

# **CRYOGEN & MAGNET QUENCH SAFETY & PROCEDURES**

## **PURPOSE**

- To ensure safety of personnel and patients as it pertains to the cooling of the magnet.
- To define magnet quenching and specify procedures for personnel.

## **PROCEDURE**

- The superconducting magnets used in MRI systems require cryogenic gases for cooling. The principle of the superconducting magnet is to create an environment that does not require a continuous electrical energy source to maintain magnet strength. The windings in the core of the superconducting magnet must be cooled to less than 9.5 K (-440 degrees Fahrenheit). This is accomplished by surrounding the windings with a dewar (sophisticated thermos bottle), and filling it with liquid helium, which has a boiling point of 4.2 K. Liquid nitrogen has a boiling point of 77 K and is also used to cool the magnet.
- Cryogenics require replenishment because of boil-off. This operation must only be performed by fully trained personnel following safety procedures. Safety glasses and heavy gloves are required. Refer to the safety documentation from the system vendor.
- A quench of a magnet refers to the rapid loss of magnetic field. This can occur if the temperature of the magnet windings rises above 9.5 K and the windings become electrically resistive. The magnet windings heat up and can cause vaporization of 100-150 L of helium and nitrogen in less than 1 minute. These gases must be vented directly to the outside environment. Refer to the safety procedures relating to a quench from the system vendor.
- The magnet quench button should only be pressed under the following conditions:
  - Forces due to the magnetic field are causing patient or personnel injury, requiring an immediate shutdown of the magnetic field.
  - A fire or other unexpected occurrence demands immediate action and entry to the MRI scan room by emergency personnel.
  - Any other situation that requires an immediate relief from the magnetic field effect as an alternative to the normal, controlled "ramp-down" of the magnetic field.
- If a quench happens:
  - Immediately remove the patient from the magnet room.
  - Evacuate all personnel and patients from the area.
  - Immediately contact MRI service personnel, the Imaging Manager and Risk Management.
  - Initiate downtime equipment protocol.
- For sites that have a pressure equalization door:
  - The area around the pressure equalization door will be taped off to prevent blocking of the door and/or injury to persons standing near door.

- Signage will be posted to explain the safety process and to ensure the area is kept clear.