NATIONAL HIGH MAGNETIC FIELD LABORATORY

NHMFL

FLORIDA STATE UNIVERSITY

SAFETY PROCEDURE

SP-16

TITLE: MAGNET CELL SAFETY PROCEDURE

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NHMFL

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SAFETY PROCEDURE

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1.0 TITLE: MAGNET CELL SAFETY PROCEDURE SP-16

This document outlines safety practices that must be followed by everyone conducting experiments in the high magnetic field facility.

2.0 PURPOSE

This procedure defines specific requirements for the protection of personnel from work place hazards when working within the resistive and superconducting magnet research cells in the Operations and Millikelvin Building.

3.0 SCOPE

This document applies to everyone working on or with equipment or systems that are under the control of the NHMFL. This Safety Procedure is to be used by everyone (employees, contractors, vendors, or users) at the NHMFL.

4.0 RESPONSIBILITIES

4.1 Personal safety in the workplace is the primary responsibility of every employee and user.

4.2 Users of this facility are responsible for reading and understanding the requirements of this procedure.

4.3 All users shall adhere to the safety rules presented in this procedure.

4.4 All NHMFL personnel, visitors, contractors, or vendors working in an

operating research cell must have read and understood these safety rules.

4.5 Anyone who has signed the acknowledgment forms in the Control Room will be presumed to have read, understood and agreed to follow this procedure.

5.0 MAGNET CELL SAFETY PROCEDURE

5.1 General

Footwear must provide secure footing on stairs and ladders and some protection of your feet from spilled liquids. Bare feet and open toed shoes, such as sandals, are not allowed in the cell area, machine shop, or other areas of the OPMD buildings.

Equipment must be arranged in the cell neatly with reasonable working space. Cables and hoses should be out of the way so people don't trip on them or catch them with moving equipment. The users are responsible for the cleanliness of the cell during an experiment and for returning all equipment and supplies to their proper places after finishing.

Gas bottles must be in the wall mounts. If the wall mounts are not convenient, ask the Control Room or Operations personnel (644-4416) to help you safely make any modifications.

There shall be at least one person in the cell whenever the power supplies are turned on and control has been transferred to the cell. Control room personnel are instructed to immediately remove control from the cell and ramp the magnet down if a cell is left unattended**.** It is best to have two persons present and participating in the experiments. Two people make fewer mistakes, solve problems quicker, do experimental procedures quicker, and generally make more efficient use of magnet time. This becomes especially important after normal business hours when Operations staff are less available. If you need an extra person temporarily to help with an operation or if you need to leave the cell and cannot ramp the magnet down, call the Control Room (644-4416). Someone will come to the cell as soon as she/he is available.

The user is responsible for the safety of everyone, other than Operations staff, who is in the cell during a magnet run. The user should warn anyone entering the cell that the field is on and can direct anyone who is not a member of the Operations staff to leave the cell. A plastic barrier chain will be available put across the cell entrance when there is current in the magnet.

5.2 Emergencies

There is a red "Emergency Off" push button located on the wall, eye level, near the exit in each cell (Figure 1). It will shut off electric power to **all** the magnets in use if it is pressed. In case of an emergency hit this button as you rapidly but calmly exit the cell.

Figure 1

Other safety circuits detect magnet and cell faults and shut off power to the magnets in milliseconds. Most cell emergencies are automatically detected and made safe in less time than most humans take to react. Do not panic, you may injure yourself or others.

Be alert to abnormal noises or conditions. Contact the Control Room if you notice anything you feel is abnormal.

