

# Purdue MRI Facility Safety Seminar

Required for becoming a Primary  
or Secondary Operator

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**InnerVision West**  
Advanced Medical Imaging

















# Sources of Information

- InnerVision MRI Safety II
- NIH NMR Center MRI Safety Course
- Videos (citations within videos)



# Part of “Scanning Approval”

- Demonstration of the following certifications in safety of human or animal subjects:
  - Completion of this MRI Safety Seminar (valid for two years) and seminar form
  - Current (adult) CPR training
  - CITI Human Subjects Research certifications (valid for five years)
  - (Optional) PACUC Orientation to obtain *Animal* designation

# CPR Training

- Required for Primary Operators.
- Need copy of certification card.
- Option – Kathryn Weil Center
  - 765-449-5133 to register.
  - Location - Medical Arts Building (26<sup>th</sup> St.), 4<sup>th</sup> floor
  - Certification valid for two years.
- Option – American Red Cross
  - [http://www.tippearc.org/classes\\_health\\_safety.shtml](http://www.tippearc.org/classes_health_safety.shtml)

# CITI Training

- Required for Primary Operators.
- Visit <http://www.irb.purdue.edu> for information on Online Training.
- CITI Training – <http://www.citiprogram.org>



# Attention Grabbers

- Play O<sub>2</sub> cylinder video.
- Play patient bed video.

# Four Main Points

- Safety first and foremost.
- The magnet is always on.
- No ferromagnetic material into the scan room.
- Never become completely comfortable.

# Main Video

- Play Dr. Shellock's MRI Safety video.



# InnerVision MRI

Objects that ARE MRI compatible are marked with a green sticker marked as “MRI SAFE”.



# InnerVision MRI

Objects that ARE NOT MRI compatible are marked with a red sticker marked as “NOT MRI SAFE”.



# Red Hand-Held Magnet





# If You Forget...

- Ferrous object in pocket – place hand over object and leave the room.
- Large ferrous object being pulled by magnet – let it go (within reason).
- Object flying into bore – wait until it stops moving.

MRI will erase all magnetically stored information rendering the following useless:

Credit Cards

Bank Cards

Parking Passes

Film

Computer Discs

Electrical and mechanical devices  
will be irreparably damaged such as:

Cell Phones

Pagers

Cameras

Calculators

Wrist Watches

Hearing Aids

# What Is A Quench?

Quenching is a process by which there is a sudden loss of the super conductivity of the magnet coils so that the magnet becomes resistive.

(play 1.5T Quench video)



# Should A Quench Occur

- Helium may displace the room oxygen if not properly vented to the outside.
- The patient and staff may suffer from suffocation and asphyxiation. It can occur **VERY** rapidly.

# Signs And Symptoms

- Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness and death.
- Such symptoms may occur in seconds without warning.
- Death may result from errors in judgment, confusion or loss of consciousness which prevents self rescue.
- Oxygen sensor alarms are used in the scan room to warn of such situations.

# What To Do If Patient Is In Scanner At Time of A Quench

- Put O2 on yourself before entering the room with extension tubing as you may NOT take oxygen tank in the scan room.
- Try both doors, if neither will open, break the window and the door should then open.
- Stay close to the ground.
- Pull patient out of the scanner as soon as possible.
- Exit room as quickly as possible.

# Oxygen Tank Location



# Emergency Quench Button





# Switched Magnetic Field Gradients

- Possible peripheral nerve stimulation due to induced currents.
- Possible muscle twitching, extremity spasms.
- Tingling sensations or itching.
- Do not form large conductive loop with hands and legs!

# Auditory Issues

- Sources of acoustic imaging noise associated with fMRI include:
  - flexion of the gradient coils
  - eddy currents
  - radiofrequency (RF) transmit and slice-selection pulses
  - ambient noise --- the air-handling system, the ventilation fan, and the liquid helium condenser facilitating super cooling of the permanent electro-magnet

# Auditory Issues

- Pings from flexion of gradient coils are of most concern.
- High intensity noise that can result in temporary or permanent hearing loss if ears are not protected
- ~ 90 dB SPL (haven't measured yet)

# Auditory Issues

- All subjects should be given ear protection – earplugs and perhaps even earmuffs.
- Likewise for any investigators that need to remain in the scan room during a session.
- Auditory stimulus volume levels should be set at the subject's just-tolerable threshold (i.e., as loud as possible, but not too loud).

# RF Field Issues

- Possible tissue heating.
- Focal heating or burns – check all coils and cables.
- No exposed wires on the body!
- RF power deposition
  - (SAR) Specific Absorption Rate: measure of the rate at which RF energy is absorbed by the body when exposed to radio-frequency electromagnetic field.
  - SAR is below FCC-approved levels.
  - To be sure ... enter correct body weight.



# Psychological Issues

- Claustrophobia
- Anxiety
- Depression
- Not addressing these issues increases the safety risk!

# Unexpected Emergencies

- Cardiac Arrest
- Life threatening incident (e.g., stroke, choking, etc.)
- Fire
- Electrical failure

# AED



# Emergency Response

- Call 911
- Location: InnerVision West facility on McClure St. in Purdue Research Park.
- Meet them at entrance,
- Remove subject from scan room.
- Perform CPR and use AED if necessary.
- Call Manager of Operations or Co-Director as soon as possible.

