



CalvertHealth



MRI AND RADIATION SAFETY

OVERVIEW OF MRI AND RADIATION SAFETY PRINCIPLES

MAGNETIC RESONANCE IMAGING

The MRI magnet is:

- **ALWAYS ON**
- 24 hours a day
- 365 days a year

Q: Where is the MRI magnet at CHMC?

A: In the hallway that goes from the ER registration desk into the Medical Office Building (MOB)

The entrance looks like this:



MRI SAFETY ZONES



Includes all areas freely accessible to the general public where the magnet field poses no hazards.



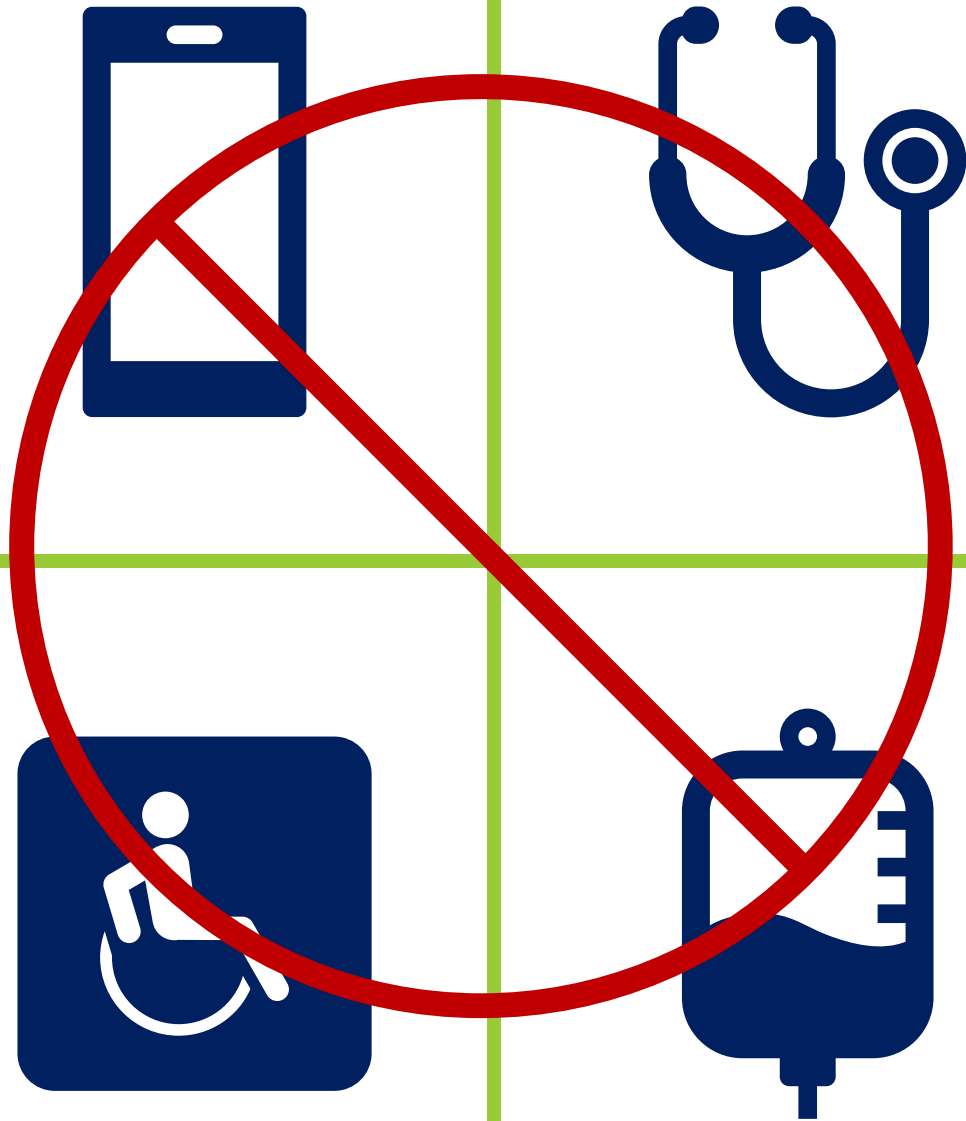
Semi-restricted area where patients are under general supervision of MRI personnel and MRI screenings often take place.



Restricted by physical barriers such a locked door. Only approved MRI personnel and patients that have undergone MRI screening are allowed to enter.



The room where the MRI magnet is located.



