



MRI Safety

- The Magnetic Resonance Imaging Scanner creates a strong static magnetic field that is always on.
- MRI does NOT produce ionizing radiation.
- Magnetic field strength is measured in Tesla or Gauss. 1T = 10,000G. Earth is 0.5G
- Medical MRI scanners range from 0.25T to 7T with research magnets up to 12T.
- The majority of MRI scanners are 1.5T or 3T.
- Magnetic fields act upon ferrous metals drawing them towards the center of the field.
- The 5 Gauss line is the point where the field is strong enough to begin acting upon these objects and is typically around 4 meters from the center of a 1.5T magnet.
- This can result in a projectile effect of any ferrous object that enters the scanner room as it is pulled towards the center of the magnet.
- Ferrous metals include: iron, steel, stainless steel, and steel alloys
- Non-Ferrous metals include: aluminum, copper, beryllium, gold, brass, etc.
- High field strengths are achieved by utilizing superconducting magnets.
- The superconducting magnet is filled with 1,000 liters of liquid helium, keeping it super cooled to 4 degrees Kelvin (-269.1C) (-452F).
- Any purge (Quench) or rupture of the helium chamber can result in violent expansion of the Helium from a liquid to a gas in a matter of 5 to 15 seconds.
- Liquid He expands to a gas at a ratio of 1:757 meaning 1,000L liquid = 757,000L gas.
- The gradient magnetic fields are created by electromagnetic coils inside of the scanner.
- The energy produced by these gradients can induce an electrical current or heating in tissues and conductive materials.
- This energy absorption can cause muscle twitching from stimulating peripheral nerves, skin irritations, or even burns.
- The gradient magnetic field also produces a significant amount of acoustic noise, 90 to 130+db, a jet engine produces around 140 db.
- The radio frequency transmitters can cause heating similar to that produced by the gradients.
- Equipment, staff, and patients, must be screened by the MRI operator before entering the room.
- Monitoring equipment must be MRI compatible and properly located in the room.
- The entire scanner room is lined with a copper Faraday cage to eliminate ambient RF noise which can create artifacts on the images. Even the doors and windows.
- The door should always be closed to prevent ambient RF leaks and as a protective barrier from unscreened personnel and objects from entering.
- Anyone entering the MR room should be screened for metallic objects, implanted devices, and metallic foreign bodies.
- Internal metallic objects can also produce image artifacts as the magnetic field bends around the object or displaces the RF energy.
- Pregnant workers should limit their exposure to the MRI environment due to the potentially harmful effects of the gradient/RF energy absorption and the acoustic noise on a developing fetus.
- In an emergency the patient should be immediately removed from the MRI room for safety.
- Any additional questions or concerns should be directed to the MRI operator.