

**Principal Investigator:**

George D. Cody (R218, x8980)

Secondary Contacts:

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Emergency Information:

Staff Member: 301-332-6970 (cell)

BBR (Gary Bors): 202-510-8577

All other emergencies: 911

Purpose:

The use of this laboratory is for Nuclear Magnetic Resonance Spectroscopy and pyrolysis Gas Chromatography. When in this laboratory, personnel must be aware of specific hazards associated with any NMR facility.

RM 222 is considered a safety restricted space: Only authorized personnel are allowed entry to this laboratory. All visitors need to be escorted due to safety issues:

Safety Issues: When in room 222 all personnel are in the presence of very high magnetic fields (low of 5 G up to 70,000 G; 10 G zone is indicated by safety square on floor), strong radio frequency irradiation, extremely high voltage electronics (up to 2000 V), and large quantities of cryogenic fluids (liquid nitrogen and liquid helium).

Specific Hazards:

- 1) High magnetic and radio frequency fields may affect pace makers
- 2) All ferromagnetic material must be kept far from magnet-do not bring ferro-magnetics into laboratory without permission, stay out of the marked hazardous area (yellow and black tape on floor) surrounding magnet
- 3) The magnet cryostat contains ~ 60 L of liquid N₂ and 60 L of liquid He, on event of a magnet quench, these liquids will be rapidly converted to gas and will displace the oxygen in the laboratory, rapid asphyxiation can occur. In event of a magnet quench evacuate room 222 immediately and do not allow re-entry until gasses have dissipated.
- 4) The power supplies for the high power amplifiers utilize very high voltage (2000 V). These amplifiers are deadly and no personnel are allowed to open the high voltage cabinet for any reason without consultation with George Cody.
- 5) The magic angle spinning probes spin samples up to 2 million rpm. The kinetic energy of the sample rotors is very high and in event of rotor failure can fragment at near ballistic velocities. Users should never open the sample loading cover while rotating samples. Protective face masks are required in the unlikely event that one feels it necessary to observe rotor spinning.
- 6) Trip hazards. The solids state NMR by design has a number of cables and hoses that could present trip hazards. No unauthorized (or untrained) personnel are allowed near the floor cables and air hoses (see note above about visitors requiring escort). Caution: stepping on the high power RF cables can seriously degrade instrument performance, replacement of these shielded cables is very expensive.
- 7) Cryogenic liquids (LN₂ and LHe) are intrinsically hazardous: potential hazards 1) very low temperatures (HIGH-tissue freezing injury), 2) asphyxiation hazard (LOW-can displace O₂)- minimized by OSHA requirements for space, 3) explosion hazard (LOW, both LN₂ and LHe have massive ΔV associated with



heating from liquid T to room T (note: the cryogenic dewars do have safety features to minimize explosion hazard upon magnetic quench - see notes on specialized training); 4) fire hazard (unlikely): LN2 and LHe will condense atmospheric oxygen over time. So long as LN2 and LHe levels are maintained (SOP) no fire hazard. If there is a magnet quench O2 may be released (note: immediate evacuation is required if a quench should occur). N2 and He will suppress any fire.

Rules of Operation:

Specialized training is required. Any potential NMR users must be trained in all aspects of the use of this instrument. The NMR software assumes the user understands all aspects of RF spectroscopy. The user has the potential in destroy this instrument through a poor choice of experimental parameters. All new pulse programs must be tested with the high power amplifiers turned off (follow the pulse output from the low power transmitters using the oscilloscope).

Directing RF power directly into the oscilloscope will destroy this very expensive piece of equipment. The 30 dB attenuator must be used whenever testing amplifier power output.

Training is required to perform liq. N2 fills. During Liq N2 fills magnet must never be left unattended. If you have to leave, it is required that the Liq N2 is turned off.

Specialized training is required to perform liq. He fills.

Specialized training is required to use the pyroprobe Gas chromatograph – Mass spectrometer.

After hours restriction:

Instrument (NMR and GCMS) operation: none

Cryogen fill: LN2 any time, LHe transfer must be accompanied by a second person being present at any time.

No work may be performed in the high voltage cabinet (when energized) after hours without a second person present.

Standard Operating Procedures: Keep Laboratory Doors Locked during off hours unless you are actively using the facility.

Laboratory User

I agree that I have thoroughly read and understood this laboratory safety document. I have access to this safety information at all times when I am working. I have been trained to be able to identify the hazards to which I may be exposed and to follow the work practices and procedures discussed in this document. I certify that I will conduct my research work safely and that I will be responsible for following stated safety policies.

User Name (Print)

User Signature

Date



Principal Investigator

I certify that the information presented in this safety document is accurate and complete. I agree to comply with all safety procedures and to fully train and supervise all researchers under my direction.

PI Signature

Date