NATIONAL HIGH MAGNETIC FIELD LABORATORY

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National High Magnetic Field Laboratory Safety Program

TITLE: Magnetic Field Safety	**SUBJECT:** The safe use of magnet systems and protection of personnel from magnetic fields
PROGRAM NUMBER: SP-19	**EFFECTIVE DATE:** 6/15/07
REVISION NUMBER: 005	**REVISION DATE:** 06/21/2024
ISSUING AUTHORITY: MagLab EHS	**REVIEW DATE:** 07/31/2024
Additional Approval Signatures on Revision and Approval Page	**APPROVAL:** NHMFL Deputy Lab Director Signed by: Tim Murphy EEC858BD1BAA403...

Overall Mission and Overview:

The National High Magnetic Field Laboratory (MagLab) Environmental, Health, and Safety (EHS) program's mission is to:

Provide support and guidance to all MagLab departments with the implementation, maintenance, and review of a comprehensive environmental, health, and safety program. The primary goal of the MagLab EHS program is to control, reduce or eliminate work-related injuries, illnesses, and loss of MagLab resources.

The MagLab is charged by the National Science Foundation (NSF) to safely:

- Promote magnet-related research to serve an interdisciplinary scientific user community.
- Provide unique high-magnetic-field facilities through a competitive and transparent proposal review process.
- Advance magnet and magnet-related technology.
- Partner with universities, other national laboratories, and industry to enhance national competitiveness in magnet and related technologies.
- Serve the NSF as a prominent example of its successful stewardship of large research facilities.
- Support science and technology education in the United States.
- Increase diversity in the science, technology, engineering, and mathematics workforce
- Promote collaboration among our three partner institutions: Florida State University (FSU), the University of Florida (UF) and Los Alamos National Laboratory (LANL).

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1.0 PURPOSE

This program defines specific requirements for the protection of personnel and equipment from workplace hazards when working with and around resistive and superconducting magnets due to the strong magnetic fields they produce.

2.0 SCOPE

This document applies to all individuals working with equipment or systems capable of producing high magnetic fields at the MagLab. Certain locations, such as the DC Magnet Building (SP-16) and the 900MHz Magnet (SP-28) have additional requirements. This Safety Program is intended for use by all personnel associated with the MagLab, including a wide range of roles from researchers to visitors.

3.0 POLICY

This document outlines general safety practices that must be followed by everyone working in the vicinity of an energized magnet that is producing a magnetic field that exceeds 10 gauss anywhere on its outer surface. This document also outlines the procedure for obtaining approval to perform maintenance or facilities work in areas that contain energized magnets.

4.0 RESPONSIBILITIES

4.1 ENVIRONMENTAL HEALTH AND SAFETY

MagLab Environmental Health and Safety (EHS) has the overall responsibility for the administration of this program. This shall include implementation of this program, identifying areas producing, or capable of producing, high magnetic fields, training of all affected personnel, evaluation of the program, reviewing and verifying that all safety precautions have been taken prior to signing the Magnet Statement of Work (MSOW) form.

4.2 PRINCIPAL INVESTIGATORS AND SUPERVISORS

Principal Investigators and Supervisors shall be responsible for ensuring that these procedures are followed in their laboratory areas. This includes ensuring proper training and guidance for all personnel, ensuring protective control measures are in place before energizing a high magnetic field system, and giving permission before any maintenance or facilities work can be performed in the vicinity of an energized magnet.

4.3 FACILITIES DEPARTMENT

The Facilities Department shall be responsible for initiating a Magnet Statement of Work Form for any work that shall be done by facilities employees, contractors or vendors in the vicinity of high magnetic field. They shall take all necessary safety precautions including the use of nonmagnetic tools when working around high magnetic fields. The appropriate personnel shall be contacted prior to the scheduling of any work to review a Task Hazard Analysis and address

all safety concerns.

4.4 PERSONAL SAFETY IN THE WORKPLACE

Personal safety in the workplace is the primary responsibility of everyone, whether they are a researcher, employee, user, visitor, or contractor. All 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.

4.5 CONTRACTORS

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

5.0 GENERAL MAGNETIC FIELD SAFETY

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. Some general precautions should be taken when working in and around high magnetic fields.

5.1 Compressed gas cylinders shall be always secured. Tools shall be non-magnetic in nature if used within the 100 gauss lines.

5.2 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 with potential foot hazards. Caution shall be taken when working around magnets if wearing steel-toed safety shoes.

5.3 Both the 10 and 100 gauss lines shall be clearly marked on the floor of each magnet that is capable of producing a magnetic field that exceeds 100 gauss (10 milli Tesla) anywhere on it's outer surface.

5.4 Credit and ATM cards should be 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.

5.6 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.

5.7 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 (SP-1), Safety Clearance Procedure shall be followed when working on electrical connections.

