

1.3 NMR Facility Policies

This section enumerates the current policies governing NMR Facility usage. These policies are subject to periodic review and revision; suggestions from the NMR user community for revisions are welcome. If you have comments or suggestions, please submit them to the NMR Facility Director. **NMR Facility users are required to know and understand these policies**, and are encouraged to provide feedback for the benefit of the entire NMR user community.

1.3.1 NMR Facility Access and Use

The NMR laboratory is a **secure-access facility for authorized users only**. Access is gained only through direct authorization, obtained via user training and subsequent checkout procedures designed to ensure that all users are capable of safe and appropriate use of the NMR spectrometers and ancillary equipment. Authorized users will have (i) key-card access to the NMR Facility and (ii) active computer accounts through which to operate the equipment for which they are granted access. Only those with explicit access are allowed to use the Facility equipment; i.e., **sharing of computer accounts and/or key access is not permitted**.

Taking or allowing *guests* into the laboratory is generally not permitted; anyone who does so may be held accountable for any injuries or damages incurred. Uniformed security personnel patrol the School of Pharmacy, including the AIC; users may be asked to show UW identification and after-hours building permits. As a secure-access facility, the NMR laboratory doors are to be closed and locked under normal circumstances, not left open or ajar; security personnel check this also.

1.3.2 NMR User Training

NMR training is provided only by NMR Facility staff, and may be modified to meet individual needs according to previous NMR training and experience and anticipated research objectives. A variety of training events are periodically offered, usually on an *ad hoc* basis. Refer to the NMR training web page at <http://www.pharmacy.wisc.edu/aic/nmr/training> for detailed information and a link to the on-line training registration form.

1.3.3 Facility Fees and Services

The NMR Facility is primarily a user-operated laboratory, in which users acquire, process and analyze their own data. Monthly accounting of and billing for spectrometer usage is in effect. A flat rate of \$3.00 per hour for both the UI-400 and UI-500 NMR spectrometers currently applies to internal (UW system) customers who operate the instruments themselves. Direct access or NMR spectroscopy services are available to external (non-UW system) customers at higher rates; see the NMR Facility Director to discuss this option. The fee structure is subject to periodic review and modification; the user community will be notified in advance before rate changes take effect.

1.3.4 Reserving Instrument Time

A web-based instrument reservation system is in use for authorized Facility users only. Access the system from <http://www.pharmacy.wisc.edu/aic> and authenticate via your facility user name and password.

1.3.5 Laboratory Safety and Health Issues

Access to the NMR laboratory proper (room 1411) is restricted to those individuals who have either (i) successfully completed an on-site training course or (ii) have otherwise received training, from an authorized agent, regarding the potential dangers inherent in a magnetic resonance facility. Requests for access authorization must be made through the NMR Facility Director. These restrictions apply to all personnel: NMR users, custodians, maintenance workers, etc.

The potential dangers inherent in a magnetic resonance facility involve the presence of strong magnetic and radio-frequency fields and cryogenic fluids (liquid nitrogen and helium), plus the general hazards of handling chemicals and glassware (primarily NMR tubes). Because only Facility personnel handle cryogenics in the NMR lab, related precautions are not discussed further in this document; common hazards regarding other topics are described below. Note, however, that the following examples are in no way all-inclusive; it is always the individual's responsibility to ensure that safe practices are followed. When in doubt, consult with the NMR Facility Director before proceeding.

For select descriptions of real-life laboratory accidents, near misses, etc., refer to the "NMR Laboratory Mishaps" web pages at <http://www.pharmacy.wisc.edu/aic/nmr/LabMishaps/LabMishaps.cfm>

Preliminary Considerations

- ⊛ **Authorized Access Only** Unless you personally have key-card access, you are not authorized!
- ⊛ **Food and Drink** Neither food nor drink is allowed in any of the NMR laboratories. Period!
- ⊛ **Proper Attire** Loose-fitting shoes or sandals, or high-heeled shoes — although they may be quite comfortable, stylish, or both! — should not be worn in the NMR laboratory. Such footwear greatly increases the risk of losing balance or falling when using the step platforms to insert or remove sample tubes from the magnets. You are responsible: Be safe, not sorry.

Hazards Related to Super-Conducting Magnets

- ⊛ **WARNING:** Persons with implanted or attached medical devices such as pacemakers or prostheses are not allowed to enter the NMR Facility (room 1411) without authorization from a physician.
- ⊛ **WARNING:** High-field super-conducting magnets produce very strong, fringe magnetic fields that extend **in all directions** beyond the magnet canister, presenting invisible yet very real dangers related to the forceful attraction of ferromagnetic objects. These magnets are always on and cannot be turned off. Each magnet in the NMR lab has its radial 5-Gauss perimeter marked out on the floor with red tape; ferromagnetic objects must be kept outside these regions at all times.
- ⊛ **WARNING:** Although fairly common during the initial energization of a super-conducting magnet, the violent quench of a stable magnet is a rare but statistically probable event. Violent quenches can cause the liquid helium (120 L in the UI-500 when full) to boil off in a matter of seconds, venting loudly through safety valves at the top of the magnet canister. There is nothing to do once this happens, except evacuate the NMR lab — after recovering from the initial scare. The real danger lies in the consequent displacement of oxygen in the room, with a risk of asphyxiation.² Normal building ventilation will flush the helium gas out of the room after some time

²The rapid boil-off of 120 L of liquid helium will produce approximately 90 m³ of gaseous helium, which is roughly 1/3 the total volume (at 310 m³) of the NMR lab.

(10–15 minutes); there is no other danger and no real need to evacuate the building (although it would probably be prudent to do so). Inform the NMR Facility Director of the bad news.

- ⊛ **CAUTION:** Magnetically encoded media (e.g., ATM cards or floppy diskettes), mechanical watches and some electronic devices may be damaged or destroyed if subjected to intense magnetic fields; keep such items outside the 5-Gauss regions.
- ☞ **Fire Extinguisher** A non-ferromagnetic, CO₂ fire extinguisher is located at the right-hand end of the laboratory bench in room 1411.

Chemical and Glassware Hazards

- ☞ **Chemical Hazards** NMR Facility users are responsible for knowing the chemical hazards of their compounds, and for taking proper steps to ensure their own and others' safety at all times, e.g., in the event of sample tube breakage and subsequent spill. It is the user's responsibility to completely clean up any spill, broken glass, etc.
- ☞ **Radio-Nuclides** Samples containing enriched quantities of radio-nuclides are not permitted in the NMR Facility.
- ☞ **Sample Preparation** Sample preparation in the NMR Facility is to be done only on the laboratory bench in room 1411; neither the computer desks nor the spectrometer consoles are to be used for such purposes.
- ☞ **Toxic or Unpleasant Substances** Such substances shall be addressed responsibly according to their nature. For example, flame sealing a sample within an NMR tube may be required to contain an offensive smell.
- ☞ **Sample Disposal** Facility users must promptly remove their samples and related materials from the laboratory when their experiments are completed. Arrangements can be made for those with special needs to store samples/tubes in the lab to facilitate their work; otherwise, NMR sample tubes persisting unclaimed in the laboratory will be discarded on a regular basis.
- ☞ **Gloves** If needed for extra protection, gloves (e.g., latex, nitrile) may be worn only while preparing or handling NMR samples. When possible, NMR samples should be prepared in advance in the user's laboratory. Gloves are **never** to be worn while operating computers or handling other community property.
- ☞ **Glassware Hazards** Routine precautions should be observed when handling glassware, typically when inserting and withdrawing NMR tubes into and from the spinner turbine. The spinners use rubber O-rings to grip the NMR tubes, and the fit can be quite snug, depending upon the condition of the O-ring and the specific NMR tube used. Grip the tube firmly near the spinner and use a twisting motion whilst inserting or withdrawing the tube. Carelessness may result in puncture wounds. *Ouch!* ☹

Miscellaneous Considerations

- ☞ **Be Careful!** Users must *carefully* insert/remove their NMR samples into/from the magnets, positioning themselves to maneuver the glass tube straight up or down — not at an angle — out

of, or into, the upper barrel. Glass does not bend well at room temperature, and we have had far too many users snap a sample tube by catching it at an angle at the top of the upper barrel. These events are distracting and time-consuming to deal with, are potentially damaging and costly to the equipment, and **are easily and completely preventable**. If you think you're in a hurry in the NMR lab, go away and come back later when you have more time; this is no place for a reckless attitude.

- ☛ **Hands Off!** Please keep your hands off the magnet canisters; if you feel compelled to support yourself while inserting/removing samples from the magnets, then you are likely doing something else wrong.
- ☛ **Common Sense** It is apparently necessary to remind some users to wash their hands and wipe their feet. Come on folks, this is a research laboratory! Let's keep our laboratory space and community property — keyboards, mice, work desks, floor, etc. — clean.
- ☛ **Temperature Control** Variable-temperature (VT) work may be performed **only** after an individual has completed specific, on-site training by NMR Facility staff. Subsequent to training, users are responsible to know the temperature limitations of both their NMR samples and the Facility instrumentation, and to know how to work safely within these limitations. Facility personnel are available for consultation and other assistance in these matters.
- ☛ **Eye Protection** Users must provide and use their own eye protection as needed.
- ☛ **Consequences** Unsafe, irresponsible or otherwise inappropriate use of the NMR Facility may result in loss of access privileges.

1.3.6 Incident Report Form

This chapter ends with important comments and information about how and when to report problems — either real or perceived — related to the NMR Facility. Problems, issues and conditions appear in all manner of shapes, sizes and significance; the term *incident* is categorically used here in reference to such phenomena. It is the responsibility of the user community to properly report incidents that they experience — or even *cause*, as the case may be. For non-emergency incidents, the appropriate procedure is to make an official report via the on-line *Incident Report Form* accessible at <http://www.pharmacy.wisc.edu/aic/nmr/forms/incidentreport.cfm>; this method ensures timely and meaningful reporting no matter what time or day the incident occurs. Emergencies should, of course, be reported immediately via the proper channels; emergency contact information sheets are posted outside the laboratory doors at the telephones within the NMR lab itself.

Years of experience dealing with these kinds of issues prompts the following comments.

- If you experience an incident, report it. Some kinds of problems are real and universal, while others are isolated or imagined; therefore, unless a particular incident is reported, it may be unknown or remain unknown to facility staff.
- Do not assume that a particular incident you experience has already been reported by someone else; this is a corrolary to the preceding point.
- Even if you know that a particular incident has been reported, report it again. Perhaps the problem is thought to have been fixed but has actually recurred, which is important to know. Intermittent problems can be exceedingly difficult to diagnose and repair, and it is important to know how

frequently they occur; relatively minor issues that occur infrequently are assigned lower priority than if they occur frequently.

- Be responsible! In some circumstances, it may be necessary for you to personally take immediate action to prevent equipment damage or ensure the safety of others. For example, imagine what could happen if someone managed to break an NMR sample tube in the magnet, then simply walked off without taking measures to prevent another person from subsequently inserting a sample into the broken glass on top of the probe. (Yes, this really happened! What would **you** do?)