



# Bio21 Institute - NMR Facility

## Safety & Emergency Procedures



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## Bio21 Institute NMR facility

The NMR facility consists of nine NMR spectrometers, each belonging to different departments of the University or Walter & Eliza Hall Institute (WEHI). This manual is a guide to safety and emergency procedures within the facility.

NMR Spectrometers include:

Manufacturer	Model	Field	Responsible Department	Contact
Bruker-Biospin	Avance	800	Bio21 Institute	David Keizer
Varian	Inova	500	Bio21 Institute	David Keizer
Varian	Inova	600	Biochemistry	Paul Gooley
Varian	VnmrS	600	Chemistry	Frances Separovic
Varian	Inova	500	Chemistry	Frances Separovic
Varian	Inova	400	Chemistry	Frances Separovic
Varian	Inova	300	Chemistry	Frances Separovic
Bruker-Biospin	DRX	600	WEHI	Mark Hinds
Bruker-Biospin	Avance	500	WEHI	Mark Hinds

*Adherence to all standard Bio21 procedures is required. This manual is a supplement for risks unique to the NMR facility*

## Safety Information

*Report ALL safety incidents to Dr David Keizer, NMR Facility Manager*

### **High Magnetic and Associated Radio Frequency (Rf) Fields:**

The high magnetic and RF fields are generated by superconducting electromagnets. These are housed in the large cylindrical objects on legs. There are currently nine (9) superconducting magnets in the Bio21 NMR cave. Two in the south pit, five on the centre platform and two in the north pit. An example of a superconducting magnet is shown at the right.



- Direct Health Risks  
Dangerous to the operation of electrical prosthetic implants such as cardiac “pacemakers”. Potentially dangerous to persons with other metallic prosthetic implants.  
Eliminate the risk: Persons with such implants cannot enter the NMR cave. These fields pose no additional direct health risk.

Refer to Appendix 1 - High magnetic fields for Risk assessment

- Indirect Health Risks

These fields are approximately 1000 times stronger than are likely to be normally encountered by members of the public. They can pull metal objects (tools, nails, bolts etc.) from grasp and cause them to become airborne and fly towards the magnet. There is risk to the individual holding the object (wrist strains, breaks etc.) and risk to an individual in the path of the flying object. The magnetic field increases steeply as you approach the magnet.

Eliminate the risk by leaving all nonessential magnetic objects (tools etc.) outside the NMR cave.

Reduce the risk by maintaining a safe distance (greater than 2 metres or the stay beyond the safety barriers, which ever is further).

NO MAGNETIC OBJECTS (TOOLS, NAILS, NUTS/BOLTS ETC.)  
ALLOWED BEYOND THE SAFETY BARRIERS

- Damage to electrical/mechanical/magnetic data devices

These fields can damage objects such as telephones, watches, computers, ATM cards etc.

Eliminate the risk by leaving all nonessential devices outside the NMR cave.

Reduce the risk by maintaining a safe distance (greater than 2 metres or the stay beyond the safety barriers, which ever is further).

Refer to Appendix 2 - Damage to electrical devices for Risk assessment

### ***Cryogenic Liquids (Nitrogen and Helium)***

Cryogenic liquids surround the magnets inside the cylindrical magnet housings. These liquids are extremely cold and can cause frostbite “burns” upon contact, they evaporate rapidly and can generate an enveloping cloud that can cause asphyxiation in a confined space. In the unlikely event that a magnet housing is breached, the cave is fitted with oxygen depletion detectors and an automatic exhaust system to reduce the risk of asphyxiation.

Additional mobile cryogen storage containers (cylindrical vessels on wheels) may be present within the NMR cave. In terms of risk from cryogenics, treat them the same as a magnet (however, they are not magnetic). Do not touch these vessels, as valves and outlets may be very cold and do not operate valves on these vessels.

Reduce the risk of damaging the magnet housing or a storage vessel and coming into contact with cryogenic liquids by maintaining a safe distance (greater than 2 metres or the stay beyond the safety barriers, which ever is further).

Refer to Appendix 3 - Cryogenics for Risk assessment

### ***Electrical Equipment.***

There are electrical devices attached to the magnets. Be aware of cables running from the magnets to other electrical devices.

## ***Other Services***

The NMR facility utilizes a number of other services including compressed air and chilled water supplies. Be aware of pipes for these services running from supply outlets to magnets and compressors located within the room.