METAL objects
and equipment are
NOT PERMITTED
in the MRI
scanning room

-
- Cell Phones
 - Companion Phones
 - Apple Watches
 - IV Poles
 - Wheelchairs
 - Stretchers
 - Stethoscopes
 - Oxygen Tank

Objects that are made of aluminum or plastic can be brought into the scanning room.

These materials are considered non-ferrous or non-magnetic.



If you are unsure if an object is MRI safe, **DO NOT** take it into the room.



ASK AN MRI TECHNOLOGIST.

U.S.




Employees of the Westchester Medical Center in Valhalla, N.Y., gather outside after learning of the deadly MRI incident. (ABCNEWS.com)

Hospital Nightmare

Boy, 6, Killed in Freak MRI Accident

abcNEWS.com

July 31 — A 6-year-old boy died after undergoing an MRI exam at a New York-area hospital when the machine's powerful magnetic field jerked a metal oxygen tank across the room, crushing the child's head.

The  [force of the device's 10-ton magnet](#) is about 30,000 times as powerful as Earth's magnetic field, and 200 times stronger than a common refrigerator magnet.

The canister fractured the skull and injured the brain of the young patient, Michael Colombini, of Croton-On-Hudson, N.Y., during the procedure Friday. He died of the injuries on Sunday, the hospital said.

The routine imaging procedure was performed after Colombini underwent surgery for a benign brain tumor last week. Westchester Medical Center officials said he was under sedation at the time of the deadly accident.

Hospital Takes 'Full Responsibility'

The projectile or missile effect occurs when non compatible materials are **pulled violently** towards the magnetic source.

REMEMBER THIS MNEMONIC

M Metal

R Results

I (in) Injury



Patient Information Screening Sheet
Phone: 410-414-2794 Fax: 410-535-5832

Name: _____ Date of Birth: _____ Date: _____

Weight: _____ Height: _____ Travel Method: Wheelchair Stretcher

Female Patients: Any possibility that you are pregnant? Yes No

What problems did you see your doctor about that resulted in this MRI being ordered? _____

What do you think caused the problem, and when did the problem start? _____

Are you claustrophobic? Yes No If YES, Meds MUST be given by nursing unit.

Have you ever had previous surgery or an MRI on the part of your body that we are scanning today?

Yes No If YES, please provide additional information below.

Date and Type of Surgery	Implants from Surgery	Date and Type of MRI
_____	_____	_____
_____	_____	_____
_____	_____	_____

Please check any of the items that are now inside or now attached to your body.

(Guideline: Anything that you were NOT born with)

- | | | |
|---|--|--|
| <input type="checkbox"/> Pacemaker / Defibrillator | <input type="checkbox"/> Metals in Eyes | <input type="checkbox"/> Prosthesis |
| <input type="checkbox"/> Brain Surgery | <input type="checkbox"/> Neurostimulators | <input type="checkbox"/> Medical Pumps (Insulin pumps) |
| <input type="checkbox"/> Heart Valve Replacement | <input type="checkbox"/> Aneurysm Clips | <input type="checkbox"/> Penile Implants |
| <input type="checkbox"/> Heart Stents | <input type="checkbox"/> Heart Surgeries | <input type="checkbox"/> Implants in Ears |
| <input type="checkbox"/> Rods or Plates | <input type="checkbox"/> Screws or Clips | <input type="checkbox"/> Shrapnel or Bullets |
| <input type="checkbox"/> Tattoos | <input type="checkbox"/> Temperature Sensing Foley | <input type="checkbox"/> Magnetic Eyelashes |
| <input type="checkbox"/> Medication Patches (nicotine, nitroglycerine, birth control, etc.) | <input type="checkbox"/> Sleep Apnea Implant | |

Please list dates of implants or surgery for any of the above items checked:

Date of Implant / Surgery	Type of Implant / Surgery
_____	_____
_____	_____

Please check if you have a history of any of the following medical conditions?