5.8 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.

5.9 Tour groups and unescorted visitors shall not enter rooms or areas that contain energized magnets.

6.0 FACILITIES/MAINTENANCE WORK PERFORMED AROUND ENERGIZED MAGNETS

All facilities or maintenance work performed in the same room or within 25 feet of an energized magnet shall require completion of a Magnet Statement of Work (SOW) form. Whenever possible, the magnet should be de-energized prior to performing the work.

6.1 The procedural steps in completing a Magnet SOW are as follows:

Step 1: Requester:

The Requester may be an FSU or NHMFL employee that will be performing or supervising the performance of maintenance or facilities work in the vicinity of a high magnetic field or magnet.

The Requester may print a Magnet SOW Form from the NHMFL Safety web site or obtain one from the safety office. The Requester, will enter their name, work start date, estimated completion date of the task, work description, hazards associated with the work, tools to be used, work procedure, required personnel and will sign the Magnet SOW on the requesters signature line. Providing his/her signature, signifies that the information entered on the form is accurate. The requester shall then contact the Principal Investigator of the area or his/her designee and review the safety concerns in the area and request an approver signature. The requester is responsible for the safety of co-worker(s) and personnel under his/her supervision working in the area. The requester shall issue instructions to any individuals working under his/her supervision of the safety hazards unique to the equipment and work area.

Step 2: Principal Investigator (Approver 1):

The Principal Investigator of the area or his/her designee signs the first approver line of the Magnet SOW form to authorize the requester to commence work. The designee must be someone that supervises or works regularly in the area and understands the hazards associated with performing maintenance/facilities work in the area. This approver is responsible for isolating hazardous sources and protecting equipment, ensuring that these procedures are followed in their laboratory, reviewing with the requester the safety precautions to be taken while working in their area. Approver 1 may choose to be present or assign a designee to be present while the work is being done. For this purpose only, the designee may be any NHMFL employee that understands the hazards associated with the magnet system and how to shut off power to the magnet if an emergency should occur.

Step 3: Safety Department (Approver 2):

The Safety Department is responsible for ensuring that all personnel receive the proper training and guidance in order to perform assigned tasks safely and in compliance with this procedure. The Safety Department signs the second approver line after confirming that all safety concerns have been reviewed and addressed.

6.2 Releasing a SOW Form

No Magnet SOW Form may be removed without the knowledge of the Principal Investigator (Approver 1) and Requester.

Step 1: Requester

It shall be the duty of each Requester holding the Magnet SOW to report the completion of work to the Principal Investigator (Approver 1). The Requester must ensure the work is complete and all tools, equipment, trash, and debris removed from the work area.

Step 2: Work Complete Acknowledgement

The Requester shall release the Magnet SOW by initialing and adding the date and time the work was completed to the bottom of the Magnet SOW and obtaining the initials of the Principal Investigator (Approver 1) or his/her designee.

Step 3: Safety Department

Return completed Magnet SOW's to the safety department.

7.0 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 de-energized. 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.

If an emergency should occur that requires immediate response, every effort should be made to contact the Principal Investigator or personnel that work in the area that know how to safely de-energize the magnet.

Contact the NHMFL EH&S Office to report any physical injury, incident, or other safety concern involved with working with a magnet.

8.0 DEFINITIONS

The following definitions are for the purpose of this procedure.

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

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.

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

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

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.

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.

9.0 APPENDIX A

Magnet Statement of Work Form

Requester: Task Start Date: Estimated Completion Date:

Tasks:

Hazards:

Tools:

Procedure:

Required Personnel:

Requester: _____ _____
SIGNATURE DATE

Approvers:

Principal Investigator _____ _____
SIGNATURE DATE

Safety Department _____ _____
SIGNATURE DATE

Work Complete:

Completion Date: _____ Time: _____

Requester Initials: _____

Approver Initials: _____

10.0 REVISIONS AND APPROVALS:

Revisions

Date	Revision #	Section	Description
8/13/07	002	Cover	Names and positions changed to reflect current management
8/13/07	002	4.1	Modification of Safety Dept. Responsibilities
8/13/07	002	4.3	Modification of Facilities Dept. Responsibilities
8/13/07	002	5.0	Removal of reference to Magnetic Field Safety Clearance
9/20/07	03	6.0	Removal of Level A and B control areas
9/20/07	03	6.1	Added to identify Requester, PI and Safety Dept. role in completing SOW
8/22/18	04	7.0	Names and positions changed to reflect current management
6/21/24	05	All	Re-format policy to updated formatting

Approvals

Title	Approver	Signature
NHMFL Director of Safety	Alfie Brown	DocuSigned by: Alfie Brown 244772F051A0421...
Director: DC Field	Tim Murphy	Signed by: Tim Murphy EEC858BD1BAA403...