# Table of Contents

1 Introduction .................................................................................................................. 3  
2 Imaging Research Facility Address and Phone Number ..................................................... 3  
3 Oversight of the Imaging Research Facility ........................................................................ 3  
4 IRF Personnel ................................................................................................................. 4  
5 Facility Description ......................................................................................................... 6  
6 IRF Zoning and Access .................................................................................................... 9  
7 Safety Procedures .......................................................................................................... 9  
8 Safety Screening for individuals entering Zone 4 (Magnet Room) .....................................13  
9 Emergency Procedures .................................................................................................16  
10 Training for Operators of the MRI Instrument .................................................................18

# Appendices and Filename:

Appendix A: IRF Operations Committee Information  
Appendix B: Documentation Forms for MR Personnel and Operators  
Appendix C: IRF Key holders and IRF Keycard Access Holders  
Appendix D: MR Safety Screening Protocol and Forms  
Appendix E: Emergency Procedures for Posting  
Appendix F: IRF Information Handout for Emergency (Fire/Rescue) Personnel  
Appendix G: IRF Emergency Contacts  
Appendix H: IRF Internal Operation Procedures
1 Introduction

This is the fourth revision of the Standard Operating Procedures (SOPs) for the Imaging Research Facility (IRF). These Standard Operating Procedures (SOPs) were initially developed in October 2005 based on guidelines from the American College of Radiology (ACR)\textsuperscript{1,2}, and with the consultation of the Indiana University Radiation Safety Officer, Gregory Crouch. The most recent version of the guidelines were published in 2013. In some cases these ACR guidelines are used verbatim, and in other cases, paraphrased. The Guidelines relating to the use of intravenous contrast agent are not relevant, as no contrast-based MRI studies are performed in the IRF. Guidelines related to the specific characteristics and operations of the IRF were also developed in-house based on the intent of the ACR guidelines.

These SOPs must be reviewed annually and updated as needed. Significant procedural updates related to safety and training must be made in consultation with the IU Radiation Safety Officer, and approved by the Institutional Review Board. Questions regarding facility operations or these SOPs should be directed to the Imaging Research Facility Director, Dr. Sharlene D. Newman sdnewman@indiana.edu.

2 Imaging Research Facility Address and Phone Number

Address: Imaging Research Facility  
Psychology Building  
Indiana University  
1101 East 10\textsuperscript{th} Street  
Bloomington, Indiana 47405-7007

Phone: (812) 856-3723

Fax: (812) 856-4544

Receptionist/check-in: Psychology Clinic Office  
Room 131  
Phone: 855-2313 or 855-2311

3 Oversight of the Imaging Research Facility

Oversight of the Imaging Research Facility (IRF) is the responsibility of the IRF Operations Committee, and the IRF Director.

3.1 Role of the IRF Director: The IRF director is responsible for the oversight of IRF Operations, including facility operations, policy development and implementation, staff hiring and management, budgeting, and safety assurance and research compliance. The IRF director reports to the Dean, College of the Arts and Sciences.

3.2 Role of the IRF Operations Committee: The IRF Operations Committee assists the IRF Director, especially with respect to facility operations, policy development and implementation, staff hiring and management, and safety assurance. There are several subcommittees that are specialized in specific functions of the IRF. Members of the IRF Operations Committee are appointed by the IRF Director. There are no set terms of service. This allows the needs and concerns of the users within the facility to be well represented, and so that their expertise can be used to shape and further the goals of the IRF. The IRF Operations Committee members information are listed in Appendix A.

4 IRF Personnel
Designation and Description of Magnetic Resonance (MR) Personnel and Non-MR Personnel

4.1 IRF Personnel include MR Personnel, who perform activities within the IRF (such as the MR physicist), and Non-MR Personnel (adapted from recommendations in the ACR White Paper), who perform work associated with the IRF from outside of the facility, such as an administrative assistant.

4.2 All MR Personnel must complete at least one MRI safety lecture or prerecorded presentation approved by the IRF Director. Attendance should be repeated at least annually and documented to confirm these ongoing safety certifications. These individuals are referred to as MR Personnel, of which there are two levels.

4.3 It is the responsibility of the IRF Director to determine which MR Personnel designations individuals may have.

4.4 A current list of MR Personnel, their levels, and the due date of their next safety training/update must be maintained within the MR facility at all times.

4.5 Level 1 MR Personnel

4.5.1 Definition. Level 1 MR Personnel are individuals who have had MR safety training as approved by the IRF Director. Typically the designation of Level 1 MR Personnel include undergraduate and graduate research assistants, post-doctoral fellows, and research assistants from individual laboratories.

4.5.2 Facility access allowance. Level 1 MR Personnel are not permitted to be in the facility unless they are under the supervision of a Level 2 MR personnel member.

4.5.3 Documentation of Level 1 MR Personnel qualification. Documentation of Level 1 MR Personnel qualification must be recorded on the appropriate form (see Appendix B), updated at least annually, and must be signed by the IRF Director. Records of documentation must be maintained within the IRF.

4.6 Level 2 MR Personnel

4.6.1 Definition. Level 2 MR Personnel are individuals designated as sufficiently trained to be in the IRF on their own, and to supervise Level 1 MR Personnel and Visitors in
the IRF. They are also sufficiently trained to oversee the MR screening process and give final approval for an individual to enter the magnet room and undergo imaging. Generally, these are individuals with greater experience in the MR environment than Level 1 MR Personnel. These individuals must demonstrate knowledge of the broad aspects of MR safety issues, including, for example, issues related to the potential for thermal loading or burns and direct neuromuscular excitation from rapidly changing gradients. They must also demonstrate specific knowledge regarding the safety procedures within the IRF. It is the responsibility of the IRF Director to identify the necessary training and to identify those individuals who qualify as Level 2 MR personnel.

4.6.2 Facility access allowance. Level 1 MR Personnel may have keycard access to Zone 2 of the IRF facility and are permitted to be there alone. Level 2 MR Personnel are permitted to be in the IRF alone and to supervise Level 1 MR Personnel when they are in Zone 3 or Zone 4 of the facility. Level 2 MR Personnel may be permitted keycard access to the IRF.

4.6.3 Documentation of Level 2 MR Personnel qualification. Documentation of Level 2 MR Personnel qualification must be recorded on the appropriate form (see Appendix B), updated at least annually, and must be signed by the IRF Director. Records of documentation must be maintained within the IRF.

4.7 MRI Operators

4.7.1 Definition. MRI Operators are those Level 2 MR Personnel who have undergone training to operate the Siemens Trio 3.0 Tesla MRI and who have been approved as IRF Operators by a current IRF Operator, the IRF Operations Committee sub-committee on Safety and Compliance, and the IRF Director.

4.7.2 Facility access allowance. As Level 2 MR Personnel, MRI Operators are permitted to be in the IRF alone and to supervise Level 1 MR Personnel when they are in the facility. Level 2 MR Personnel are permitted keycard access to the IRF.

4.7.3 Documentation of MRI Operator qualification. Documentation of MRI Operator qualification must be recorded on the appropriate form (see Appendix B), updated at least annually, and must be signed by the IRF Director. Records of documentation must be maintained within the IRF.

4.7.4 Training for MR Operators is described in Section 10.

4.8 Non-MR Personnel

4.8.1 Definition. Non-MR Personnel include individuals who are associated with the IRF but who do not work within the IRF itself. These include administrative assistants, research assistants, and others who work with the IRF, but have not undergone safety training. Specifically, non-MR personnel will be the terminology used to refer to any individual or group who has not within the previous 12 months undergone the designated formal MRI safety training of IRF. Non-MR Personnel must be escorted within the IRF by a Level 2 MR Personnel. These individuals will not enter the magnet room (room 163) without appropriate screening.
4.8.2 Facility access allowance. Non-MR Personnel are not permitted to be in the IRF alone or to have keycard access to the IRF.