- | | | |
|---|---|--|
| <input type="checkbox"/> Sickle Cell Trait / Anemia | <input type="checkbox"/> Diabetes | <input type="checkbox"/> Latex Allergy |
| <input type="checkbox"/> Kidney Disease or Failure | <input type="checkbox"/> Dialysis Patient | |
| <input type="checkbox"/> Cancer: Area of Cancer _____ | Date Diagnosed _____ | |

Allergy to MRI Contrast (Not iodine, different than CT or IVP contrast) Yes No

Medication Allergy Yes No If yes, please list: _____

Patient/Caregiver Signature: _____

Technologist Comments: _____

BUN _____	Creatinine _____	GFR _____	Contrast: Type _____	Amount _____	cc's _____
		Patient Information Screening Sheet MRI Services CalvertHealth Medical Center Prince Frederick, MD 20678 700-05 (9/2022)		PATIENT LABEL	
* C L I N . N O T E S *					

MRI PATIENT SCREENING FORM

- MRI screening form should be completed by the **patient and/or the patients family member who knows the patient's medical history.**
- If an RN assists with completion of MRI screen form a signature from the RN should be included
- An implant card for all known devices must be available to the technologist.
- Any item added to the patient's body since birth is investigated before they can enter the magnet.
- The patient MRI screening form can be found on the intranet under forms and documents – MRI # 700-05

PACEMAKERS

Pacemakers **MUST** be carefully investigated before a patient can have an MRI. This is done through a multistep process.

Clinically updated pacemakers are MRI conditional, and the exams are completed in the following steps:

1. The device and leads implanted must be identified in writing; Once it is determined that the system is MRI conditional:
2. Orders will be sent to the cardiologist for approval and to determine the pacemaker settings
3. The procedure can then be scheduled with the following present:
 - a. Pacemaker Representative
 - b. MRI Technologist
 - c. Interventional RN



PREGNANT MRI PATIENTS AND PERSONNEL

- Pregnant patients regardless of trimester are only scanned if the results of the study will change the care of the patient
- CalvertHealth Medical Center requires an informed consent for pregnant patients undergoing an MRI
- Pregnant MRI Personnel do not stay in the room during the scanning process



Non-MRI Personnel Screening Sheet
Phone: 410-414-2794 Fax: 410-535-5832

Name: _____ Date of Birth: _____ Date: _____

CalvertHealth System Department in which you work _____

Employee ID: _____

Company / Vendor Representative: _____

Family Member: _____

Have you ever had previous surgery or an MRI on any part of your body?
 Yes No If yes, please provide additional information below.

Date and Type of Surgery	Implants from Surgery	Date and Type of MRI
_____	_____	_____
_____	_____	_____
_____	_____	_____

Please check any of the items that are now inside or now attached to your body.
(Guideline: Anything that you were NOT born with)

- | | | |
|---|--|--|
| <input type="checkbox"/> Pacemaker / Defibrillator | <input type="checkbox"/> Metals in Eyes | <input type="checkbox"/> Prosthesis |
| <input type="checkbox"/> Brain Surgery | <input type="checkbox"/> Neurostimulators | <input type="checkbox"/> Medical Pumps (Insulin pumps) |
| <input type="checkbox"/> Heart Valve Replacement | <input type="checkbox"/> Aneurysm Clips | <input type="checkbox"/> Penile Implants |
| <input type="checkbox"/> Heart Stents | <input type="checkbox"/> Heart Surgeries | <input type="checkbox"/> Implants in Ears |
| <input type="checkbox"/> Rods or Plates | <input type="checkbox"/> Screws or Clips | <input type="checkbox"/> Shrapnel or Bullets |
| <input type="checkbox"/> Tattoos | <input type="checkbox"/> Temperature Sensing Foley | <input type="checkbox"/> Magnetic Eyelashes |
| <input type="checkbox"/> Medication Patches (nicotine, nitroglycerine, birth control, etc.) | | |


Please list dates of implants or surgery for any of the above items checked:

Date of Implant / Surgery	Type of Implant / Surgery
_____	_____
_____	_____
_____	_____

Signature of Employee/Vendor/Family Member: _____

Signature of Lead MRI Technologist: _____

Comments: _____

 * CLIN. NOTES *	Non-MRI Personnel Screening Sheet MRI Services CalvertHealth Medical Center Prince Frederick, MD 20678 700-04 (11/2021)	PATIENT LABEL
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NON-MRI PERSONNEL SCREENING FORMS

- Non-MRI personnel who have daily tasks near the MRI machine **MUST** complete a screening form
 - This is completed by an MRI technologist and kept on file
- Patient support persons or caregivers who are non-MRI patients will also be screened before accompanying a patient into the MRI scanning room
- The non-MRI personnel screening form can be found on the intranet under forms and documents – MRI # 700-04

PATIENT EMERGENCIES IN MRI

If there is a patient emergency in MRI:

- The patient should be taken out of the MRI scanning room by an MRI technologist
- The MRI table unlocks and pulls out with the patient remaining in place
- Codes or STAT Team procedures **WILL NOT** be conducted in the MRI scanning room

PERSONNEL ACCESS RESTRICTIONS AND TRAINING

There are 2 levels of training for all personnel who have access to MRI

- **Level I Personnel**

- Minimally trained in MRI Safety and can ensure their own safety in zone III. They are NOT responsible for the safety of a patient in the MRI environment and would not be left alone with a patient.

