

Fermilab Test Beam Facility (FTBF) Hazard Awareness Training Handout

[PDFTBF01/CB/01]

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Overview

This document is intended to inform you of some of the more common hazards encountered at the Fermilab Test Beam Facility (FTBF). Please [read the entire document and complete the online quiz](#). This basic hazard awareness training is required for all personnel who intend to work at FTBF. It is valid for two years. There is additional Hazard Awareness training for personnel working in MC7 at the Test Beam.

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1. Introduction

This training document is intended to inform you of hazards at the Fermilab Test Beam Facility (FTBF) consisting of the Meson Detector Building (MDB) West, including MT6.1, MT6.2, and MC7 enclosures. An additional training document will cover hazards specific to the MC7a and MC7b areas. This hazard awareness training is required for all personnel who intend to work at FTBF. It is valid for a period of two years. Fermilab ID badges must be visibly worn at all times. Access to FTBF is via card readers for people with valid FTBF HA training. Unbadged or untrained individuals must be escorted while in FTBF. All tours and visitors under the age of 18 must have the approval of the FTBF Coordinator.

If you find a situation in which you need advice, training, review or a decision regarding safety or safe operations, you should go to your immediate supervisor/spokesperson or the FTBF Coordinator or the PPD Division Safety Officer. If you are unable to reach any of these people, you should reference the contact list posted near each of the doors in the facility. During off hours or the middle of the night, the Main Control Room may be able to advise. **In the event of an emergency, you should call ext. 3131 from any Fermilab telephone located in a safe area.**

Consult the FTBF Emergency Call List for the individuals listed above. This list is available at <https://ftbf.fnal.gov/contacts/>.

Environmental Safety, & Health (ES&H) materials referenced in this document can be consulted for guidance on ES&H issues. These materials can be found on-line at <https://eshq.fnal.gov/>

1.1. Programs for Controlling Hazards

Fermilab employees and users should ensure their supervisor or Individual Training Needs Assessment contact is aware they are working at FTBF and updates their ITNA appropriately.

Work activities performed by Fermilab employees and users should be done using the methods presented in training course [FN000628 - Work Planning and Hazard Analysis](#) and in accordance with [FESHM 2060 - Work Planning and Hazard Analysis](#), of the Fermilab ES&H Manual (FESHM) All users should have completed this course and review it periodically. Written procedures and job hazard analyses are usually developed by those doing the work and their supervisors, in consultation with ES&H personnel or subject matter experts when necessary. Technical assistance is generally not available late in the afternoon or in the evening and overnight. You are encouraged to do sufficient work planning to make use of assistance when it is available.

All user equipment at FTBF must undergo an “Operational Readiness Clearance” (ORC) safety review before going into operation. See [FESHM 2005](#) for details of the ORC program. Contact the FTBF Coordinator to arrange for this review. Equipment should not be energized until the steps of a review plan have been developed with the FTBF Coordinator.

2. Electrical and other Stored Energy Hazards

Many components utilize potentially dangerous high voltages and currents. Certain electrical devices and components may retain their charge after their voltage sources are removed. These sources of energy can cause electric shock to personnel if work on these devices is carried out improperly. All personnel are required to have [Electrical Safety Orientation \[FN000387\] Training](#).

Faults that occur in electrical equipment operating at 50V or above must be reported to Division Safety Officer. Users may not repair Fermilab owned electrical equipment without explicit permission of the FTBF Coordinator.

An excellent review of common electrical hazards at FTBF can be found in “Electrical Safety ORC Review Guidelines” from the [ORC Guidance Documents](#). It is strongly recommended that all users read this document before installing any equipment. A common problem is “daisy-chaining” of extension cords and power strips. Extension cords and power strips may not be connected in series. All conductors need to have current protection such as fuses, circuit breakers, or a current limited supply to prevent the current from exceeding the rated capacity of the conductor.