## **Emergency Procedures**

### **General Building Evacuation**

If an evacuation alarm is activated, exit to the basement car park via the closest set of doors (located at the south and north end of the NMR cave). Make your way to the assembly area which is the above ground car park to the north of the main buildings. Await instructions from the designated floor wardens (yellow hard hats).

## **Magnet Quenches**

### ***Overview***

A quench of a superconducting magnet occurs when resistance is encountered in the coil causing the generation of heat and subsequent loss of superconducting properties. This will result in both liquid helium and nitrogen converting to the gaseous phase. Each litre of liquid helium expands by a factor of 740 and each litre of liquid nitrogen by 680 resulting in an oxygen depleted atmosphere.

These may occur at any time but are extremely rare. The risk of a quench is highest when liquid helium levels are low or during a liquid helium transfer.

### ***Response***

In the event of a quench, the following procedures **MUST** be followed:

- All persons to exit the room in an orderly manner
- It may be necessary to drag an unconscious person from the room
- Press the red emergency ventilation button located at each exit
- Do NOT reenter the room under any circumstances while red strobe lights at entrances are flashing
- If facility staff are not present alert university security personnel who will notify the BEC
- Request first aid for injured persons if required

Facility staff are to:

- Secure access to the NMR cave and notify BEC
- Mute the ventilation alarm
- Obtain the portable oxygen sensor from room B11
- Allow 10 minutes to pass before assessing oxygen levels entering the room

- Shut down electronic equipment and other services connected to the affected spectrometer
- Notify BEC that the facility is safe
- Resume normal operations with other spectrometers after clearance from BEC
- Notify contact in the responsible department

*These procedures MUST also be followed in the event of the low oxygen sensors activating automatic alarms regardless of whether you perceive a hazard to exist.*

In the event of a quench or low oxygen alarms occurring after hours, Bio21 security will secure the facility and notify NMR facility staff. The NMR cave is not to be entered until clearance is given by facility staff.

Refer to Appendix 4 - Magnet Quenches for Risk assessment

## **Unconscious Person**

### **Overview**

Many causes are possible for a person to collapse and enter a state of unconsciousness. However, given the nature of the NMR facility, an oxygen depleted atmosphere must always be considered.

### **Response**

The following guidelines MUST be followed after discovering an unconscious person in the NMR facility.

- If victim is observed through windows, do NOT enter the room
- If victim is in either pit, do NOT enter the pit
- Notify facility staff and Bio21 Security

Facility staff are to:

- Secure access to the NMR cave
- Activate ventilation system and mute the ventilation alarm
- Obtain the portable oxygen sensor from room B11 and assess oxygen levels
- Render assistance to collapsed person if safe to do so

Refer to Appendix 5 - Discovery of unconscious person for Risk assessment

## General Comments

- A safety induction must be completed before entering the NMR cave. Visitors are not permitted in the NMR cave unless authorized by a person below and accompanied at all times
- Gloves & lab coats should not be worn in the NMR cave
- Food & drink are not permitted at any time
- Users are responsible for cleaning up broken glass if a NMR tube is broken. A breakage report must be completed.
- Report all problems to either the facility manager or departmental contact listed below

## CONTACTS

UNIVERSITY SECURITY (834) 46666  
Bio21 Security (834) 42480

### *NMR ACCESS & GENERAL ENQUIRIES*

Hamish Grant Bio21 Institute (834) 42477  
David Keizer Bio21 Institute (834) 42477 0417 162 386

### *NMR INSTRUMENTS – UNIMELB*

Hamish Grant Bio21 Institute (834) 42477  
David Keizer Bio21 Institute (834) 42218 0417 162 386  
Paul Gooley Biochemistry (834) 42273  
Frances Separovic Chemistry (834) 42447

### *NMR INSTRUMENTS - WEHI*

Mark Hinds 9345 2537

### *BUILDING AND SERVICES*

Garry Clark (834) 46527 0417 054 533

*OUT-OF-HOURS* David Keizer 0417 162 386

*Bio21 Institute – NMR Cave*

*Safety Questionnaire*

1. List 3 items not to be taken within the 5 Gauss line of any magnet
  
2. List the 2 cryogens used in the NMR facility
  
3. What is meant by the term quench?
  
4. What would trigger the quench alarms in the NMR cave?
  
5. In the event of an after-hours emergency in the NMR facility, who would you contact *initially*?

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*User Acknowledgements*

- I do not have a pacemaker or other implanted / attached medical device
- I have received a copy of the NMR Safety Manual and will abide by the procedures listed

User:

Department:

Supervisor:

Staff/Student number:

Access Card Number:

Phone:

Email:

Signature:

Date: