NHMFL

FLORIDA STATE UNIVERSITY

SAFETY PROCEDURE

SP - 19

1.0 TITLE: MAGNETIC FIELD SAFETY PROCEDURES

This document outlines safety practices that must be followed by everyone working in the vicinity of an energized magnet capable of producing high magnetic fields.

2.0 PURPOSE

This procedure defines specific requirements for the protection of personnel from work place hazards when working with and around resistive and superconducting magnets at locations other than in the OPMD Building Magnet Cells.

3.0 SCOPE

This document applies to everyone working on or with equipment or systems capable of producing high magnetic fields at the NHMFL. This Safety Procedure is to be used by all personnel, including employees, contractors, vendors, visitors and users assigned to the NHMFL.

4.0 RESPONSIBILITIES

4.1 The NHMFL Environmental Health and Safety Office (EH&S) has the overall responsibility for the administration of this procedure. This shall include implementation of this procedure, identifying areas producing, or capable of producing, high magnetic fields, training of all affected personnel, and evaluation of the program.

4.2 Principal Investigators and Supervisors shall be responsible for all personnel under their direction. This includes ensuring that all personnel receive the proper training and guidance in order to perform assigned tasks safely and in compliance with this procedure. They shall ensure that all protective control measures are in place prior to energizing a high magnetic field system. Work order request forms shall be completed indicating the type of magnet, field maintained, and other safety related issues involved with the work to be performed. Training of employees shall be coordinated with the NHMFL EH&S Office.

4.3 The Facilities Department shall be responsible for reviewing work order requests for safety precautions if the request involves work in the vicinity of high magnetic fields, equipment design and modification to existing magnets, or other sensitive research equipment. The appropriate personnel shall be contacted prior to the scheduling of any work to review safety concerns

4.3 Personal safety in the workplace is the primary responsibility of each employee, user, visitor and contractor. All of the affected personnel shall receive the necessary training to ensure their safety. This training is to be provided prior to assignment to areas producing, or capable of producing, high magnetic fields. Refresher training shall be received as necessary and whenever

new equipment or systems are installed.

4.4 All contractor personnel must check in with the NHMFL Facilities and Administration Department prior to performing any work on or around a magnet or magnet system. The Facilities and Administration Department shall be responsible for arranging for instruction, training and supervision by NHMFL technical or safety personnel.

4.5 High field superconducting magnets present special conditions with respect to work in the immediate area of the magnet. Magnetic fields attract tools to the magnet, may attract dust and particles that are magnetic, and will affect magnetic items such as credit cards, magnetic tapes, prosthetics, and implanted medical devices etc. These characteristics pose safety problems for personnel as well as creating the potential for physical damage to expensive and sensitive research equipment. For these reasons all activities in the immediate vicinity of these magnets shall be controlled through a Magnet Safety Clearance Procedure.

4.5.1 Magnet Controlled Areas

4.5.1.1 Areas of control shall consist of two levels. Level 1 areas shall state the level of control within the 10 gauss line. Level 2 areas shall state the level of control outside the 10 gauss line and within 25 feet of the magnet.

4.5.1.2 Work related research within the Level 1 areas (within the 10 gauss line) require the magnet to be tagged with a Magnet Safety Clearance Tag. The field at which the magnet is maintained will be written on the Magnet Clearance Safety Tag. When the field is maintained while work near to the magnet or research is to be conducted, the Principle Investigator or his/her designee shall be present at all times. The Magnet Safety Clearance Tag shall be completed, attached to the magnet so that it is clearly displayed in the work area.

4.5.1.3 Level 2 areas outside the 10 gauss line, but within the same room and 25 feet of the magnet, require the magnet(s) to be tagged with a Magnet Safety Clearance Tag in accordance with section 4.5.1.2.

4.5.1 Requester

4.5.1.1 The Requester may be an FSU or NHMFL employee, user, subcontractor, or other person having cause to work in the vicinity of a high magnetic field or magnet.

4.5.1.2 The Requester requests a Magnet Safety Clearance from either (not all) the Facilities Program Assistant (Sheila Workman - phone # 644-0526), the Hazardous Materials Manager (Todd Wegenast - phone # 644-6955) or Safety Coordinator (Wm. Kyle Orth - phone # 644-0233).

4.5.1.3 The Requester, by providing his/her signature, signifies that control areas are established and properly marked, the Magnet Safety Clearance Tag is properly hung, and all personnel working under the Magnet Safety Clearance are aware of any and all special working conditions and hazards associated with those special working conditions.

4.5.1.4 The acceptance signature on the Magnet Safety Clearance Sheet signifies that the control areas have been established and that all responsible parties are authorizing the work to commence.

4.5.1.5 The requester is responsible for the safety of co-worker(s) and personnel under his/her supervision working within the controlled areas. The requester shall issue instructions to any individuals working under his/her supervision of the safety hazards unique to the equipment and work area.

4.6.1 Issuing Authority

4.6.1.1 The Issuing Authority shall be the Facilities Program Assistant (Sheila Workman - phone # 644-0526), or Hazardous Materials Manager (Todd Wegenast - phone # 644-6955) or the Safety Coordinator (Wm. Kyle Orth - phone # 644-0233).

4.6.1.2 The Issuing Authority, the Principle Investigator or assigned designee, and the Requester shall have the responsibility for establishing the control areas.

4.6.1.3 The Issuing Authority is the only person authorized to issue the Magnet Safety Clearance by signing the clearance tag.

5.0 MAGNET SAFETY PROCEDURES

5.1. Safety Clearance Procedure

5.1.1. As standard operating procedure, when work is to be conducted in control area levels 1 and 2 all magnets are to be de-energized. In cases where this is not feasible, the Prinicpal Investigator, Head of Facilities Engineering and Operations and Safety Coordinator must approve the following procedural steps.

5.1.2. The procedural steps in obtaining a magnet safety clearance are as follows:

Step 1: Requester:

Requests a Safety Clearance from the Issuing Authority: The request must specify which equipment and systems that are required to be tagged, and the reason for the Magnet Safety Clearance. The Requester must transmit this request to the Issuing Authority.

Performs an Independent Verification of the Magnet Safety Clearance: Independent verification of equipment associated with Magnet Safety Clearance is not only vital to the safety of personnel working under the safety clearance, but to the equipment itself. INDEPENDENT VERIFICATION is complete when the person establishing Safety Clearance boundaries has their work checked by the issuing authority.

Requester acceptance of the Magnet Safety Clearance: To accept the Magnet Safety Clearance, the Requester signs the safety clearance tag.

Step 2: Issuing Authority: Facilities Program Assistant, Safety Coordinator, or Hazardous Materials Manager:

Acts as the Issuing Authority: Receives the Magnet Safety Clearance request, and determines if the request will have impact to magnet operations or the work in the area of the Safety Clearance Tag. The Issuing Authority will review system and equipment operational requirements with the Principal Investigator and determine if a Magnet Safety Clearance can be issued.

Issues the Magnet Safety Clearance: The Issuing Authority will initiate the magnet safety clearance procedures and verifty control areas for the task. They will direct the Principal Investigator or his/her designee to reposition equipment as necessary, and then will hang Magnet Safety Clearance Tag hang clearance tags. All tags shall be complete and properly filled out before being posted.

Authorizes Work: Once the equipment or system is isolated, control areas established, and tag posted, the Issuing Authority will authorize work to commence.

Step 3: Principal Investigator:

Responsible for establishing level 1 and 2 control areas: By consultation with the Issuing Authority, agrees that the Magnet Safety Clearance zones isolate all hazardous sources and protect equipment and personnel.

5.1.3 Releasing a Magnet Safety Clearance

No Magnet Safety Clearance tags may be removed, and no control areas changed or removed without the knowledge of the Principal Investigator and approval of the Issuing Authority and Requestor.

Step 1: Requester

It shall be the duty of each Requester holding a Magnet Safety Clearance to report the completion of work and return the Magnet Safety Clearance Tag to the Issuing Authority as soon as the work is completed.

Ensures safe-to-operate conditions: The Requester must ensure the work is complete. All tools, equipment, trash, and debris must be removed from the work area by the Requester.

The Requester releases the Magnet Safety Clearance by turning in the

Magnet Safety Clearance Tag to the Issuing Authority. This should be completed as soon as possible following the completion of the work.

Step 2: Issuing Authority

Verifies completion of the task and delegates the removal of Magnet Safety Clearance Tag. To release the active Magnet Safety Clearance the issuing authority must contact the PI and verify that all work is completed satisfactorily,

5.2 Appendix

Copies of the administrative documents used with NHMFL Magnet Field Safety procedure are including on the following pages:

Magnet Safety Clearance Tag: Appendix A

6.0 DEFINITIONS & GENERAL REQUIREMENTS

6.1 Definitions

The following definitions are for the purpose of this procedure.

a. High Magnetic Field- Any steady or slowly varying field whose peak value exceeds 1 Tesla.

b. Magnet Quench- The spontaneous, usually quite rapid, drop in magnetic field when the coils of a superconducting magnet becomes resistive, or goes into a normal state. A quench is accompanied by a rapid boil-off of helium, often evidenced by a cloud of vapor above the magnet.