4.8.3 Documentation is not required for Non-MR Personnel.

5 Facility Description

5.1 The IRF is located on the first floor of the Psychology Building, at 1101 East 10th Street, Bloomington, Indiana, 47405, on the Indiana University Bloomington campus. It consists of a total of 10 suites.

5.2 Suites 165 and 163, of the IRF house the MRI facility. This part of the IRF has dual keycard accessible locked entrances from the Psychology Building Clinic hallway and from suite 165. This latter doorway is at the end of a ramped hallway which has several doors into other parts of the IRF. Key card-access to this part of the IRF is possible for Level 2 MR Personnel. The room descriptions for this restricted access part of the IRF appear below:

Room 159A: Interview, screening area, and MR facility research assistant's office.
Room 159B: Dressing room and restroom.
Room 163: The MRI instrument room (Siemens 3 Tesla MRI scanner)
Room 165: The MRI control room.
Room 165A: The MRI equipment room.

5.3 Suite 161 houses the Mock MRI Scanner and it control room, with an adjoining office for the MRI Physicist. It is accessible from the back door of MRI Facility (Suites 159/163) or from Suite 190.

Room 161A: The Mock MRI scanner control room.
Room 161B: The Mock MRI scanner instrument room.
Room 161C: MRI Physicists' Office.

5.4 Schematic diagrams of the IRF: The location of the facility in the Psychology Building, and the layout of the IRFs MR Suite and other components are illustrated below.

**Psychology Building & IRF Location**
The footprint of the entire IRF consists of a restricted access area (MRI facility with arrows depicting the two entrances to the MRI facility), as well as other areas which house the Mock MRI scanner suite, neuroimaging data analysis suite and EEG/TMS laboratory.
6 IRF Zoning and Access

6.1 Zoning. For the purpose of safety, the IRF and vicinity is considered to have four zones (as specified by the ACR guidelines). Only Zones 3 and 4 lie within the physical confines of the IRFs MRI facility.

6.1.1 Zone 1 (outside the IRFs MRI facility) is the Psychology Clinic waiting room and Psychology Clinic Office, Room 131, at the opposite end of the clinic hallway from the IRF, and the rest of the IRF and the Psychology building.

6.1.2 Zone 2 (outside the IRFs MRI facility) is the hallway directly outside the IRF and rooms in the IRF that have no direct access to the MRI scanner room.

6.1.3 Zone 3 includes all rooms in the IRFs MRI facility except Suite 163, which is the MRI magnet/instrument room.

6.1.4 Zone 4 is Suite 163, which is the MRI magnet/instrument room.

6.2 Unescorted access: To have unescorted access, individuals must be Level 2 MR personnel.

6.2.1 The IRF, Suite 159, is physically restricted from general public access using door locks which can be unlocked only by keycard or using a key. The outer door is spring-loaded and closes automatically after entry.

6.2.2 The door lock to the IRF is not accessible using the Psychology Building master key. The only individuals with unrestricted access by key to the IRF are: the IRF Director, the MR Physicist, the Director of the Technical Support Group (Department of Psychological and Brain Sciences), and IRF MR technologists.

6.2.3 Access by keycard to the entire IRFs MRI facility, except for room 165A (the Siemens equipment room), is restricted to Level 2 MR personnel.

6.2.4 Appendix C is a list of key and access card holders.

7 Safety Procedures

7.1 Annual Cumulative Limits for Exposure to MR: At the request of the Laboratory Safety Committee in October 2004, we now have set an annual limit of 40 hours of MR imaging for a given individual on the IRF Siemens 3T TIM Trio MRI scanner. Although no actual safety issues have been identified – there are no studies of long term effects from exposure to relatively higher field strengths of 3.0T and above – this annual limited time is implemented preemptively should safety risks be identified later, on the advice of the Institutional Review Board at Indiana University. This time limit applies to that part of the session during which imaging data are being collected, but does not include the time spent lying in the bore of the magnet waiting to undergo imaging.

7.1.1 The total amount of time per imaging session is counted in 15 minute increments and the data (names, etc.) will be tracked in the facility according to IRB recommendations for the safe-keeping of confidential information.

7.2 Pregnancy-Related Issues: In keeping with current ACR guidelines, pregnant MR personnel are permitted to continue working in all areas of the IRF throughout their pregnancies. Acceptable activities include, but are not limited to, positioning individuals within the scanner, imaging, entering Zone 4 in the case of an emergency. Pregnant MR personnel should NOT be present within Zone 4 while imaging is in progress.

7.2.1 ACR guidelines permit pregnant women to undergo MR imaging. As recommended in the ACR guidelines, pregnant women will only undergo imaging in the IRF after consultation with a radiologist or other physician.

7.3 Safety concerns related to children

7.3.1 Although permitted by ACR guidelines, children who are research volunteers will not be sedated for MRI within the IRF.

7.3.2 Children should be either gowned before entering Zone 4, or their pockets should be checked by MR personnel, either manually or with a metal detector, prior to entering Zone 4. Prior to bringing personal objects such as stuffed toys into Zone 4, these objects must be checked for ferromagnetic content with the metal detector.

7.3.3 Because children may be unreliable historians, children must be screened in conjunction with their parents or guardians. Some older children may have tattoos or ferromagnetic jewelry or makeup that their parents do not know about, and therefore, to get reliable reports of these objects, they should be questioned separately from parents. As a rough guideline, children aged 10–17 will be screened both with their parents or guardians and separately to ensure an accurate account of safety prior to entering Zone 4.

7.4 Auditory considerations

7.4.1 Research participants, patients, and anyone accompanying these individuals in Zone 4 during imaging must wear hearing protection. These must be in place prior to initiating any MR sequences.
7.5 Thermal issues

7.5.1 General issues: The body temperature increases if the patient absorbs more energy per unit of time than can be dissipated through thermoregulation (increased perspiration and blood flow). During the MR examination, patients experience heat sensations on the skin and may begin to perspire. Their pulse rates may increase as well. The effects vary from patient to patient. The intensity of these effects depends on the measurement program selected. Following the examination, the body will cool off and the pulse rate will return to normal. The increase in core body temperature is usually well below 1 degree during the course of the MR examination if the SAR limits are maintained.

7.5.2 Specific Absorption Rate (SAR)

7.5.2.1 Definition: A quantity that describes how much electromagnetic energy is absorbed by the body over time, typically expressed in units of watts per kilogram. SAR depends upon the pulse sequence and the size, geometry, and conductivity of the absorbing object.

7.5.2.2 Possible adverse effects: A high local SAR may result in RF burns. A high SAR evenly distributed across the entire body exerts stress on the patients’ cardiovascular and thermoregulation system.

7.5.2.3 Protection against risk: SAR is limited in MRI studies to minimize body temperature increases. Accurately determining SAR is difficult; it depends upon heat conduction and body geometry as well as upon the blood flow changes. The Siemens 3T system requires the participant’s weight and birth date to be input when setting up the run. It uses those two measures to calculate an appropriate SAR. If the SAR is too high for a given set of inputted parameters, a message appears on the computer interface of the system indicating that it will not allow the image sequence with those parameters. Also, subjects are asked about their comfort level during the session.

7.5.3 Individuals with electrically conductive materials

7.5.3.1 Individuals with electrically conductive materials in their bodies, such as wires, leads, or implants will not be imaged in the MRI scanner due to thermal or voltage dangers relating to the presence of a strong, rapidly varying magnetic field.

7.5.4 Individuals with tattoos that have ferromagnetic properties may be imaged as long as care is taken to keep the affected area thermally insulated (using air, pads, ice packs, etc). It is also advisable to keep the affected area as far as possible from the inner walls of the MR scanner bore. Individuals whose tattoos are less than 48 hours old should not be scanned as it may cause the tattoo edges to run, although this presents no additional physical danger to the person in the magnet.

