Centre for Neuroscience Studies

fMRI Facility

Standard Operating Procedures #08

Emergency Shut-Down and Quench Procedures

1. Introduction

i. Research involving Magnetic Resonance Imaging (MRI) at high magnetic field strengths present unique hazards to both research subjects and individuals working within and around the MRI system. Consequently, the potential for serious personal injury is present due to the sheer size and strength of the static magnetic field along with the immense flexibility of the research system and associated peripheral hardware.

ii. The static magnetic field in the 3T MRI facility is always present. It is important that all those entering the facility be aware of the presence of the field, as it cannot be detected by our person in any way, i.e. magnetic fields cannot be felt, seen, or smelt.

iii. As a result of the potential for serious injury, access to the 3T MRI Facility is restricted, and requires permission. See SOP#01 “Authorization for Access to the 3T MRI Facility”, and SOP#02 “MRI Facility Visitor Approval Policy”

iv. Working within and around the high field MRI requires in depth training on safety and Standard Operating Procedures, and documented proof of other necessary training. See SOP# 03 “Safety and Operator Training Procedures”.

v. It is imperative that all personnel who are within and around the 3T MRI facility always keep in mind the potential safety risks, and act in accordance with the guidelines set out in the Standard Operating Procedures.

vi. In case of emergency, the electrical power to the MR system can be cut abruptly without turning off or “quenching” the static magnetic field, or the static magnetic field of the MR system can be turned off. Quenching can potentially damage the MR magnet, will result in several days of system down-time, and recovery to operation is expensive. It is therefore to be initiated only in the cases of 1) an uncontrollable fire, or 2) someone is pinned against the magnet by a magnetic object.

2. Description of a Quench

i. A “quench” is an event that occurs only in superconducting magnets and results in a loss of the magnetic field of the MRI magnet. It is caused by a loss of superconductivity; a rapid increase in the resistivity of the magnet coil windings, which generates heat that results in the rapid evaporation, or boil-off of the magnet coolant (liquid helium). This evaporated coolant is a hazard that requires emergency venting systems (quench pipe through roof) to protect patients and operators. NOTE: once initiated a quench cannot be stopped and can potentially cause total magnet failure.

ii. There are 2 situations in which a quench may occur.

a. Spontaneously due to some force or disruption to the magnet system.
b. The emergency "Magnet Stop" button is depressed during an emergency situation.

3. Depressing the "Magnet Stop" Button

i. The "Magnet Stop" button will cause the magnet to quench and must be pressed if there is a fire in the magnet room that cannot be contained using the non-magnetic fire extinguisher and requires the assistance of the fire department. Refer to SOP# 07 "Emergency Fire Procedure" for the emergency fire procedures.

ii. The "Magnet Stop" button must be pressed if any individual is pinned to the magnet, trapped or in a potentially life threatening situation by a non-removable ferrous object.

4. **Emergency Quench Procedure**

i. Evacuate the magnet room if possible.

ii. Depress <u>one</u> of the "Magnet Stop" buttons. They are located:

a. At the center of the alarm box located on the wall to the left of the operator station, under the protective covering. The button is red and is labeled STOP.
b. In the magnet room, on the wall beside the door to your left as you enter the room, under the protective covering. The button is labeled STOP.

iii. The alarm will be activated at the alarm box, the MAG STOP led will light up, and an alarm signal will sound.

iv. If the magnet was quenched because someone was pinned, and they are injured, the operator must apply first responder principles. If the victim is not responding, not breathing and has no pulse, follow the procedure outlined in SOP# 06 "Emergency Procedure". Once all parties are safely out of the magnet room, close the magnet room door.

v. Notify the Facility Director, and Queen's Security (x36733), <u>immediately</u> following the incident. The facility staff must then file an appropriate Queen's incident report of the situation.

5. Description of an Emergency Shut-Down

i. The emergency shut-down procedure will shut down the entire MRI system but will NOT quench the magnet. Personnel must be aware that after initiating the emergency shut-down procedure the 3 tesla magnetic field is still present and all magnet safety procedures must still be followed.

ii. After an Emergency Shut-Down button has been activated and the emergency situation has been resolved, the system power can be restored and the MRI system restarted by an Operator.

6. Emergency Shut-Down Procedure

i. One of the Emergency Shut-Down buttons must be pressed if there is a fire or an electrically-based accident

ii. Emergency shut-down buttons are located in the Control Room, the Magnet Room, and the Equipment Room