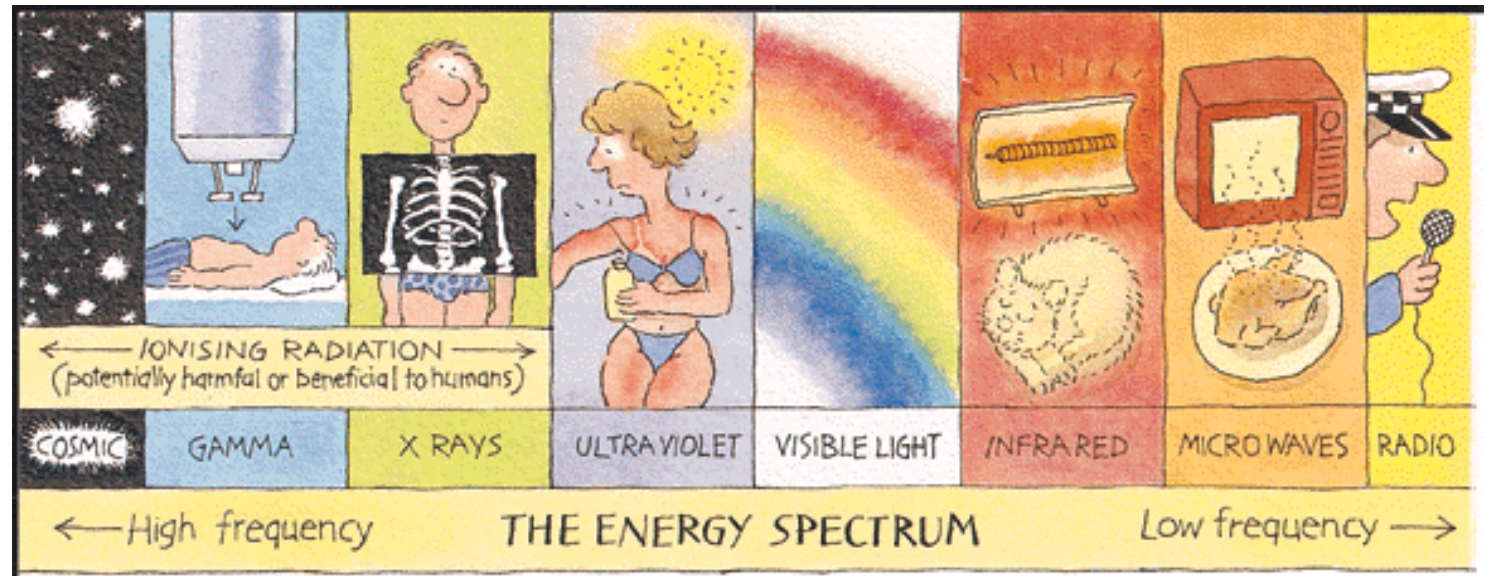
- **Level II Personnel**

- Extensively trained and knowledgeable of the MRI environment, the potential hazards of the agents, the equipment used and MRI safety precautions.
- The MRI Safety Director, Radiologists and all MRI technologists are considered Level II personnel

RADIATION

WHAT IS RADIATION?

The transmission of energy in the form of electromagnetic waves (EM) or fast-moving particles



REM ROENTGEN EQUIVALENT IN MAN

A unit of effective absorbed dose of ionizing radiation in human tissue.

This is the unit used to measure/track radiation exposure in workers.

Maximum
whole-body dose
5 REM/year

- Not all radiation can be felt or seen by the human body or eye.
- Some EM waves can be perceived by the human sensory system. Ex: radiant energy in the form of heat or our eyes detecting different colors of visible light.
- Other forms of EM waves like x-rays are undetectable by our sensory system.
- **Although radiation may produce damage to living tissues through ionization, it is crucial in the diagnosis and treatment of disease.**
- Two most common types of radiation that will expose the human body are X-rays and Gamma rays.

RADIATION

SOURCES OF RADIATION DOSE IN THE HOSPITAL

The majority of medical radiation exposure is from CT.

