologist will document on the requisition the physician approval (MD name, date, time of exam approval).

5.10 **Pediatric Patients**

5.10.1 All pediatric patients will be screened with the help of their parent/guardian.

5.10.2 All pediatric patients will be required to change into Kaiser-approved metal-free patient garment (such as gowns, paper shorts or tops).

5.10.3 All pediatric patients must be wanded with handheld metal detector, even if the MRI suite has a ferrous detection system in place.

5.10.4 If a parent/guardian is needed to accompany the patient in Zone IV, the parent/guardian will be required to complete a screening form, change clothing and must be wanded.

5.11 **Facility Support Services**

5.11.1 All cleaning and maintenance equipment must be previously approved by MRI Level 2 trained personnel, before use in Zone IV.

5.11.2 Metallic tools, devices, and equipment will not be brought into Zone IV without the explicit examination and approval by Level 2 trained MRI personnel. (Floor buffers, mechanized floor strippers, mops, buckets, cleaning utensils, power drill, metallic tools, etc...)

5.11.3 No cleaning devices shall be brought into Zone IV when a patient is on the table.

5.11.4 No cleaning shall be performed in Zone IV without the immediate supervision of authorized Level 2 trained MRI staff.

5.12 **Emergency and Security Personnel**

5.12.1 In the event of an emergency (i.e., respiratory arrest/cardiac arrest), patient will be removed promptly from Zone IV by MRI Level 2 trained staff, and treatment will be administered outside of Zone IV.

5.12.2 If Security or Emergency personnel are ever called by the Imaging Services Department to report to the MRI area, they shall be screened prior to entering Zone III; all patients will be taken out of Zone IV by the MRI technologist.

5.12.3 If a need arises that requires Emergency or Security personnel to enter the MRI room (Zone IV), this can only be done after being cleared by a level 2 MRI personnel. (Non-MRI personnel will be asked to remove any ferromagnetic materials (Zone III) including credit cards, wallet, watches, rings, electronic devices, etc.)

5.12.4 During the course of exams on critically ill patients or during emergencies which attract numerous personnel, entrance into the MRI exam area (Zone II and III) will be continually controlled by level 2 MRI personnel that will screen equipment and persons for potential hazards.

5.12.5 All fire extinguishers and oxygen tanks located in or brought into the MRI scanning room will be checked for MRI safety compliance (ex: non-ferrous), by Level 2 personnel.

5.12.6 MRI safety education for all appropriate medical center employees shall be conducted annually.

## 6.0 References/Appendices

http://mrisafety.com/

- Reference Manual for Magnetic Resonance Safety, Implants and Devices-2006-Frank G. Shellock, PhD
- Invisible Metallic Microfiber in Clothing Presents Unrecognized MRI Risk for Cutaneous Burn, published December 15, 2011 as 10.3174/ajnr.A2827
- ACR Manual on MRI Safety – 2020
- Interrelating Sentinel Event Alert #38: https://www.acr.org/~/media/ACR/Documents/PDF/QualitySafety/MR-Safety/InterrelatingSentinelEventAlert38.pdf