

THE UNIVERSITY OF BRITISH COLUMBIA



# **Charles E. Fipke Integrated Neuroimaging Suite Magnetic Resonance Safety Policy**

July 2021

*The following document contains important safety information with respect to the MRI facilities at the UBC MRI Research Centre Purdy Pavilion facility and the Charles E. Fipke Integrated Neuroimaging Suite (UBC MRI Research Centre and UBC PET/MRI Imaging Centre). Please read this entire document thoroughly and retain a copy for your records.*

<u>Outline:</u>	Page
1. Introduction	2
2. MRI Access Zones	3
3. Screening and Approval of Researchers and Visitors	6
4. Requirements and Responsibilities for Access to Zone 3 and Zone 4	7
5. MRI Safety and Facility Orientation	7
6. Protocol Proposal Committee (UBC MRI Research Centre and UBC PET/MRI Imaging Centre)	7
7. Research Subjects	8
8. Incidental Findings	8
9. Emergency Procedures	9
10. Access and Training for Emergency Personnel	10
11. Access and Training for Custodial Staff	10
12. Safety Officer	10
13. No Scent Policy	11
14. Incidents	11

1. Introduction

This manual outlines the specific safety policies to mitigate the risks and safety hazards unique to the 3 Tesla MRI environments within the Charles E. Fipke Integrated Neuroimaging Suite (located in the Djavad Mowafaghian Centre for Brain Health). The safety procedures outlined are intended to supplement safety regulations and policies already established by the Vancouver Coastal Health Authority.

All MRI systems will be operated in strict adherence to existing Canada Health and Welfare safety guidelines regarding acoustic noise, static magnetic field, pulsed gradient magnetic fields, and radiofrequency electromagnetic absorption (SAR). All policies and personnel access levels are based on and informed by the ACR Guidance Document on MR Safe Practices and the Diagnostic Accreditation Program Standards for Magnetic Resonance.

## 2. MRI Access Zones

MRI departments are designed in a 4 Zone configuration designed to control access to the hazardous environments within:

**Zone I:** This region includes all areas that are freely accessible to the general public. This area is outside the MR departments.

**Zone II:** This region is the interface between the publicly accessible, uncontrolled Zone I and the strictly controlled Zones III and IV. This area includes the waiting rooms, changing rooms, washrooms, CBH conference room and Neurophysiology areas.

**Zone III:** This area is the region in which free access by unscreened non-MR personnel or ferromagnetic objects or equipment can result in serious injury or death as a result of interactions between individuals or equipment and the MR scanner's particular environment.

**Zone IV:** This area contains the MR scanner itself, located entirely within Zone III. This area is extremely hazardous due to the very strong magnetic field which is always present, even when the MR unit is not actively scanning. During scanning there are additional hazards of acoustic noise, pulsed gradient magnetic fields, and radiofrequency electromagnetic absorption (SAR). All individuals entering this room must be screened by an MR Technologist for contraindications in addition to being closely supervised by MR personnel.

**Radiation Hazard:** The Charles E. Fipke Integrated Neuroimaging Suite contains areas where radiation hazards exist. There is no admittance to these areas unless additional training in Radiation Safety is completed. If you are involved in research involving Position Emission Tomography (PET) please contact Carolyn English ([Carolyn.English@ubc.ca](mailto:Carolyn.English@ubc.ca)) so this can be arranged.

<b>Zone I</b>		
<b>Hazards</b>	<b>Activities</b>	<b>Rules</b>
-None	-Freely accessible public space	-None