7.5.5 Conductive Loops
7.5.5.1 Description: Having ones hands or legs in contact can form an electrical current loop. Skin to skin contact from hands to legs or touching knees together is another form of a conductive loop.

7.5.5.2 Possible adverse events: Local burns could result from this type of body position, however, this is unlikely. The most general result is a feeling of discomfort. In some instances the subject may feel as though their arms or legs have “fallen asleep” or have a tingling sensation. This sensation will go away and is not permanent.

7.5.5.3 Protection against risk:

7.5.5.3.1 Avoid conductive loops problem by placing individuals on the patient bed in positions that do not form conductive loops. Also, this issue must be described to the participant so that if he or she shifts positions on the patient bed, conductive loops are not created. Specifically, individuals must be instructed not to cross their arms or legs while in the magnet.

7.5.5.3.2 Also, discuss with the participant about the potential of local burns and tingling sensations to occur, and to alert the MR operator if this occurs.

7.5.6 Drug delivery patches and pads: Some drug delivery patches contain metallic foil, thus increasing the risk of thermal injury. If the patch is in the volume of excitation of the transmitting RF coil, the individual must not undergo MR imaging at the IRF. If the drug delivery patch is outside of the volume of excitation of the coil, the individual can undergo imaging with an ice pack applied directly to the patch. The individual should be instructed to let the MR personnel know immediately if the patch begins to warm.

7.6 Cryogen-Related Issues

7.6.1 If anyone is in the magnet room while a quench occurs, OPEN the magnet room door immediately for ventilation or the person has the potential to suffocate!

7.6.2 In the event of a system quench, it is imperative that all personnel, research participants, and patients be evacuated from Zone 4, the magnet room, as quickly and safely as is feasible. Site access should be immediately restricted until the arrival of Siemens equipment service personnel.

7.6.3 The sudden appearance of white clouds or fog around or above the MRI scanner indicates that cryogenic gases have vented partially or completely in the magnet room. Police, fire, and other emergency personnel should be restricted from entering the room with their axes, oxygen tanks, etc., until it can be confirmed that the magnetic field has dissipated. There may still be a considerable residual static magnetic field despite a quench or partial quench of the magnet.

7.7 Claustrophobia and anxiety

7.7.1 Individuals undergoing imaging will be screened for known claustrophobia and anxiety about undergoing imaging. If these individuals wish to undergo MR imaging, they will first be offered an opportunity to practice lying in either the Siemens 3T TIM
Trio or in the simulated MR environment provided by the mock scanner in the IRF. All individuals undergoing imaging are advised that they may speak to the MR personnel throughout the imaging session, or squeeze the handheld squeeze bulb to indicate that they need attention or wish to be removed from the magnet and patient bed.

7.8 Contrast Agent Safety

7.8.1 No contrast agents will be used within the IRF.

7.9 Firefighter, police, and security safety considerations: For the safety of these emergency personnel who are responding to an emergency call at the IRF, a Level 2 MR personnel should be on site if possible, prior to the arrival of the emergency responders to ensure that they do not have free access to Zone 4.

7.9.1 The IRF Director is responsible for prospectively educating the local fire marshals, firefighter association, police, and security personnel about the potential hazards of responding to emergencies in the MR suite. It should be stressed that even in a fire or other emergency, the magnetic fields may be present and fully operational. Therefore, emergency personnel with air tanks, axes, crowbars, other firefighting equipment, guns, etc. cannot be given free access to Zone 4. Such access might prove catastrophic or even lethal to those responding or others in the vicinity.

7.9.2 In addition to training, emergency personnel will also be provided with documents providing information about the facility and safety issues (see Appendix F).

7.9.3 As part of the Zone 3 and Zone 4 restrictions, the IRF has readily accessible, MR-safe fire extinguishers that are present in MRI suite. There are two of these, and they are located in the magnet room (163) and control room (165). Also for fire safety, there is a smoke detector system and a sprinkler system that will be automatically activated in case of smoke or fire, respectively.

7.9.4 If there is a fire requiring firefighters or other emergency personnel to enter the MR facility with non-MR safe equipment, either Zone 4 must remain locked or off limits, or a decision to quench the magnet should be very seriously considered. This decision should be made if needed to protect the health and lives of the responders and other persons present. Should a planned quench be performed, Level 2 MR personnel must ensure that all emergency personnel and unscreened individuals continue to be restricted from Zone 4 until the static field is no longer detectable or at least sufficiently attenuated such that it no longer present hazardous conditions to persons with ferromagnetic objects, such as axes or oxygen tanks.

7.10 EEG/TMS Laboratory. This facility has recently come on line and is currently available only to users at the discretion of the IRF Director

8 Safety Screening for individuals entering Zone 4 (Magnet Room)
8.1 The Screening Protocol and IRB approved screening forms are included as Appendix D.

8.2 The purpose of safety screening is to ensure that no one enters the magnet room with ferromagnetic objects, either in their bodies, on their bodies, or as part of any materials or equipment that is being brought into the magnet room. Safety screening of all individuals entering the magnet room is a cornerstone of keeping the MRI environment safe.

8.3 A formal screening protocol is in place for the IRF, and was developed with the guidance of ACR materials and the advice of the IU Radiation Safety Office. The procedure and documentation forms are approved by the Institutional Review Board (IRB).

8.4 In keeping with the recommendations of the ACR, the magnetic safety screening for individuals entering Zone 4, whether or not they will undergo imaging, is essentially the same. Individuals undergoing imaging must answer additional questions, such as height and weight. Such questions are relevant to either safety issues, such as specific absorption rate, or SAR, or to the presence of objects that may affect the quality of the images or the participant’s comfort during imaging.

8.5 IRF staff and all MR personnel must undergo MR Safety Screening as part of their employment process or prior to beginning research training or work in Zone 4. MR personnel are not required to be screened prior to each and every entry into Zone 4. However, MR personnel must immediately report to the IRF Director any trauma, procedure, or surgery they undergo during employment in which a ferromagnetic metallic object or device may have been introduced within or onto them. At such a time, the employee will be re-screened to determine if any safety issues allow that employee to safely work in Zone 4.

8.6 Completed screening forms are stored in a locked file cabinet within Zone 3 of the IRF.

8.7 Research participants must be fully safety screened prior to entering Zone 4 at every session, including the MR Safety Questionnaire and, as always for ferromagnetic personal belongings and devices on them or in them, such as watches, jewelry, pagers, and cell phones.

8.7.1 Metal detectors are not to be used as a substitute for careful screening by MR personnel, but may be used as an adjunct to the screening process.

8.7.2 Any individual undergoing MR imaging must remove all readily removable metallic personal belongings and devices on them or in them, such as watches, jewelry, pagers, cell phones, body piercings (if removable), and cosmetics containing metallic particles. It is recommended that clothing items that may contain metallic fasteners, hooks, zippers, loose metallic components, or metallic threads are also removed or screened with a metal detector prior to entering Zone 4 to ensure that they are not ferromagnetic. Research participants and patients may wear site-supplied scrubs or a gown.

8.7.3 All individuals whose screening reveals a history of potential ferromagnetic foreign object penetration must undergo further investigation prior to being admitted into Zone
4. Examples of acceptable methods of screening include patient history, plain X-ray films, prior CT or MR studies of the questioned anatomical area, or access to written documentation of the type of implant or foreign object that may be present. After positive identification has been made as to the type of implant or foreign object that is within the patient, MR compatibility must be assessed using product labeling or Shellock MR Safety guidelines. Decisions based on published MR compatibility or safety claims must recognize that all such claims apply to specifically tested static field and static gradient field strengths.