At FTBF there are electrical receptacles capable of delivering a variety of outputs - primarily 120V and 208V single phase 60Hz. Users must verify that equipment, electrical plug and receptacle, and cordset are compatible with the proper voltage, frequency, phases, and current capacity before plugging anything in and to consult with FTBF staff if there are questions. You may find unusual and non-standard cordsets left by other users. Do not assume that "if the plug fits" there will be no problems. Consult with FTBF staff before arriving about any unusual or non-USA standard electrical needs so that appropriate arrangements can be made and equipment and cordsets properly labeled.

People performing service or maintenance work on or near equipment that could cause them injury if it were to become energized must lockout and tagout that equipment's energy source(s) and must have current [Fermilab LOTO Level 2 \[FN000212\] Training](#). Only LOTO Level 2 trained personnel are authorized to work on equipment that could become hazardous to them if that equipment were unexpectedly energized. LOTO requires the use of a designated red lock and a DANGER – Do Not Operate tag to isolate the hazardous stored energy source (e.g., electricity, gravity, springs, pneumatics, hydraulics). Additional information about LOTO can be found in [FESHM 2100](#) Fermilab Energy Control Program (Lockout/Tagout).

Another form of energy control is known as “Configuration Control”, which applies to the lockout and tagging of equipment to control the state or operation of equipment or systems where individuals are not actively engaged in servicing or maintenance. Improper removal of these locks and/or tags may lead to accidental injury of personnel or the public, damage to equipment, disruption of normal process, or degradation of system performance. The application of "configuration control" locks should be implemented with a (non-red) padlock and a configuration control tag that may include text indicating “Danger” (but not “Danger – Do Not Operate”), “Caution,” “Warning,” or “Notice.”. Manila tags are also acceptable. Configuration control locks and/or tags are applied by persons or groups authorized by line management and are typically removed by the same person or group who applied the devices. (See Appendix B of [FESHM 2100](#) for further details and examples of Configuration Control.)

3. Radiation Hazards

When beam is transported through the MTest or MCenter Beamline, ionizing radiation is a significant hazard in the MT6 or MC7 enclosures. Access to enclosures with active beam is controlled with interlocked gates. Controlled Access procedures for MT6 and MC7 enclosures will be covered in section 4 below.

FTBF contains other areas where radiation hazards can be found and is posted as a Controlled Area and a Radioactive Material Area. Radiation fields can also be found near activated objects and radioactive

sources. The ALARA (As Low As Reasonably Achievable) concept is used to keep doses to radiation workers at a minimum.

At a minimum, [General Employee Radiation Training \(GERT\) \[FN000241\]](#) is required to enter the facility. If work needs to be performed in an enclosure during a controlled access, [Radiological Worker – Classroom \[FN000470\]](#), [Radiological Worker – Practical Factors \[FN000471\]](#), and [Controlled Access \[FN000311\]](#) Training is required. If work needs to be performed with a radioactive source, [Radiological Worker – Classroom \[FN000470\]](#), [Radiological Worker – Practical Factors \[FN000471\]](#), and [Radioactive Source \[FN000048\]](#) Training is required.

Radiation dosimetry badges are not required for general access to this facility. However, they are required when performing a controlled access, when working with a radioactive source, and/or when entering posted Radiation Areas. Temporary badges are available from the Communications Center (on the Ground Floor of Wilson Hall, ext. 4251). Please put your name or initials on your badge using a permanent marker. Badges are not transferable and may not be shared. Permanently assigned badges are located on badge racks in the facility and temporary badges may be stored on the same racks. Quarterly radiation dose reports can be obtained through the RSO assigned to the area. Dosimetry badges must remain on the Fermilab site.

All items in the beamline that are removed during a controlled access must be surveyed with the frisker. Only personnel with current [Radiological Worker – Classroom \[FN000470\]](#) and [Radiological Worker – Practical Factors \[FN000471\]](#) can conduct surveys. ([GERT \[FN000241\]](#) does NOT allow you to perform a survey.) When an experiment is complete, equipment should be gathered and a survey must be performed by an authorized surveyor before leaving the site.

Access to all areas above the 7-foot height of the shielding blocks is prohibited during MCenter or MTest beam-on operations.

Only personnel who have current [Radiological Worker – Classroom \[FN000470\]](#), [Radiological Worker – Practical Factors \[FN000471\]](#), and [Radioactive Source Training \[FN000048\]](#) can sign out radioactive sources from the designated “source monitor”. The names of the source monitors for FTBF are posted on the radioactive source storage box.

4. Controlled Access

Controlled Access is the normal mode of access to beamline enclosures during brief down-times of accelerator operation when it is expected that interlocks will be maintained. Controlled Access is made by following the [Fermilab Controlled Access \[FN000311\] Training](#) and procedures. In addition, FTBF-specific training for Controlled Access Practical Factors and Controlled Access Leaders should be scheduled with the FTBF Coordinator. For controlled access, access keys are to be checked out from the remote key trees at MT6.1, MT6.2, or MC7 gates. All controlled accesses are governed by a Radiation Work Permit (RWP). The active RWP is available at the key trees and must be reviewed and signed every time a key is obtained before accessing the enclosure. The RWP contains information on the radiological training, PPE, and dosimetry required for access. Every entrant is to have their own individual access key during a controlled access.

5. Chemical Hazards

Small amounts of chemical materials, such as epoxies and solvents, are used or stored in certain areas. If handled incorrectly, some of these materials may become harmful. All hazardous (e.g., flammable, corrosive, reactive, or toxic) materials that are not in use must be stored in specially designated cabinets. Flammable liquids, such as ethanol, must be stored in a Flammable Liquids Cabinet. Figure 1 shows an example of a Flammable Cabinet. Rags or Kim Wipes used in the application or cleanup of such solvents must be collected, disposed of in flammable rag containers and must be emptied every night.

Safety Data Sheets (SDS's) containing information on all of these and other materials within the facility can be found online at http://www-esh.fnal.gov/pls/ip/msds_search.html. Additional information regarding chemical hazard communication is outlined in FESHM 4110 Hazard Communication.

Contact a [Waste Generator](#) (employees trained in proper disposal of regulated chemical waste) or [ES&H waste personnel](#) for information about proper disposal of hazardous or unknown chemicals.



Figure 1. Example of a Flammable Cabinet.

As a general practice, the use of combustibles within FTBF should be limited. If there are questions regarding the combustibility of building materials (e.g., cables, foam board, plastics), please obtain a sample of the building material and contact the FTBF Coordinator. ORCs include a fire safety review by a subject matter expert. All combustibles, such as cardboard or wood, should be removed from the beam enclosures.

*Flashpoints: Flammable material <100F (37.8C)
Combustible material ≥100F (37.8C) to ≤200F (93.3C)*

No liquids should be stored in unlabeled bottles. Chillers should have labels with identity of coolant in use. Ethylene glycol should be avoided in favor of propylene glycol when appropriate.

6. Environmental Hazards

An accidental release of some materials (e.g., oil, gasoline, diesel fuel) from equipment could become harmful to people or the environment if not promptly contained. If you know or suspect that such a release has occurred or will occur, call ext. 3131 to report a spill emergency. Designated personnel are trained to execute procedures designed to minimize the spread of accidentally released materials. In addition, the following materials are prohibited from disposal in trash cans and dumpsters:

- all hazardous (e.g., flammable, corrosive, reactive, toxic) materials
- degreasing agents (e.g., Freon)
- uncured epoxy
- ethylene glycol (“anti-freeze”)
- fluorescent light bulbs

- oils
- paints
- pesticides
- radioactive material, radiation signs and labels
- scrap metal
- NiCad, lead/acid, and lithium batteries
- any free liquids (regardless of chemical nature)

Contact a [Waste Generator](#) or [ES&H waste personnel](#) for information regarding the proper disposal of such items. Whenever possible, please recycle rather than throw away materials that are no longer of use.