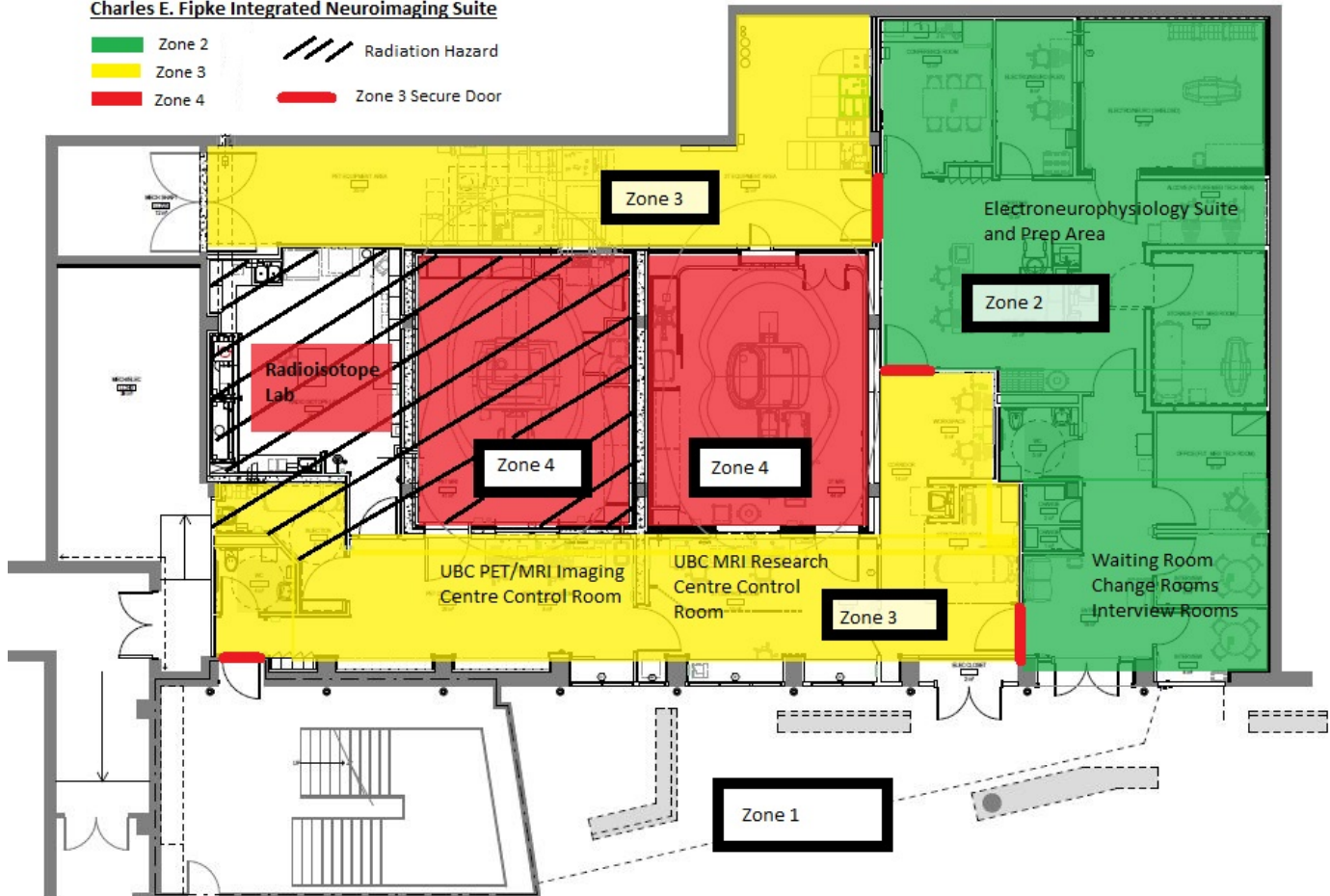
  

<b>Zone II</b>		
<b>Hazards</b>	<b>Activities</b>	<b>Rules</b>
-None	<ul style="list-style-type: none"> <li>- Research subjects and staff undergo MRI Safety Screening</li> <li>-Research subjects change into hospital clothing and secure their personal items</li> </ul>	-None

<b>Zone III</b>		
<b>Hazards</b>	<b>Activities</b>	<b>Rules</b>
<ul style="list-style-type: none"> <li>- Zone III contains magnetic fringe fields (particularly the 5 Gauss Line)</li> <li>-Zone III contains the entrance to Zone IV (the magnet room)</li> <li>- Unsafe for pacemakers and other electrically active medical implants</li> </ul>	<ul style="list-style-type: none"> <li>- MR subject preparation</li> <li>-Mobility challenged subject physical transfers</li> <li>-Researcher operation of MR approved equipment for fMRI presentation, intra-MRI interventions (i.e. MRE, CVR)</li> <li>-MR scanner operation by qualified persons only</li> </ul>	<ul style="list-style-type: none"> <li>-Entry is permitted to screened persons only</li> <li>-Screened subjects must be accompanied into Zone III by an MR Technologist</li> <li>-Ongoing access is permitted to MR personnel only</li> <li>-Zone III doors must be kept closed.</li> <li>-Persons may be asked to leave Zone III immediately in consideration of patient confidentiality and privacy</li> <li>-Passages and hallways must not be blocked by equipment</li> </ul>