8.7.4 Under no circumstances will individuals be admitted into Zone 4 of the IRF if they have aneurysm clips, cardiac pacemakers, diaphragmatic pacemakers, auto-defibrillators, deep brain stimulators, or other electromechanically activated devices.

8.7.5 Research participants and patients as well as their escorts must complete an MR safety-screening questionnaire prior to entry into Zone 4. All escorts who remain in the facility beyond the arrival with the patient or research participant must undergo this screening in case they need to enter into Zone 4.

8.7.6 There is potential for thermal injury from excessive RF power deposition. If a person undergoing MR imaging is in contact with electrically conductive material, such as a tattoo with metal particles in it, cold compresses or ice packs can be placed on the affected body area during imaging.

8.7.7 Final decisions regarding whether a given participant or patient can undergo MRI in the IRF must be made by Level 2 MR personnel following criteria for acceptability predetermined by the IRF Director, and approved by the Institutional Review Board and its advisors. The Level 2 MR personnel confirms this decision by signature on the participant or patient’s MR screening form.

8.7.8 If any Level 2 MR Personnel who screens a participant finds that additional considerations are necessary before approving the participant to enter the magnet room or undergo imaging, the case must be brought to two Level II Personnel, consisting of the MRI Physicist and the IRF Director who will make the final determination (with additional information from the potential participant or consultation with other experts as needed) about whether the participant is eligible for MR imaging in the IRF.

8.8 Device and object screening: Before an object or device is introduced into Zone 4, these objects must be tested for detectable ferromagnetic attractive forces. To do so, Level 2 MR personnel in the facility must use a strong handheld magnet (greater than or equal to 1000 G). This will allow testing for detectable ferromagnetic attractive forces. All portable metallic or partially metallic objects that are to be brought into Zone 4 must be properly identified and appropriately labeled utilizing the current FDA labeling criteria developed by ASTM (American Society for Testing and Materials) International (http://www.astm.org) (see the figure below).
U.S. Food and Drug Administration labeling criteria (developed by ASTM [American Society for Testing and Materials] International) for portable objects taken into Zone 4. The square green "MR safe" label (left) is for objects that typically do not have metallic components and who are unaffected in the presence of a large magnetic field. The triangular yellow label (middle) is for objects with an "MR-conditional" rating, and the round red label (right) is for "not MR-safe" objects. Under no circumstances should objects labeled with the red "Not MR-safe" be brought into Zone 4.

9 Emergency Procedures

9.1 Emergency procedures must be visibly posted in the IRF, reviewed and updated at least annually, and must be incorporated into safety training for all MR personnel. The current version of the posted emergency procedures is in Appendix E.

9.2 The major risk in the facility is related to individuals entering the facility who are unfamiliar with the magnetic resonance imaging environment and its hazards. MR personnel working in the facility must be constantly vigilant of who is entering the control room and magnet rooms. Especially in emergency situations, MR personnel must ensure that no one without proper training or screening enters the Zone 4 of the IRF, the magnet room, and that those individuals who do enter have removed all ferrous material from their persons.

9.3 ALL personnel who will use the IRF must have up-to-date safety training as specified in the requirements for MR personnel. These individuals must also be fully aware of the current procedures for both medical emergencies and facility emergencies.

9.4 There is a participant-operated squeeze bulb on the MR patient table that must be given to all research participants while they are in the scanner. Squeezing this bulb sends an audible alarm to the control room, signaling the MR personnel of any problems or discomfort the participant or patient may be experiencing. Additionally, there is a video camera mounted on one end of the magnet, providing a view in the control room of the participant or patient. There is also an intercom system in place between the control room and the magnet room so that the participant and MR personnel may communicate verbally.
9.5 The IRF is equipped with a First Aid kit, which is mounted on the west wall of the control room (Room 165). Note that the First Aid Kit itself and its contents are not MR-safe.

9.6 As part of the Zone 3 and Zone 4 restrictions, the IRF has readily accessible, clearly marked, MR-safe fire extinguishers available. Additionally, there is a smoke detector system and a sprinkler system that will be automatically activated in case of smoke or fire, respectively.

9.7 During imaging activities involving research participants or patients, there must be at least two MR personnel present for the duration that a participant or patient is in Zone 4. This policy is in place to facilitate responses to emergencies.

9.7.1 A typical scenario would be that in addition to the participant and the MRI operator, at least one additional MR personnel would be present in the control room or elsewhere in Zone 3 or Zone 4. Thus, in case of an emergency involving the participant or patient, one MR personnel will be available to attend to the participant or patient while the other can contact emergency personnel and meet and guide them safely within the facility.

9.7.2 In the event of younger children undergoing imaging (Zone 4), there should be an additional person (total of 3 MR personnel) present to oversee the needs and safety of a parent or escort of the child. The number of MRI trained personnel should be increased appropriately if it is anticipated that there will be more untrained personnel besides the parent and the child undergoing imaging.

9.7.3 The only exception to the rule of having at least two MR personnel present when imaging is if a volunteer is being imaged, and this imaging is not part of IRB approved research or for clinical purposes. Such a situation would occur, for example, when testing equipment or pulse sequences in the MRI. Only in this case is it acceptable for an MRI operator to conduct imaging without additional MR personnel within the IRF.

9.8 Specific Emergencies and Responses

9.8.1 The following specific emergencies and responses are addressed in Appendix E: distressed or injured individual, and facility emergencies not involving people.

9.8.1.1 In case of emergency, there are several IRF personnel designated as emergency contacts; these are listed in Appendix G. In case of emergency, at least one of these individuals should be contacted immediately.

9.8.1.2 In case of alarms sounding inside or heard from outside of the IRF, or other facility emergencies, there must be contact information for at least three responsible IRF personnel posted in visible locations within the IRF and outside the door of the IRF. In addition, individuals from the Psychology Clinic office, the Psychological and Brain Sciences main office, and Physical Plant must be given this information to keep on file.

9.8.1.3 If an MR Personnel or another person notices smoke or fire, 911 should be called, and IRF Personnel should be notified.
9.8.1.4 If an MR Personnel or another person notices water leaks, Physical Plant should be notified, and IRF Personnel should be notified.

9.8.1.5 If there is a potentially life-threatening situation, such as fire or smoke, MR Personnel and research participants, patients, and their escorts must be removed immediately from the IRF and should be escorted to a safe location outside of the building.

9.8.1.6 If it is safe and feasible, MR personnel should accompany emergency personnel into the IRF. MR personnel should take all possible steps to ensure safety of all emergency personnel in Zone 4, the magnet room. If it is necessary for non-MR safe equipment to be introduced into the magnet room, a quench of the magnet should be very seriously considered.

10 Training for Operators of the MRI Instrument

10.1 MRI operator trainees must be certified Level 1 MR personnel. Before certification as an MRI Operator, the trainee must be certified as a Level 2 MR personnel. Training of MRI operators must be approved by the IRF Operations Committee sub-committee on Safety and Compliance. Certification of MRI operators must be approved by the IRF Director. This approval is documented on the form included in Appendix B.

10.2 MRI operator trainees undergo intensive personal training with a certified Level 2 IRF Operator. Training progresses through three phases.

10.2.1 Observer phase: Trainees observe the training Operator for a minimum of 8 hours of imaging. This phase of training is meant to familiarize the trainee with operating procedures. Trainees who are not Level 2 MR personnel do not conduct safety screening during this phase. Trainees move on the next phase at the discretion of the training Operator.

10.2.2 Assistant phase. The trainee assists the training Operator for a minimum of 20 hours of imaging, with the training Operator taking the lead. This phase of training is meant to give the trainee hands-on experience with the operating procedures, and allow them to gradually begin to perform the duties of a certified Operator. Trainees who are not Level 2 personnel may still conduct safety screening at this phase, but only under the supervision of the training Operator. Trainees move on to the next phase at the discretion of the training Operator and the Safety and Compliance Committee.