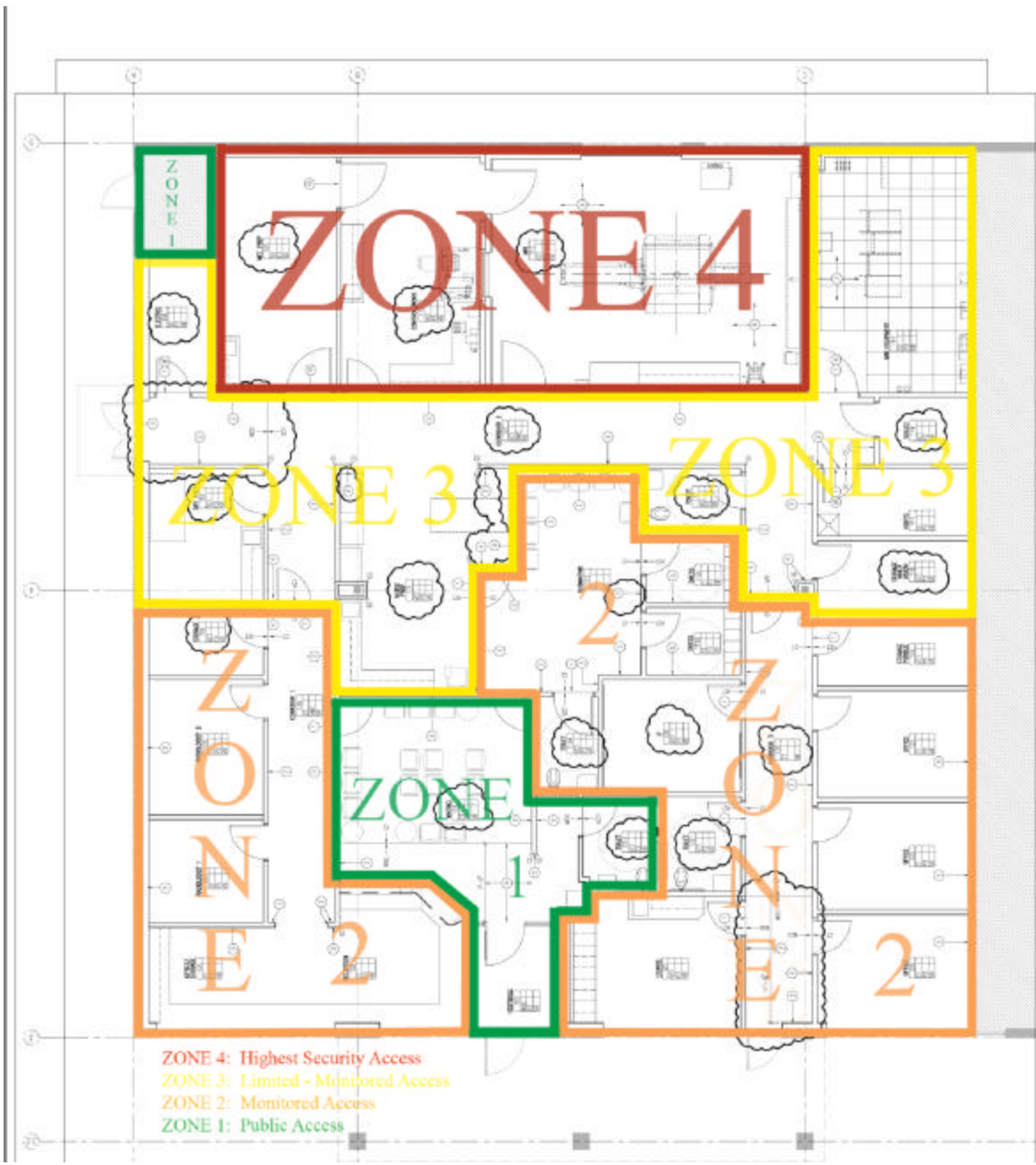
# Subject Comfort

Subject should notify you ...

- if they experience warmth or heating
- are unable to continue
- have any discomfort
- by using the patient alert system or when in communication between runs.

# Subject Preparation

- Screen all entering console room.
- Give all subjects earplugs.
- Use patient alert system.
- Do not leave subjects unattended in scanner; at least one individual present in scan room or console room.



- ZONE 4: Highest Security Access**
- ZONE 3: Limited - Monitored Access**
- ZONE 2: Monitored Access**
- ZONE 1: Public Access**



# Violation of Guidelines

- Repeated violations will likely result in the loss of scanning privileges
- Safety guidelines in place to provide a safe research environment for subjects, operators, and investigators ... please follow the guidelines at all times!

# Report Incidents

- Safety Incident Report Form
  - Whenever a safety incident has occurred, even if no resulting injuries.
- Equipment Incident Report Form
  - Whenever a piece of equipment malfunctions, even if temporarily.
- Contact Manager of Operations or Co-Director if an emergency or urgent matter.

# Personal Safety Advice

- Avoid standing in the direct line from the magnet door to the magnet.
- You might become the victim if someone else forgets the rules!
- Be on guard at all times; do not fully relax.

# The End

- Questions?
- Please complete MRI Safety Seminar Completion Form.