c. Gauss Lines- Lines identifying the boundary at which the magnetic field has a particular fixed value.

d. Tesla - A unit of magnetic field strength. One tesla is equal to 10,000 gauss.

e. Barriers- Devices such as walls, posts, chains, fences and platforms, to limit the access of unauthorized personnel to high magnetic fields.

f. Controlled Access- The restricting of an area to non-authorized personnel when high magnetic fields are present.

g. Emergency Shutdown- The shutdown of a high magnetic field system as a result of an unexpected event, such as a magnet quench, loss of electrical power, or loss of coolant.

h. Authorized Personnel- Employees, users, visitors and contractors who have met the requirements of this procedure shall be considered to be authorized personnel.

i. Magnetic Shielding- Enclosures made of magnetically permeable materials to reduce

magnetic fields outside the magnet and/or create a low field region for sensitive equipment.

j. Magnetic Field Safety Clearance Tag- By issuing a Magnet Safety Clearance Tag the issuing authority signifies that the equipment or system has been rendered safe for specific work specified on the tag. The tag indicates that all controll areas have been established an all responsible personnel have authorized work to be performed. It does not, in itself, verify that the worksite is actually free of all hazards.

k. Issuing Authority - Personnel responsible for issuing and establishing Magnet Safety Clearance and ensuring appropriate personnel have been notified and have authorized work to be performed within the appropriate control areas.

6.2 General

6.2.1 Equipment must be arranged in the work area neatly to allow a reasonable working area. Cables and power cords shall be kept off the floor as much as possible to prevent tripping hazards. Maintain evacuation routes in the event of an emergency.

6.2.2 Footwear shall provide secure footing, protection from spilled cryogenic liquids, and protection from falling objects. Bare feet and open toed shoes shall not be worn when working in areas where there are known or potential foot hazards. Caution shall be taken when working around magnets if wearing steel-toed safety shoes.

6.2.3 Compressed gas cylinders shall be secured at all times. Tools shall be non-magnetic in nature if used within the 100 gauss lines. Ten and one hundred gauss lines shall be established and marked on the floor surrounding all magnet(s) to warn personnel of the field strength.

6.2.4 The Principal Investigator or his/her designee shall be in the area when a magnet is energized and operating. Do not leave an operating magnet unattended for any reason. If it is necessary to leave an operating magnet arrange for relief or de-energize the magnet.

6.2.5 The Principal Investigator or his/her designee is responsible for the safety of all personnel entering the control area. The Principal Investigator or his/her designee shall warn unauthorized personnel that the magnet is energized and access is restricted.

6.2.6 Access to an area containing a potential high magnetic field shall be restricted using a plastic barrier chain, signage, and/or having an authorized attendant present at all times when at field. Contact the EH&S Office for assistance in acquiring the appropriate signs and barriers.

6.2.7 An authorized representative of the research group shall be present when maintenance or service work is to be performed in or around an operating magnet or magnet system.

6.2.8 When handling cryogenic fluids, all personnel shall comply with the NHMFL Safety Procedure 4, Cryogenic Safety For Laboratory Users. All dewars shall have adequate pressure relief valves.

6.3 Electrical Hazards

Some of the magnets in use at the NHMFL are powered by high energy power supplies. Caution shall be taken when working around these magnets to prevent accidental contact with the power supplies. The NHMFL Safety Procedure 1, Safety Clearance Procedure and Safety Procedure 2, Clearance Procedure shall be followed when working on electrical connections, repair work, modifications.

6.4 Magnetic Fields

Strong magnetic fields exist around an energized magnet. Lines at the ten and one hundred gauss shall be marked on the floor around the magnet as applicable. Credit and ATM cards should kept beyond the 10 G line. Steel, iron and other magnetic objects shall be secured and fastened down or kept behind the 100 G line. Small hand tools, such as wrenches and screwdrivers, shall not be left around the magnet. Compressed gas cylinders shall be secured to a fixed wall mount. Steel chairs are not allowed within the 100 G lines. Personnel with implanted pacemakers, metal plates, pins or staples shall contact the NHMFL EH&S Office before entering areas where high magnetic fields may be present.

6.5 Emergencies

In the event of an emergency resulting in a life or limb threatening circumstance, power to the magnet shall be turned off. In the event that an object is drawn into the magnet, do not attempt to remove it until the magnet is deenergized. If a magnet quenches, all personnel shall leave the immediate area to allow the gas to dissipate. Be alert when operating magnets at field for any abnormal sounds, noises or conditions. Contact the NHMFL EH&S Office to report any physical injury, incident, or other safety concern involved with working with a magnet.