10.2.3 Probation phase. Trainees operate the MRI device under the supervision of the training Operator for a minimum of 20 hours of imaging. This phase allows the trainee to build confidence in their ability to perform operating procedures, and develops the level of skill and responsibility necessary to be certified Operators. Trainees perform all operating procedures during imaging, using the training Operator as an information resource, only. Trainees who are not Level 2 MR personnel may still conduct safety screening, but must have the form inspected and signed by the training Operator. Trainees may apply for certification from the IRF Director at the joint discretion of the training Operator and the Safety and Compliance Committee (see Appendix A).
IRF Operations Committee Members

Sharlene D. Newman, Ph.D., Director of IRF
Aina Puce, Ph. D., ex-officio
Hu Cheng, Ph.D., MR Physicist, Chair of the Safety Committee
Joshua Brown, Ph.D., Chair of Instrument Committee
Thomas James, Ph.D., Chair of Pilot Scanning Programs Committee
Anne Catherine Krendl, Ph.D., member-at-large

Subcommittees:

<table>
<thead>
<tr>
<th>Subcommittees</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety/Compliance</td>
<td>Hu Cheng*, Sharlene Newman, Sean Berry, Kelsie McKinney</td>
</tr>
<tr>
<td>Instrument/Techniques</td>
<td>Josh Brown*, Hu Cheng, Nicholas Port, a member of department’s tech support staff</td>
</tr>
<tr>
<td>Research Outcomes/Pilot seeds grant</td>
<td>Tom James*, Karin James, Dan Kennedy, Rob Potter</td>
</tr>
</tbody>
</table>

*: chair of subcommittee.
Documentation of Safety Training
For Level 1 MR Personnel
Imaging Research Facility (IRF)
Indiana University - Bloomington

Name: ___________________________ Department: ___________________
E-mail Address: ___________________ Phone Number: ___________________
Office Address: ___________________

IU Position (circle): Faculty  Post Doc  Grad Student  Staff  Other:_________
Non-IU Position (please describe): _______________________________________

Name of IRF Core User or Principal Investigator with whom your MRI research is associated: _______________________________________________________

Name of Safety Trainer: _____________________________________________

_____ Read Version ____ (insert version no.) of the IRF Standard Operating Procedures and Appendices
_____ Viewed MR Safety Video
_____ Attended IRF MRI safety training lecture and tour
_____ Previously attended safety training:   ___Fall   ___Spring   ___ S1   ___S2

I agree to comply with the IRF SOPs during the course of my work at the Indiana University Imaging Research Facility.

Signature: _____________________________ Date: ____________

I hereby confirm that this individual has completed the requirements to work as a Level 1 MR personnel at the Indiana University Imaging Research Facility. I will provide adequate supervision and any additional training necessary to ensure that all safety procedures are observed during the course of his/her work.

IRF Director Signature: _____________________________ Date: ____________

Maintain this form on file at the Indiana University Imaging Research Facility
Documentation of Safety Training
For Level 2 MR Personnel
Imaging Research Facility (IRF)
Indiana University - Bloomington

Name: ___________________________ Department: ___________________
E-mail Address: __________________ Phone Number: __________________
Office Address: __________________
IU Position (circle): Faculty Post Doc Grad Student Staff Other: _________
Non-IU Position (please describe): ________________________________
Name of IRF Core User or Principal Investigator with whom your MRI research is associated: ________________________________
Name of Safety Trainer: ________________________________

____ Read Version ____ (insert version no.) of the IRF Standard Operating Procedures and Appendices
____ Viewed MR Safety Video
____ Attended IRF MR safety training lecture and tour
____ Previously attended safety training: ___ Fall ___ Spring ___ S1 ___ S2
____ Passed Test for Level 2 MR Personnel

I agree to comply with the IRF SOPs during the course of my work at the Indiana University Imaging Research Facility.

Signature: ___________________________ Date: ____________

I hereby confirm that this individual has completed the requirements to work as a Level 2 MR personnel at the Indiana University Imaging Research Facility. I will provide adequate supervision and any additional training necessary to ensure that all safety procedures are observed during the course of his/her work.

IRF Director Signature: ___________________________ Date: ____________

Maintain this form on file at the Indiana University Imaging Research Facility
Current Key Holders and Keycard Access Holders

<table>
<thead>
<tr>
<th>Name</th>
<th>Position/Affiliation</th>
<th>Access Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharlene Newman, Ph.D. Director</td>
<td>Psychological and Brain Sciences Faculty</td>
<td>Keys, keycard</td>
</tr>
<tr>
<td>Hu Cheng, Ph.D., MR Physicist</td>
<td>MRI Physicist</td>
<td>Keys, keycard</td>
</tr>
<tr>
<td>Sean Berry, MR Technician</td>
<td>PBS Research Staff</td>
<td>Keys, keycard</td>
</tr>
<tr>
<td>Kelsie McKinney, MR Technician</td>
<td>PBS Research Staff</td>
<td>Keys, keycard</td>
</tr>
<tr>
<td>Karin Harman James, Ph.D.</td>
<td>PBS Faculty</td>
<td>keycard</td>
</tr>
<tr>
<td>Thomas James, Ph.D.</td>
<td>PBS Faculty</td>
<td>keycard</td>
</tr>
<tr>
<td>Aina Puce, Ph.D.</td>
<td>PBS Faculty</td>
<td>keycard</td>
</tr>
<tr>
<td>Josh Brown, Ph.D.</td>
<td>PBS Faculty</td>
<td>keycard</td>
</tr>
<tr>
<td>Nicholas Port, Ph. D.</td>
<td>Optometry Faculty</td>
<td>keycard</td>
</tr>
<tr>
<td>Anne Krendl, Ph. D.</td>
<td>PBS Faculty</td>
<td>keycard</td>
</tr>
<tr>
<td>Rena Fukunaga</td>
<td>PBS Graduate Student</td>
<td>keycard</td>
</tr>
<tr>
<td>Bethany Sussman</td>
<td>PBS Graduate Student</td>
<td>keycard</td>
</tr>
<tr>
<td>Andrew Jahn</td>
<td>PBS Graduate Student</td>
<td>keycard</td>
</tr>
<tr>
<td>Lee Deckard</td>
<td>PBS -- Technical Support Group</td>
<td>keycard</td>
</tr>
</tbody>
</table>
MRI Safety Screening Questionnaire for RESEARCH VOLUNTEERS
Imaging Research Facility, Indiana University – Bloomington

Name: ____________________________ Date: ____________  □Male  □Female

Date of birth: _______________ Height: ___________ Weight: ____________

Have you ever had an MRI?  YES NO
If yes, Did you experience any problems during the scan?  YES NO
  o Please describe: ________________________________

Have you ever been imaged here?  YES NO
  If yes, when was the last time? ________________________

Exclusion Criteria

Have you ever had surgery involving a metallic, mechanical, or magnetic implant?  YES NO
  ___Cardiac pacemaker or defibrillator?  ___Stent?
  ___Aneurysm clip?  ___Deep brain stimulator?
  ___Cochlear or other ear implant?  ___Magnetically-activated implant or device?
  ___Any type of prosthesis?  ___Spinal cord stimulator?
  ___Internal electrodes or wires?  ___Other?(describe )_____________________

Have you ever been injured by a metallic object that may NOT have been completely removed (e.g. bullets, shrapnel, BBs)?  YES NO

Women only: Are you pregnant or do you suspect you may be pregnant?  YES NO
  What was the first date of your last menstrual cycle? __________________________
  Do you use an intra-uterine device (IUD) or diaphragm?  YES NO
  Please describe: ________________________________

Risk Factors

Have you ever done any welding, grinding or cutting of metal in your lifetime?  YES NO