7. Hazards Associated with Operating Machinery

7.1. Cranes and Forklifts

Improper use of cranes and forklifts or lifting devices can endanger people working in the area as well as material being moved. People operating cranes and forklifts must complete operator training and renew this training every three years. Operators must clear personnel from the area of the lift and warn others of approaching loads. All personnel are prohibited from the area near or under any suspended load. Personnel conducting, or in the vicinity of, crane operations must wear hard hats and safety shoes. Procedures for crane use can be found in FESHM 10100 Overhead Cranes and Hoists and FESHM 10140 Mobile Cranes.

Crane operators in the FTBF high bay warn others of approaching loads by using the bell. Be alert.

7.2. Tech Shop Equipment and Power Tools

Machines in this area present hazards due to moving parts. Power tool operations present similar hazards. In general, use of the tech shop is restricted to FTBF trained technical staff. Users can request assistance as needed. Prior to using tech shop equipment, workers must complete Tech Shop Safety - Basic [\[FN000258/CR/00\]](#) training. Workers must also be cleared by the FTBF Tech Shop Point of Contact.

Users can operate hand tools and hand power tools (hand drill). Safety glasses are required when using tools and gloves are encouraged for most activities. Note that drilling, cutting, sanding, or grinding of concrete or other silica containing materials requires respirators and special training. Please contact the FTBF Technical Coordinator for assistance with such activities.

Safety glasses, gloves, and other personal protective equipment (PPE) are available in a marked cabinet at FTBF.

7.3. Motion Tables

Multiple motion tables exist within the facility to position experimental equipment into and out of the path of the particle beam.. See <https://ftbf.fnal.gov/motion-tables/> for additional information. These tables generally move at a slow pace but can pose potential pinch hazards. No user shall operate a motion table without a briefing from FTBF staff. Make sure you know the location of the emergency stop buttons on the larger tables.

8. Hazards Associated with Working at Heights

Access to all areas above the 7-foot height of the shielding blocks is prohibited during MCenter or MTest beam-on operations. Fall hazards (people) and drop hazards (equipment) exist when working at height from ladders, scaffolds, personnel lifts, etc. Personnel lifts may only be used by trained personnel. Work from elevated platforms (4 ft or higher) that have no railings requires [Fall Protection Orientation \[FN000304\] Training](#), the use of a body harness and lanyard, and a written hazard analysis including rescue plan. Hard hats must be worn whenever someone is working above you or during overhead rigging activities.

When working with ladders, a number of rules and a training course apply:

- Always use the appropriate ladder for the job. Avoid reaching or leaning from a ladder to complete a task.
- When ladders are not in use, they must be stored in a secure location that will not cause an obstruction to walkways or workspaces.
- The physical condition of ladders and scaffolds should always be inspected prior to use and must be used in accordance with any posted instructions and/or safety precautions.
- Ladders are required to access cable trays. Climbing atop the concrete shielding blocks to access cable trays is not permitted.

All workers who use ladders or rolling stairs with 3 or more rungs must complete [Ladder User Safety Training \[FN000654/CB/01\]](#).

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9. Hazards Associated with Compressed Gas and Pressure Vessels

FTBF contains systems and operations that utilize compressed gases and pressure vessels that may become hazardous if ruptured or handled improperly. All gas cylinders must be properly regulated while used and capped while stored. They also must remain protected from falling at all times by securing them to a storage rack or other solid object. Only trained personnel, with current [Fermilab Compressed Gas Training \[FN000213\]](#), should handle compressed gasses. Additional requirements and procedures regarding compressed gas systems and pressure vessels can be found in the FESHM 5000 series.

FTBF utilizes flammable gas systems for use in experiments. The systems are properly identified. Open flame or spark is prohibited within 10 meters of the gas systems.

10. Emergencies

Call ext. 3131 from a safe location in the event of an emergency, such as personnel requiring medical treatment for any reason. Stay on the phone until the emergency operator indicates that s/he has all the necessary information, including your name, location and nature of the emergency. Do not attempt to bandage another person or clean any bodily fluids from another person's injury. An Automated External Defibrillator (AED) is located just outside the doors to MTest Control Room.

When evacuating any area, proceed to the designated assembly point and wait there until the 'all clear' signal is given. If you must leave and can't wait for the 'all clear', tell your supervisor or an Emergency Warden. Rescue attempts will be made by the Fire Department if someone is unaccounted-for and believed to be in an unsafe area (e.g., burning structure, oxygen deficient area). If you notice that a fellow

worker is missing during an emergency, immediately report this to an Emergency Warden, the Incident Commander (Fire Dept.) or the Fire Chief.

10.1. Fire Alarm

The fire alarm is a steady alarm that may be accompanied by a flashing strobe light. Leave the area via the nearest exit and go to the designated assembly point across the street from the west side of the building. Fire extinguishers should be used by trained personnel only.

10.2. Sitewide Emergency Warning System (SEWS)

SEWS is a verbal communication system broadcast throughout all areas of the laboratory to notify personnel when hazardous conditions exist and what protective actions to take. You must respond to its warning tones and messages and follow the transmitted instructions. If the nature of the message indicates severe weather, promptly go to the designated shelters which for FTBF are the bathrooms on the west side of the building.

11. Cryogenic Hazards

There may be areas within the facility where cryogenics such as liquid nitrogen or argon is present. A leak of these materials can cause local zones of oxygen deficiency. In addition, there may be areas where acute physical hazards associated with handling cryogenic materials, such as burns to the eyes and skin, are present. When cryogenic materials are handled, appropriate PPE, such as gloves and protective eyewear with side shields, must be worn. Additional information regarding the controls and procedures required of cryogenic and ODH areas are contained in FESHM 5032 Cryogenic System Review and FESHM 4240 Oxygen Deficiency Hazards (ODH) (Work Smart Standard).

Anyone who handles large (160 liter) dewars must complete [Large Portable Liquefied Gas Dewar Handling \[FN000475\] Training](#) and use a special lifting fixture available from the FTBF Technical Coordinator. Liquid argon may be in use in MC7 at times and there are oxygen monitors in the enclosure. MC7 is classified as an ODH-0 area. This means there is no special ODH training required to enter the area, but all personnel must exit the enclosure by the nearest door if the whooping and strobe alarms go off.

12. Miscellaneous

The following describes some additional general hazards and work rules which exist within FTBF:

- Smoking at facilities is permitted only outdoors and at least 15 ft. from the nearest indoor entrance.
- All new visitors working at Fermilab must register with the Users' Office (Wilson Hall Mezzanine, ext. 3111) upon their arrival.
- It is always preferred that people not work alone. When this is impractical, workers should at least insure that another person is aware of when and where they are working, and they should arrange to periodically check-in with that person. This is especially important for work during off-hours. Also note that for some types of jobs, explicit "two-man rule" requirements may exist.
- Nothing must be attached to or suspended from overhead sprinkler pipes.
- Since janitorial personnel do not service some areas within the facilities, you must clean up after yourself.
- Appropriate PPE must be worn to protect against hazards.
 - Closed-toe shoes must be worn at all times within the FTBF.
- Alcoholic beverages are prohibited within FTBF.

- No food or beverages are allowed in the MT6.1, MT6.2 or MC7 enclosures.
- There may be areas at FTBF posted as “NO ACCESS”. No entry to these areas should be attempted without explicit permission from the FTBF Coordinator.
- The FTBF coordinator should be notified of all tours. Anyone giving a tour must have this training and current GERT or Rad Worker training.
- Users at FTBF under the age of 18 must be approved by the Radiation Safety Officer assigned to PPD.