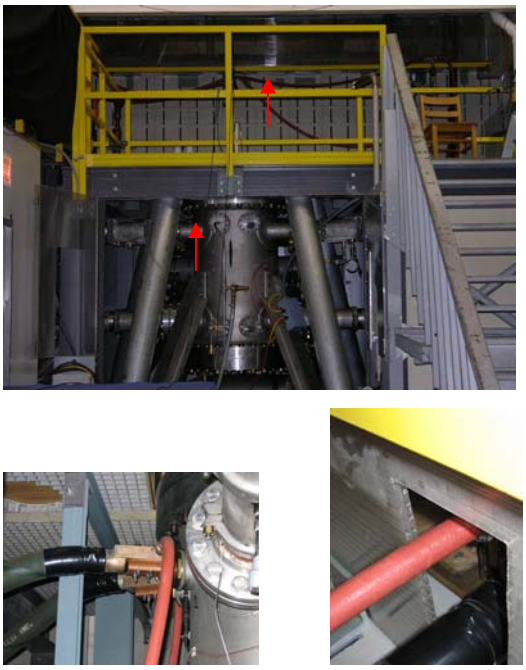
In case of physical injury contact the Control Room immediately (644-4416) or 911.

5.3 Electrical Hazards

The magnets are powered by one or more ungrounded 500 volt, 20,000

amp power supplies. There are uninsulated electrical conductors in each cell. These are located at the points where the green, water cooled, power supply cables terminate at the magnet housing and in the overhead behind the magnets, above the platform, against the wall (Figure 2). While user access is prevented by physical barriers, all magnet users should be aware of where these uninsulated conductors are and make sure that neither you nor anything else comes in contact with this power source. Contact could be fatal or lead to severe damage to the experimental equipment.

Figure 2



The magnet housing is connected to the magnet through the cooling water. The magnet housing is grounded to the facility grounding grid. The magnet bore tube is grounded through a 20 Ω resistor to detect any ground faults. To be as safe as possible, the sample tube should be treated as if there could be a 500 volt potential at any time. The magnet housing and bore tube should also be treated as if there could be a 500 volt potential at any time.

5.4 Platform Access

High-pressure water is in the magnet housing and in the connected pipes. For this and reasons above avoid spending long periods of time on top of the magnet. **Please inform the control room if you absolutely must be up on the magnet platform when there is current in the magnet (644-4416).**

Do not enter the area around the magnet under the platform. There are many ways to injure yourself there and no good reason to go in. If you drop something down there, contact the Control Room to get someone to retrieve it. However, the area directly under the magnet is available for experimental access, talk with the Control Room or User Services staff about any hazards in that area if you want to use it.

5.5 Magnetic Fields

Be aware that strong magnetic fields exist around the magnet. Lines at the 10-G and 100-G level are drawn on the floor of the cell. Credit and ATM cards should be kept behind the 100-G line.

People who have pace makers should consult with NHMFL Operations or Safety personnel before entering magnet cells.

Steel, iron or other magnetic objects should be fastened down or kept behind the 100-G line. Be very sure that screwdrivers, wrenches and other hand tools are not left around the magnet because the ferromagnetic force might cause them to be pulled into the magnet.

Be especially aware of the location of compressed gas cylinders, as they **must** be kept behind the 100G line (what is the common wisdom here?)

5.6 Communication

Continuous contact between the users and the Control Room must be maintained over the intercommunication system during operation of the

magnet.

The user can start the communication by pressing and releasing the Call Button on the speaker cabinet and saying, for example, "Cell five calling the Control Room." Do not press the Call Button after the Control Room has answered, just speak in a fairly loud voice directly into the speaker cabinet. If you can't reach the Control Room via the intercom, dial 4-4416 on the telephone.

5.7 Handling of Cryogenic Liquids

Face masks and gloves are provided in each cell.

Eye protection must be used when handling cryogenic fluids.

Gloves must be used when removing the transfer tube from a dewar. Doing so prevents freezing your skin. It also reduces the probability of damaging the transfer tube so that it will be available for your next transfer.

Body length protective aprons are available for use as desired. Contact the Control Room if an apron is desired.

More people are injured with liquid nitrogen than liquid helium because it is more commonly handled directly. Always wear gloves when you might touch cold metal tubing.