Have you ever had an injury to the eye involving a metallic object or fragment (e.g., metallic slivers, shavings, foreign body, etc.)?  YES NO

Have you ever experienced claustrophobia?  YES NO

Have you been diagnosed with seizure/epilepsy?  YES NO

Have you ever been injured by a metallic object that WAS removed?  YES NO
  Please describe: ________________________________

Have you ever had surgeries and/or extensive dental work performed?  YES NO
  Please list, with approximate dates: ________________________________

_____________________________________________________________________________
Do you have cosmetic piercings (e.g., navel ring)?
   YES  NO
Do you have any piercings that cannot be removed?
   YES  NO

Comfort Concerns and Experimental Issues
Do you have tattoos or tattooed eyeliners?
   YES  NO
Are you wearing a transdermal medication patch (e.g., nicotine, nitroglycerine)
   YES  NO
Is there any reason you would be unable to remain still for long periods of time?
   YES  NO
Do you have any drug allergies?
   YES  NO
   If yes, please list: ___________________________________________________________________
Is there any reason you feel you should not undergo an MRI exam today?
   YES  NO

Have you removed all metal items from your person?
   ___ jewelry (incl. wristwatch)   ___ everything from your pockets (incl. credit cards)
   ___ glasses  ___ hair accessories (e.g., bobby pins, hair bands)
   ___ shoes  ___ any other metallic objects (e.g., underwire bra, hearing aid, dental retainer, colored contact lenses, extensive eye make-up)
   ___ wigs, hair pieces, hair extensions, hair weaves

Additional Comments
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Signature of Subject _____________________________________________________________ Date

Signature of Level 2 MR personnel _________________________________________________ Date

MRI Safety Screening Conclusions (to be completed by Level 2 MR personnel)
☐ Safe to enter MRI room and undergo imaging  ☐ NOT safe to enter MRI room
☐ Safe to enter MRI room but NOT to undergo imaging  ☐ Additional considerations necessary. This individual to be reviewed by two Level II Personnel, consisting of the MRI Physicist and the IRF Director.
MRI Safety Screening Questionnaire for CHILD RESEARCH VOLUNTEERS
Imaging Research Facility, Indiana University – Bloomington
To be filled out by parent or guardian

Child’s name: ___________________________ Date: _____________ □Male □Female

Informant’s name: ___________________________________________

Child’s date of birth: _____________ Height: _______________ Weight: _______________

Has your child ever had an MRI? YES NO
If yes,
Did your child experience any problems during the scan? YES NO
  o Please describe: ___________________________

Has your child ever been scanned here? YES NO
When was your child’s last scan__________________________________________

Exclusion Criteria
Has your child ever had surgery involving a metallic, mechanical, or magnetic implant? YES NO
  □Cardiac pacemaker or defibrillator? □Stent?
  □Aneurysm clip? □Deep brain stimulator?
  □Cochlear or other ear implant? Magnetically-activated implant or device?
  □Any type of prosthesis? □Spinal cord stimulator?
  □Internal electrodes or wires? □Other? (describe below)

Has your child ever been injured by a metallic object that may NOT have been completely removed (e.g. bullets, shrapnel, BBs)? YES NO
Has your child ever been diagnosed with seizure/epilepsy? YES NO
Has your child ever experienced claustrophobia?

Risk Factors
Has your child ever spent any time in a welding, grinding or metal cutting environment? YES NO
Has your child ever had an injury to the eye involving a metallic object or fragment (e.g., metallic slivers, shavings, foreign body, etc.)? YES NO
Has your child ever been injured by a metallic object that WAS removed? YES NO
  Please describe: _______________________________________________________

Has your child ever had surgeries and/or extensive dental work performed? YES NO
  Please list, with approximate dates:________________________________________

Does your child have cosmetic piercings (e.g., earrings)? YES NO
Pregnancy may be considered as a risk factor for MRI, do you think it is an issue for your child?  YES  NO

**Comfort Concerns and Experimental Issues**

Does your child have tattoos?  YES  NO

Is your child wearing a transdermal medication patch?  YES  NO

Does your child have any drug allergies?  YES  NO

If yes, please list: __________________________________________________________

*Have you removed all of the following items from your child?*

___ all jewelry (incl. wristwatch) ___ everything from his/her pockets

___ glasses ___ hair accessories (e.g., barrettes, hair bands, etc.)

___ shoes ___ any other metallic objects (e.g., hearing aid, dental retainer, colored contact lenses, extensive eye make-up)

___ wigs, hair pieces, hair extensions, hair weaves

**Additional Comments**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Signature of Parent or Guardian  Date

Signature of Level 2 MR personnel  Date

**Note:** Parents or guardians wishing to enter the magnet room must be screened separately.

**MRI Safety Screening Conclusions** (to be completed by Level 2 MR personnel)

☐ Safe to enter MRI room and undergo imaging  ☐ NOT safe to enter MRI room

☐ Safe to enter MRI room but NOT to undergo imaging  ☐ Additional considerations necessary. This individual to be reviewed by two Level II members, consisting of the MRI Physicist and the IRF Director.
Protocol for Ensuring Magnet Room and MR Imaging Safety
Step by Step Procedures and Screening Form
Imaging Research Facility, Indiana University Bloomington

Protocol-Steps for Screening:

1. **Screening begins with providing information** regarding the safety issues within the magnet room and the importance of accurate and complete responses to the screening questions so that we can determine the safety of having the individual in the magnet room. Here’s a sample script for what could be said in this process: “The MRI machine has a very strong magnet. The magnet is so strong that it creates a forceful pull throughout the entire magnet room. Since many metal objects are magnetic, it is dangerous to bring metal objects into the magnet room. The magnet can pull some metal objects through the air into the magnet, injuring anyone in the way. Some individuals have metal in their bodies. If they enter the magnet room, the metal object inside their body may move or heat up and possibly injure the person. Thus, to ensure your safety while you are in our MRI facility, I will need to ask you a few safety questions. You must answer these questions completely and honestly if you wish to go into the magnet room. However, you may choose not to answer these questions and not to enter the magnet room. If you are uncertain of how to answer any of my questions, please be sure to let me know.”

2. After the above information is provided verbally to the person being screened, the appropriate paper questionnaire will be given to the person, which they must fill out fully. Note: Fill out questionnaire in its entirety each time the person undergoes MR imaging.

3. A Level 2 MR personnel conducts the screening interview. The interviewer will go through each question one-by-one to ensure that there are no safety concerns before the person enters the magnet room (Zone 4). Level 2 MR personnel are safety trained, understand the rationale for each question and are able to answer any questions and address any safety concerns of people entering the magnet room. Therefore, this interview cannot be performed by a Level 1 MR personnel.

4. An important part of the interview process is to ensure that all metallic personal items are removed from the person prior to entering the magnet room. These include jewelry (wristwatches, earrings), bobby pins, barrettes, hearing aids, shoes, wallet, and credit cards.

5. Once the interview is complete, both the Level 2 MR personnel interviewer and the person being screened must sign and date the questionnaire. The questionnaire will then be filed in the locked file cabinet located in the IRF.