<b>Zone IV</b>		
<b>Hazards</b>	<b>Activities</b>	<b>Rules</b>
<ul style="list-style-type: none"> <li>-<b>At all times:</b> very strong magnetic field (<u>projectile</u> hazard)</li> <li>-<b>At all times:</b> liquid helium in a cryogenic chamber inside the magnet housing (<u>cryogen</u> hazard)</li> <li>- <b>During scanning:</b> pulsed gradient magnetic fields (<u>electric current stimulation</u> hazard)</li> <li>-<b>During scanning:</b> radiofrequency electromagnetic absorption or SAR (<u>heating, burn, fire</u> hazard)</li> <li>-<b>During scanning:</b> loud acoustic noise</li> </ul>	<ul style="list-style-type: none"> <li>- MR subject preparation and positioning</li> <li>-Mobility challenged subject physical transfers</li> <li>-Researcher operation of MR approved equipment for fMRI presentation, intra-MRI interventions (i.e. MRE, CVR)</li> </ul>	<ul style="list-style-type: none"> <li>-Entry is permitted to screened persons only</li> <li>-Screened subjects must be accompanied into Zone IV by an MR Technologist</li> <li>-Persons entering this room are closely supervised by MR personnel</li> <li>-Zone IV doors must be kept closed</li> <li>-Only equipment approved by an MRI Safety Officer is permitted inside Zone IV</li> </ul>

### Charles E. Fipke Integrated Neuroimaging Suite



### 3. Screening and Approval of Researchers and Visitors

Everyone entering Zone 3 and Zone 4 are required to undergo safety screening by an MR Technologist. This involves completing and signing a screening form and undergoing a verbal screening by an MR Technologist. If any possible contraindications are revealed or if there is uncertainty regarding a person's screening status, access will be denied. A UBC Hospital Radiologist may be consulted and their decision will be final. It may be necessary for health record documentation and MR device labelling to be obtained for the radiologist to make a final decision.

Visitors briefly accessing Zone 3 only while accompanied by MR personnel on a one time basis (tours, educational sessions, contractors) will fill out the UBC MRI Research Centre Offsite Visitor Screening Form. All other persons will fill out the Vancouver Coastal Health Magnetic Resonance Imaging Screening Form. The level of screening required is entirely at the discretion of the MR Technologist.

Once screening forms are completed it is the screened individual's responsibility to inform the MR Technologist if their screening status changes (i.e. recent or planned surgery). The MR Technologist may

review an individual’s screening status and update their screening form on file, especially if the individual has been away from the facility for 6 months or more.

Individuals entering Zone 4 are required to remove all metallic projectile hazards, electronic devices and key cards with magnetic strips. **All individuals must check with the MR Technologist before entering Zone 4 to ensure safety procedures are adhered to.**

Any equipment or object entering Zone 4 must be pre-approved by the MRI Safety Officer: labelled and signed by the approver. Any equipment for use in research in Zone 4 needs to be referenced in the Protocol Proposal for the study.

4. Requirements and Responsibilities for Access to Zone 3 and Zone 4

	<b>Access Level</b>	<b>Requirements</b>	<b>Responsibilities</b>
Screened Visitor Zone 3	-Zone 3 only	-Complete the UBC MRI Research Centre Offsite Visitor Screening Form, followed by MR Technologist review	-Follow safety instructions from MR Technologist and MR personnel
Screened Visitor Zone 4	-Zone 3 and Zone 4	-Complete the Vancouver Coastal Health Magnetic Resonance Imaging Screening Form, followed by MR Technologist review -Allowed entry to Zone 4 only if accompanied by an MR Technologist	-Follow safety instructions from MR Technologist and MR personnel
Level 1 MR Personnel	-Zone 3 and Zone 4	-Complete the Vancouver Coastal Health Magnetic Resonance Imaging Screening Form, followed by MR Technologist review -Allowed entry to Zone 4 only if accompanied by an MR Technologist -Attend an <b>MRI Safety and Facility Orientation</b> (see section 5)	-Follow safety instructions from MR Technologist -Act as support personnel to MR Technologist if necessary -Support execution of MR experiment, operate accessory MR equipment -Notify MR Technologist if screening status changes