X-ray machines in the hospital, can be portable, stationary in the radiology department or in the OR.

In nuclear medicine, radioactive materials are administered to the patient. These are stored in a secure lab with limited access.

OCCUPATIONAL EXPOSURE

Can occur when working around ionizing radiation in places of the hospital such as:

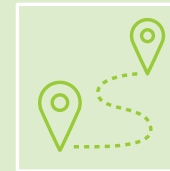
- **Radiology Department**
- **Operating Room**
- **Nuclear Medicine Department**

BEST PROTECTION FROM RADIATION



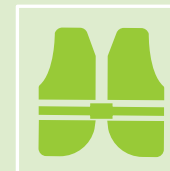
TIME

Less time spent near source = less radiation received



DISTANCE

Keep as far away as possible. 2 times distance = 1/4 the exposure.



SHIELDING

Shield yourself and patients when applicable.



COMMON RADIATION WARNING SIGNS

ALARA

Always keep the exposure in any medical imaging situation:

As

Low

As

Reasonably

Achievable

01

Dosimetry badges are issued to employees who work in areas where they have the potential to reach up to 10% of the annual MPD.

02

Badges are to be worn on the collar area outside of lead aprons and must be changed each month.

03

Upon exchange, badges are sent for processing to record any exposures.

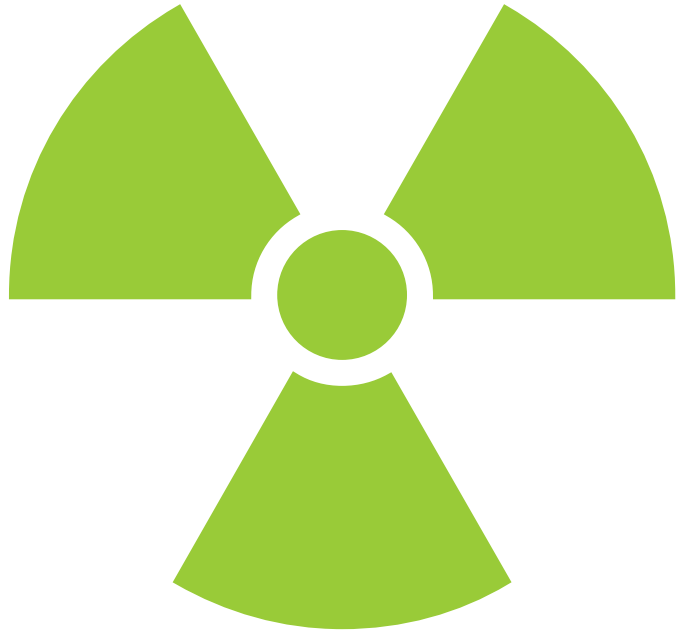
04

Reports are then returned from the dosimetry company to the physicists and radiation safety officer for review and follow-up of any high exposures.

PERSONNEL MONITORING

RADIATION AND PREGNANCY

If an employee who currently wears a dosimetry badge (this applies to employees who were issued a badge upon hire) voluntarily declares their pregnancy in writing to a supervisor, they will receive a second badge to monitor fetal exposure.



RADIATION SAFETY CULTURE

- A commitment to emphasize safety to ensure protection of people, the environment, and security of radioactive sources.
- **CHMC is committed to a radiation safety culture.** All employees involved in activities involving radiation are expected to promote and practice radiation safety. This is achieved through leadership, respect, accountability, effective communication, and continuous learning.

MRI & RADIATION SAFETY

**CALVERTHEALTH
MEDICAL CENTER**

Glenn Selman, MD

Medical Director of Radiology and
Radiation Safety Officer
(410-535-8318)

Kelly Williams

Radiation Safety Department Chair
(410-535-8322)

Lisa Curl

Film Badge Coordinator
(410-535-8318 ext: 5364)

Joan Rozran

Lead MRI Technologist
(410-535-8318 ext: 2794)

References

- *ACR Manual on MR Safety* (Version 1.0) (2020). Retrieved from <https://www.acr.org/-/media/ACR/Files/Radiology-Safety/MR-Safety/Manual-on-MR-Safety.pdf>
- (2001) Boy,6, Killed in Freak MRI Accident, abcNEWS, July 31. Available at: <https://abcnews.go.com/US/story?id=92745&page=1> (Accessed: January 2, 2023).
- Supplement 30. Code of Maryland Regulations. S 26.12.01.01 (1995)