6.0 HYBRID MAGNET CELL SAFETY – CELL 15

6.1 Hybrid Magnet Users

All users of the hybrid magnet will read and follow NHMFL safety procedure SP-16, Paragraph 5 on Magnet Cell Safety and the handling of cryogenic fluids.

The force on ferromagnetic tools is too great for them to be allowed any closer than 6 meters from the axis of the magnet when the outsert is energized to full field. The hybrid operators have a small supply of non-

magnetic tools for use while the outsert is energized. Users whose probes require special tools for adjustment will have to bring non-magnetic versions with them.

All people **must** keep themselves, their hands, and even non-ferromagnetic tools **at least two meters away from the axis of the magnet when the insert is energized to more than 4.0 kA (5% of peak field).** This means that all probes that require positioning or adjustments at high fields must have remote actuators for all the adjustments. Other adjustments can be made by ramping the insert current to less than 4.0 kA, making the adjustment, and returning to the set point.

Liquid helium transfers from a storage dewar on the outsert cryostat will be permitted while the outsert is fully charged and the insert current is less than 1 kA. Such transfers must be closely supervised by a hybrid operator. **Users must use one of the yellow plastic platforms when inserting the transfer tube into or withdrawing it from the storage dewar.** Both the input leg and the flexible section of the transfer tube are too long to permit easy handling by one person or handling from the floor level.

Due to the absence of specific government standards regarding high DC magnetic fields, users are advised to minimize the time they spend close to the magnet bore when the outsert is energized.

Equipment and cables must be arranged neatly to avoid presenting hazards as people move about the platform and must not hinder people using the emergency exits.

There is a RED Emergency Power Off button mounted at the top of the stairs and another near the Emergency Exit door (Figure 3). Do not set up equipment nor work near either of them. Accidentally bumping the button will dump both magnets and may make the hybrid unavailable for a few days.

Figure 3

Any problem with the magnet is likely to be automatically made safe before a user could leave the platform. Leaving the platform in haste is more likely to cause an injury than staying on it during a magnet fault. Users are therefore urged to use common sense and wait a minute to find out what is happening and then take the most sensible route off of the platform. Hybrid operators will be responsible for instructing users in the above as they are setting up and before energizing the magnet. Hybrid operators are responsible for enforcing the safety rules and other required procedures on the hybrid platform and have the authority to do so.

6.2 NHMFL/FSU Personnel

NHMFL/FSU personnel are required to keep the general public out of areas when the swinging gates that lead to the Hybrid Magnet Area are closed and signage indicates “NHMFL personnel and users only". Only NHMFL personnel and users are allowed beyond this point without permission from the hybrid operator. Any employee who is escorting visitors must get permission from the hybrid operator each time before passing the gates. People seeking permission may stop in the control room and ask the operator to call the hybrid operator by phone.

Warning lights will be activated when the magnet is operational. Yellow lights are mounted near the swinging gates that limit visitor access. Red lights are mounted in the area that is restricted to Hybrid Operators only.

All personnel with the exception of the Hybrid Operators are prohibited from entering the area that is designated as Hybrid Operators Only. The swinging gates will be closed and signage will indicate “Hybrid Operators

Only".

Access will be permitted up to the Plexiglas area if all gates are opened. In the event of an emergency evacuate the area and if possible contact the Hybrid Operator or the Control Room.

6.3 Visitor Requirements

Tours are to be arranged in advance with the Center for Integrating Research and Learning (CIRL). Tour groups shall be lead by a leader who has received training and approval from the CIRL group and the Safety Office. Tours shall not enter the Hybrid Magnet area when the swinging gates are closed and signage indicates "NHMFL Employees and Users Only".

Warning lights will be activated when the magnet is operational. Yellow lights are mounted near the swinging gates that limit visitor access. All visitors are prohibited at all times from entering areas designated as Hybrid Operators Only.