5. MRI Safety and Facility Orientation

Persons who accompany research subjects to the MRI environment, who regularly work in the Fipke Integrated Neuroimaging Suite and require prolonged access to the MRI environment for the purposes of research are required to complete the MRI Safety and Facility Orientation. The MRI Safety Officer will keep a record of those persons currently trained and ensure those working in the MRI environment update their training per Vancouver Coastal Health guidelines.

## 6. Protocol Proposal Committee (UBC MRI Research Centre and UBC PET/MRI Imaging Centre)

These Committees are comprised of individuals knowledgeable of research procedures in MR, medicine, and physics. The Protocol Review Committee is responsible for review and approval (or disapproval) of protocol proposals for all research uses of the MRI facilities of the UBC MRI Research Centre and UBC PET/MRI Imaging Centre. Research Protocols should first be submitted to the UBC Ethics Board for review. Research studies will not be conducted without the approval of both the UBC MRI Research Centre Protocol Review Committee and the UBC Ethics Board.

## 7. Research Subjects

All research subjects and volunteers for an MRI will be required to:

- Sign an approved UBC Ethics Board consent form.
- Complete a standard MR screening form for contraindications to MRI.
- Review MR screening form with MR Technologist. Subjects with contraindications to MRI will not be scanned.
- Change into hospital clothing. Remove ALL jewelry and piercings, metallic objects, dentures, and foil medication patches. **Underwear and socks made of anti-microbial fabrics must be removed.**
- Subjects and volunteers MUST remain in Zone 2 (waiting area) until permission to enter Zone 3 or 4 is given by the MR Technologist.

Subjects with implants will be scanned according to safety guidelines and UBC Ethics approval. Researchers may be required to forward operative reports for certain surgical procedures and implants in subjects to the MR Technologist for radiologist's review.

Volunteers with possible metal in their eye will not be scanned. Subjects with a possible metallic foreign body in their eye will be required to have an orbital x-ray reported by a radiologist before proceeding with study. The subject's referring physician is responsible for ordering orbital x-rays. **The UBC MRI Research Centre will NOT refer patients for orbital x-rays.**

All subjects will be closely monitored during the MR procedure. An emergency call bell will be given to the subject and he/she will be instructed to notify MR Technologist of discomfort of any kind. Should this occur, the scan will be interrupted to check on the subject and the MRI may be terminated at the Technologist's discretion.

## 8. Incidental Findings

All scanning protocols are designed to answer research questions for studies approved by the Protocol Proposal Committee and UBC ethics. Research scans are typically not designed for clinical diagnosis.

**Study and protocol development scans will NOT be routinely reviewed by the Centre Radiologist.** The Centre does not have a routine screening process in place for unexpected or incidental findings - although it does have a procedure for reporting such findings when identified during standard image

quality assessments. The P.I. is expected to have a procedure in place for the identification and reporting of such findings when:

- \* The brain pathology or population under investigation is likely to have unexpected or incidental findings (for example populations likely to have findings not previously imaged)
- \* The brain pathology under investigation may impact the ability to differentiate unexpected or incidental findings from known pathology (for example brain injury or unknown manifestation of pathology).

If a finding is incidentally identified (by the MR technologists or investigators) in volunteers or research subjects, the Centre Radiologist will review the scans and take the following actions when appropriate if the finding is of potential clinical significance and follow up is needed:

- Notify the Principal Investigator.
- Explain to the research participant or volunteer that an incidental finding has been identified, and with their permission, contact his/her family physician.
- Directly refer subjects with central nervous system related incidental findings to the designated UBC Neurologist, subject to the approval of the subject and his/her family physician.