6. If any Level 2 MR Personnel who screens a participant finds that additional considerations are necessary before approving the participant to enter the magnet room or undergo imaging, the case must be brought to two Level II IRF Operations Committee members, consisting of the IRF Director and IRF Physicist, who will make the final determination about whether the participant is eligible for MR imaging in the IRF (using additional information from the potential participant, additional consultation with experts, etc., as needed).
MRI Safety Screening Questionnaire for VISITORS
(Non-Scanned Persons) Entering Magnet Room
Imaging Research Facility, Indiana University – Bloomington

Name: ____________________________ Date: ________________

Have you ever been safety screened here at the Imaging Research Facility before?  YES  NO
If yes, when was the last time? _____________________________________________

Exclusion Criteria

Have you ever had surgery involving a metallic, mechanical, or magnetic implant?  YES  NO
___Cardiac pacemaker or defibrillator? ___Stent?
___Aneurysm clip? ___Deep brain stimulator?
___Cochlear or other ear implant? ___Other? (describe below)

Have you ever been injured by a metallic object that may NOT have been completely removed
(e.g. bullets, shrapnel, BBs)?  YES  NO

Risk Factors

Have you ever done any welding, grinding or cutting of metal in your lifetime?  YES  NO
Have you ever had an injury to the eye involving a metallic object or fragment (e.g., metallic
slivers, shavings, foreign body, etc.)?  YES  NO
Have you ever been injured by a metallic object that WAS removed?
Please describe: ____________________________________________________________

Have you ever had surgery?  YES  NO
Please list, with approximate dates: __________________________________________

Do you have cosmetic piercings (e.g., navel ring)?  YES  NO

Have you removed all of the following items from your person?
___jewelry (incl. wristwatch) ___everything from your pockets (incl. credit cards)
___glasses ___hair accessories (e.g., bobby pins, hair bands)
___shoes ___any other metallic objects (e.g., hearing aid, dental retainer,
___any other metallic objects (e.g., hearing aid, dental retainer,
___________________________ colored contact lenses)
___________________________

Additional Comments _____________________________________________________

________________________________________ Date
Signature of Visitor

________________________________________ Date
Signature of Level 2 MR personnel

MRI Safety Screening Conclusions (to be completed by Level 2 MR personnel)

☐ Safe to enter MRI room ☐ NOT safe to enter MRI room
☐ Additional considerations necessary. This individual to be reviewed by two Level II members of the IRF
Operations Committee, consisting of the MRI Physicist and the IRF Director.

Last updated: 19DEC2012
Key Points for Safety in the Magnet Environment:
- Be vigilant of who is entering the control and magnet rooms.
- Individuals unfamiliar with the magnetic resonance environment and its hazards are at the greatest safety risk.
- Everyone entering the magnet room, including emergency responders, must be fully screened and must remove all ferrous material from their person.
- Safety training is required of ALL personnel who will use the neuroimaging facility.

Three (3) Types of Emergency Buttons for Different Purposes

1. The Table Stop Button
   Press the Table Stop button immediately in case of accidents or risk of injury due to table movements (points of injury through crushing/bruising). If a table stop button is hit, the table comes to an immediate stop.
   - In the control room
     Press the red button on the top of the Intercom Console to stop the patient table movement. If it occurs in the middle of an exam, the scan is also stopped. Imaging can also be stopped using the scanner software.
   - In the MRI instrument room
     Press the red button in the MR control panel.

1.1. To resume normal table operation, press the Table Movement Up/Inward button and then press the Table Movement Down/Outward button. This will cancel the Table Stop. The fastest way to move the subject out of the bore is pressing the Home Position button in the MR control panel. In case of power failure or defective motorized drive, the table can be manually pulled out of the
magnet bore. To do so, locate the red arrow on the patient table, pull the unlocking handle outward and upward to the end stop. The tabletop is mechanically decoupled from the motorized drive unit. Pull the tabletop out of the magnet using the handle at the foot end.

2. The Emergency Power Off (EPO) Button (2 locations)
- Press the EPO button to:
  o Stop all electronics associated with the MRI, including the control room computer;
  o Release the brake on the patient table.
- Two locations of the EPO buttons
  o Control Room: On the east wall, to the right of the console.
  o Magnet Room: On the west wall, from inside the room, it is to the right of the door.

3. The Quench Button
- Quenching the magnet is a LAST RESORT: it is dangerous if not done properly.
- BEFORE initiating a quench, attempt to remove a person from the magnet without quenching – this is a safer alternative than an unnecessary quench.
If you determine that quenching the magnet is the safest option, press the QUENCH button to bring down the magnetic field VERY RAPIDLY.

If a person is in the magnet room OPEN THE DOOR BEFORE QUENCH.
  o The room must be ventilated or persons inside will suffocate rapidly!
  o If NO ONE is in the magnet room, quench with the DOOR CLOSED.

CALL 911 as soon as is possible, and Siemens service (1-800-888-7436).

DO NOT leave the scene. There is no danger as long as there is adequate ventilation.

Even after the magnet has quenched, there may still be a considerable static magnetic field. Precautions must be taken for all IRF and emergency personnel entering the magnet room.

Response Plans for Specific Emergencies

- **Distressed Subject**: Subject indicates distress by pressing the squeeze bulb or verbally conveying distress OR facility staff notice distress and determine that the subject must be removed rapidly from the MR imager.
  o Possible scenarios include panic attack, claustrophobia, general fear or extreme discomfort, or a medical emergency.

Follow these steps:
  1. Stop imaging immediately from the MRI console. Do not use the Table Stop button on the intercom.
  2. Use the intercom to reassure the participant that you are coming in to remove them.
  3. Remove the participant from the magnet room, as instructed in Section 1.1.
    - The participant be can be rolled out of the room on the MR compatible gurney or the participant can walk out of the room.
  4. Talk with the subject in the waiting room and assess whether emergency personnel are needed; if so, call 911. Tell them the situation and give the address:

      IU Psychology Building  
      1101 East Tenth St.  
      Room 159 in Psychology clinic wing
  5. The First Aid kit mounted on the west wall in the control room.
  6. Monitor all emergency personnel in the IRF to ensure their safety and to prevent them from introducing equipment or medical instruments, which may present safety risks, into the magnet room.

- **Person Trapped in or Injured by Projectile in the Magnet**: Follow these steps:
  1. Stop imaging immediately from the MRI console. Do not use the Table Stop button on the intercom.
  2. Use the intercom to reassure the participant that you are coming in to attend to them.
3. Assess whether removing the person from the magnet could lead to severe loss of blood.
   - For example, if a person is impaled by scissors near an artery or area of large blood supply, such as in the neck, femoral region, or heart, DO NOT REMOVE THE IMPALING OBJECT as more blood loss may occur. Instead, leave the person in a stable position and let emergency responders decide the most appropriate action.
   - Or, for example, if a person has been impaled by scissors in a hand or other extremity, consider removing the impaling object by prying it off the magnet (2 or more people may be needed), and then administer first aid.
   - If a person is trapped in the magnet or against the magnet by a ferromagnetic object, attempt to pry it off of the magnet.
   - If a person is trapped by the magnet or against the magnet, it may be necessary to quench the magnet so that the person can be removed. OPEN THE MAGNET ROOM DOOR FIRST!!

4. If the subject can be safely removed from the magnet environment without further injury, escort the subject to the control room and assess whether emergency personnel are needed. If so, call 9-911. Explain the situation and give them the address:
   IU Psychological and Brain Sciences Building
   1101 Tenth Street
   Room 159, Psychology Clinic Wing

5. If first aid is needed, use the First Aid kit mounted on the wall in the control room.

6. If emergency personnel are called, monitor them while present in the IRF to ensure their safety and to prevent them from introducing equipment or medical instruments, which may present safety risks, into the magnet room.

7. If the subject CANNOT be safely removed from the magnet without inciting further injury, contact emergency services by calling 9-911. Explain the situation and give them the address.
   IU Psychological and Brain Sciences Building
   1101 Tenth Street
   Room 159, Psychology Clinic Wing

8. Stay in constant contact with the subject over the intercom system or by having another safety screened individual stand in the room with them. When emergency personnel arrive they MUST be safety screened and made to remove all ferrous objects on their person. Failure to do so may cause injury to the responding emergency personnel, other individuals present in the MRI room, and may cause further injury to the subject trapped in the MRI!

9. The MRI safe gurney is located in the MRI Instrument room and can be used as a way to safely transport subjects out of the MRI environment.

10. Call Siemens service at: 1-800-888-7436
Facility emergencies: Staff member or other person notices fire, water leaks, foreign objects in magnet with or without subject present, but no one is in grave danger.
  - Call 911 if there is a fire.
  - Remove subject if one is present.
  - Attempt to contact someone from the IRF Emergency Contact List
  - Call Siemens service at: 1-800-888-7436
INFORMATIONAL HANDOUT FOR EMERGENCY PERSONNEL

Indiana University

Imaging Research Facility (IRF)

Located in the Psychology Building, 1101 E. 10th. St.

This document contains information for safety and emergency personnel (police, fire, EMT) about the MRI (magnetic resonance imaging) magnet in the Indiana University IRF located in the Psychology Building on the IUB campus at 1101 E. 10th. St.

The IRF is located in the south-east corner of the Psychology Building on the 1st floor, attached is a drawing showing the relative location of the facility within the building.

The IRF is composed of several rooms, see attached floor plan. These several rooms and their uses are:

- Room 159A: Interview and screening area.
- Room 159B: Dressing room and restroom.
- Room 161A: The Mock MRI scanner control room.
- Room 161B: The Mock MRI scanner instrument room.
- Room 161C: MRI Physicists’ Office.
Room 163: The MRI magnet/scanner room.
Room 165: The MRI control room.
Room 165A: The MRI equipment room.

Suites 165 and 163, of the IRF house the MRI facility. This part of the IRF has dual key-card accessible locked entrances from the Psychology Building Clinic hallway and from suite 165. This latter doorway is at the end of a ramped hallway which has several doors into other parts of the IRF. Key card-access to this part of the IRF is possible for Level 2 MR Personnel.

Suite 161 houses the Mock MRI Scanner and it control room, with an adjoining office for the MRI Physicist. It is accessible from the back door of MRI Facility (Suites 159/163) or from Suite 190.

Only one room in the IRF suites requires special consideration/action by emergency personnel. Room 163 which contains the MRI magnet itself has special risks and safety precautions associate with it.
The MRI is a very strong magnet. This magnet is so strong that it creates a magnetic pull throughout the entire room. The magnet can actually cause some metal objects to fly through the air toward the magnet, with the potential to injure anyone in the path of the flying object. Also, if an individual who has any metal object in their body enters the magnet room it is possible for that metal object inside the body to move and possibly injure the person. THE MAGNET IS ALWAYS ON!

No person, safety/emergency personnel or other, should enter the MRI magnet room if they have any of the following medical/surgical conditions:

- have a pacemaker or defibrillator,
- have a stint,
• have an aneurism clip
• have been injured by a metallic object that was not removed
• have a cochlear (ear) or middle ear implant
• have had surgery involving a metallic implant (e.g. knee or hip replacement)
• is a woman and have an intra-uterine device (IUD)
• have dental braces or dentures containing metal
• have body piercing (e.g. navel ring, ear rings, etc.)
• have a deep brain stimulator implant.

None of the following items should be on or be worn by any person entering the MRI magnet room:

    jewelry (e.g. wristwatch, rings, necklace, etc.)
    hair accessories (e.g. bobby pins, burettes, hair elastic, etc.)
    wallet, credit cards
    any metical objects (e.g. hearing aid, etc.)

Emergency and safety personnel should be especially mindful that absolutely no metical equipment, tools or weapons should ever enter the MRI magnet room:

    ladders containing any metal
    fire extinguishers
    fire axe
    weapons
    gurney
    metal medical instruments
    tools (e.g. wrench, pliers, hammer, etc.)

The magnet room (163) is locked and entry can only be gained by entering a code into a keypad on the door. Except in cases of extreme urgency, it is advisable to contact one of the emergency contact personnel listed below to escort emergency personnel into the magnet room.
IRF Emergency Contacts

<table>
<thead>
<tr>
<th></th>
<th>Office Phone</th>
<th>Lab Phone</th>
<th>Home Phone</th>
<th>e-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hu Cheng</td>
<td>856-2518</td>
<td>856-3723</td>
<td>331-6197 cell: 325-5787</td>
<td><a href="mailto:hucheng@indiana.edu">hucheng@indiana.edu</a></td>
</tr>
<tr>
<td>Lee Deckard</td>
<td>855-5573</td>
<td>n/a</td>
<td>3229387</td>
<td><a href="mailto:ledeckar@indiana.edu">ledeckar@indiana.edu</a></td>
</tr>
<tr>
<td>Joshua Brown</td>
<td>855-9282</td>
<td>856-1846</td>
<td>Cell: 716-2057</td>
<td><a href="mailto:jwmbrown@indiana.edu">jwmbrown@indiana.edu</a></td>
</tr>
<tr>
<td>Sean Berry</td>
<td>856-3723</td>
<td>n/a</td>
<td>Cell: 797-0992</td>
<td><a href="mailto:seanberr@indiana.edu">seanberr@indiana.edu</a></td>
</tr>
<tr>
<td>Colleen McCracken</td>
<td>856-3723</td>
<td>n/a</td>
<td>cell: 391-0595</td>
<td>cmccrack @indiana.edu</td>
</tr>
</tbody>
</table>

If an accident occurs, for instance someone may be pinned against the magnet by a metal object, the following emergency procedures should be used.

The worst case would be that addition personnel enter the room to aid the victim of the accident without first screening themselves for metal objects, thus causing further accidents. Assess the level urgency involving the victim and act based on the following guidelines.

a) If there is no serious injury to the victim, remove the victim from the magnet room.

b) If the victim is pinned by a metal object, enlist the aid of several individuals to help remove the object (all personnel entering the magnet room should be free of metallic objects).

c) If the victim has sustained a life threatening injury from a metallic projectile and remains pinned to the magnet, then magnet can be shut down (or “quenched”). Quenching a magnet is a VERY serious response and should ONLY be performed in the case of serious bodily injury to a victim due to projectile ferromagnetic objects. A quench button is located on the wall beside the door to the magnet room and is labeled with a black magnet on yellow background with a red X through it (see attached picture). Importantly, a quench results in the emission of large amounts of helium, which can cause cryogen burns. The release of helium also quickly displaces the air from the room, resulting in a deadly low oxygen environment if there is no ventilation (if magnet door is closed).

The IRF suite is equipped with fire detection equipment, fire pull stations, fire strobes and ceiling mounted sprinklers.
## IRF Emergency Contacts

<table>
<thead>
<tr>
<th>Name</th>
<th>Office Phone</th>
<th>Lab Phone</th>
<th>Home Phone</th>
<th>e-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hu Cheng</td>
<td>856-2518</td>
<td>856-3723</td>
<td>331-6197 cell: 325-5787</td>
<td><a href="mailto:hucheng@indiana.edu">hucheng@indiana.edu</a></td>
</tr>
<tr>
<td>Lee Deckard</td>
<td>855-5573</td>
<td>n/a</td>
<td>3229387</td>
<td><a href="mailto:ledeckar@indiana.edu">ledeckar@indiana.edu</a></td>
</tr>
<tr>
<td>Sharlene Newman</td>
<td>856-0839</td>
<td>856-1776</td>
<td>Cell: 345-9524</td>
<td><a href="mailto:sdnewman@indiana.edu">sdnewman@indiana.edu</a></td>
</tr>
<tr>
<td>Sean Berry</td>
<td>856-3723</td>
<td>n/a</td>
<td>Cell: 797-0992</td>
<td><a href="mailto:seanberr@indiana.edu">seanberr@indiana.edu</a></td>
</tr>
<tr>
<td>Kelsie McKinney</td>
<td>856-3723</td>
<td>n/a</td>
<td>cell: 322-6848</td>
<td><a href="mailto:Km27@indiana.edu">Km27@indiana.edu</a></td>
</tr>
</tbody>
</table>