Tours shall be closely monitored to ensure the safety of all persons. The tour leader shall account for all persons before allowing the group to exit the area.

Unauthorized access is prohibited on the Hybrid Magnet Platform even when the gates are opened. Contact the Director of the Continuous Fields Facility and/or Hybrid Operator for approval to access the platform.

6.4 Training Requirements

Minimum training requirements for NHMFL personnel is General/Hazcom Safety Training. Training is documented and maintained by the NHMFL Safety Office.

6.5 Enforcement

The failure to follow this established Safety Procedure may result in

disciplinary actions. The employee's direct supervisor or the Safety Office will be responsible for enforcing and administering the actions. The actions will be based on a review of the incident and the severity of the potential hazards(s) involved. Disciplinary actions will include:

6.5.1 First Occurrence of a minor infraction: Counseling on proper procedure.

6.5.2 First Occurrence of a significant infraction or repeated occurrences of minor infractions: Oral reprimand or up to three days suspension.

6.5.3 Second Occurrence: Three days suspension to dismissal.

6.5.4 Third Occurrence: Dismissal

Failure by a high field facility user to follow this established Safety Procedure may result in disciplinary actions. The Director of the DC High Field Facility User Program and the Safety Office will be responsible for enforcing and administering the actions. Disciplinary actions will be:

6.5.5 First Occurrence of a minor infraction: Counseling of proper procedures.

6.5.6 First Occurrence of a significant infraction or repeated occurrences of minor infractions: Notification of Principal Investigator or up to six-month suspension of magnet usage privileges for the user and his/her group.

6.5.7 Second Occurrence: Up to one-year suspension.

6.5.8 Third Occurrence: Denial of any future magnet usage

7.0 Exceptions:

Exceptions to the above rules may only be granted for specific situations for limited times after careful consideration. The exception may take effect as soon as the form is signed. Copies of the completed form must be sent to each of the individuals listed plus the Magnet Lab Safety Office. If possible, equipment

and/or procedures should be redesigned to make the exception unnecessary before future 45 T magnet time is granted.

The only persons who may grant exceptions:
Magnets other than the 45 T hybrid magnet: Director of DC Facility (Bruce Brandt), Chief of User Instrumentation (Scott Hannahs) or designee
45 T hybrid magnet: Head of Cryogenic Operations (John Pucci), Lead Hybrid Operator (Kevin Bryant), Director of DC Facility (Bruce Brandt), Chief of User Instrumentation (Scott Hannahs)

7.1 Exception Request Form

Magnet Safety Procedure Exception Request

Date: _____ Magnet and Cell: _____ Requestor: _____

Others involved the this project: _____

Brief description of requested exception:

Reason for exception:

Hazards associated with exception:

Plan to minimize hazards:

I _____ authorize the above exception to normal Hybrid Operating Procedures, under the following conditions/restrictions:

This exception will expire (date) _____ _____

Signature

This document can only be signed by the Director of DC Facilities, Chief of User Instrumentation, Head of Cryogenic Operations, Lead Hybrid Operator. A copy of this document must be filed in the Safety Office.

Revisions

Date	Revision #	Section	Description
6/7/06	02	Cover	Names and positions changed to reflect current management
7/13/06	02	Throughout	Control Room Phone number added where "contact the control room" is referenced
7/13/06	02	5.2	Figure 1 added
7/13/06	02	5.3	Figure 2 added
7/13/06	02	5.2	Changes made to reflect current electrical hazards
7/13/06	02	5.7	Add use of eye protection when working with cryogens
7/3/06	02	6.1	Updated to reflect current policies including the addition of the 2 meter rule when the magnet insert in energized
7/13/06	02	6.1	Figure 3 added
7/13/06	02	6.2	Addition of section 6.2 Guidelines for NHMFL/FSU Personnel
7/10/06	02	7.0	Addition of Section 7.0 Exceptions
7/10/06	02	7.1	Addition of Section 7.1 Exceptions Request Form