Clinical MR scans will **NOT** be performed at the Centre for follow up of incidental findings.

A clinical radiology report of research scans will **NOT** be routinely issued.

All potential incidental findings identified by investigators, including students, research assistants, scientists, and principal investigators must be reported to the 3T MR technologists in order to facilitate review by the Centre Radiologist. In the event that the Centre Radiologist is unavailable to review the scans and the incidental finding is felt to be of potential clinical concern, one of the UBC Hospital MRI Radiologists will be contacted for a preliminary consultation.

## 9. Emergency Procedures

- a) **Procedure in the Event of a Quench:** The MR systems are designed such that in the event of a quench, the helium gas is exhausted through a vent to the outside. A quench can be unexpected or can be initiated by pushing the quench button when a staff or subject is pinned to the scanner by a metal object due to the magnetic field.

In the event of a quench:

1. Refer to the posted Quench Emergency Procedures.
2. Clear the scan room of all persons.
3. Follow the instructions of the MR Technologist
4. Close and secure the scan room door.



5. Call a Code Brown.

b) **Procedure in the event of an incident or medical emergency requiring medical attention:**

The operator must remove the subject from the scan room, so the emergency response team will not be required to enter the scan room.

In the event of an incident or medical emergency, **depending on severity**, the following emergency responses are available:

- Initiate Code Blue emergency response in the **Purdy Pavilion (UBC Hospital Code Blue Team)**
- Call 911 for the **Djavad Mowafaghian Centre for Brain Health**
- Initiate Code White emergency response. (Security, First Aid, and Porter)
- Call the UBC Radiologists, Radiology Residents, or MR Fellow
- Transport to Urgent Care

c) **Procedure in the Event of a Fire:**

1. Refer to the posted Fire Emergency Procedures
2. Remove people from immediate danger (close all doors, shut off equipment)
3. Activate fire alarm pull station.
4. Telephone 7111, State Code Red and location
5. Evacuate/extinguish, move all persons out of fire zone

10. Access and Training for Emergency Personnel

It may be necessary for UBC security, paramedics, and fire department personnel to enter the facility in response to an emergency situation. In the case of an emergency, Centre staff or MR technologists will immediately remove subjects or volunteers from the scan room. Centre staff will assist and inform emergency responders, with regard to potential hazards in responding to situations inside the magnet room, and initiate a magnet quench if required.

All emergency personnel that may potentially respond to an emergency within the MRI facility must undergo a safety orientation and consultation with the MRI Safety Officer.

11. Access and Training for Custodial Staff

Custodial staff will have access to the Zones 2 and 3 for daily cleaning. Routine cleaning of Zone 4 will be done by MR Technologists. Screened Custodial Staff may enter Zone 4 for scheduled cleaning under the direct supervision of an MR Technologist.

## 12. Safety Officer

The MRI Technologist Supervisor is appointed as the MR Safety Officer to oversee all elements of the Safety Policy. The Safety Officer is responsible for coordinating all safety training, monitoring safety compliance, liaising with emergency personnel and custodial staff, and maintaining records of screening activities and safety incidents. The Safety Officer will report periodically to the MRI Centre Core Group and will propose any changes to the Safety Policy as needed.

Ideally, the Safety Officer will conduct all safety training and record keeping procedures. However, other MR technologists will, at their own discretion, conduct training procedures if the Safety Officer is unavailable. Safety forms, Incident Reports, training material and records will be kept in the MRI console area.

## 13. No Scent Policy

The UBC 3T MRI Research Centre is a scent free environment. All staff, researchers, patients, normal volunteers, and visitors MUST refrain from wearing scented products. (Perfume, aftershave, scented shampoos etc.) Any persons wearing scented products will be asked to remove scent (wash) or leave the MRI Department immediately.

## 14. Incidents

All personnel will report all violations of safety procedures and protocols, accidents, incidents involving damage to equipment, emergency quenches, and incidents requiring medical attention to the Safety Officer, Centre Director, and Centre Radiologist. All incidents and corrective actions to prevent a recurrence of such an incident will be recorded in the Vancouver Coastal Health Patient Safety Learning System and reported to the UBC MRI Research Centre Core Group.