

Mu2e - Building Hazard Awareness Training Handout

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Overview

The Installation phase of the Mu2e experiment presents many potential hazards. This document is intended to inform you of the potential hazards you may encounter in the Mu2e facility and the proper precautions to take to reduce risks. Please read the entire document, then either take the online test, or sign and submit the signature sheet at the end. This hazard awareness training is required for personnel entering the Mu2e building, except for individuals being given tours of the building. All work must be scheduled and approved by the Mu2e integration team or the Mu2e Floor Manager. All tours must be approved by the ES&H Coordinator. As new phases are entered, updated versions of this document will be released and retraining may be required.

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1 Introduction

This training document outlines the hazards specific to the Mu2e building.

During the Installation period, the Mu2e Integration team and the Mu2e Floor Manager must be notified of persons entering the building or performing any work. To facilitate planning, members of the Mu2e Project team and members of the Mu2e Collaboration are asked to plan their work as described in Sec. 1.1.

Upon entering the Mu2e building, you MUST check the Notification Board (located in the main entrance) for updates on current hazards. If you may be creating any hazards with your work, inform the Mu2e Floor Manager (or designee) so that this information can be included on the Notification Board.

The PPE requirements will be job specific.

If you find a situation in which you need advice, training, review or a decision in regards to safety or safe operations, you should first consult with your immediate supervisor. If you and your supervisor conclude that the matter goes beyond your own group, that you need assistance in resolving it, or that you need to arrange for safety training, you should contact one of the PPD Division Safety Officers (DSO), Raymond Lewis (x8445, rhlewis@fnal.gov) and Katie Swanson (x6497, kswanson@fnal.gov), or the Mu2e ES&H Coordinator, Dee Hahn (x2354, dhahn@fnal.gov). In the event of an emergency, you should call ext. 3131 from any Fermilab telephone.

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

1.1 Planning Your Work

Prior to initiating new work at the Mu2e Hall you need to contact the Mu2e Integration Team (mu2e-IntegrationTeam@fnal.gov). Depending on the scale, complexity, and associated safety hazards you may be asked to make a small presentation at the Mechanical Integration Meeting. The appropriate ES&H documentation and sign-offs will be required prior to starting any new work.

Daily planning and coordination on site at the Mu2e Hall will be performed by the Mu2e Floor Manager, Dervin Allen (x2511), in consultation with the Mu2e integration team.

ES&H oversight will be provided by the Mu2e ES&H Coordinator, Dee Hahn (x2354), and the PPD Division Safety Officers, Raymond Lewis (x8445) and Katie Swanson (x6497).

Issues of building maintenance should be directed to the Mu2e Building Manager, Leonard Nelson (x2564).

1.2 Programs for Controlling Hazards

The ES&H programs for controlling the hazards that may be found within the facility generally have three parts: (1) reviews to minimize hazards of new systems; (2) personnel training; and (3) documented operating and safety procedures or guidelines to follow. In addition, work activities performed by Fermilab employees and users shall be reviewed via a Job Hazard Analysis (JHA) before work is started (see Chapter

2060 of the Fermilab Environmental, Safety, and Health Manual ([FESHM](#))). Reviews to minimize hazards in the design, construction, and operation of new systems are conducted by specific review committees or Environmental, Safety, and Health (ES&H) personnel. If you are involved in an operation that you feel should be reviewed or is required to be reviewed, contact your supervisor or the Mu2e ES&H Coordinator, Dee Hahn (X2354). Training courses are conducted by supervisors or the Fermilab ES&H Section, depending on the specific need. Written procedures and job hazard analyses are usually developed by those doing the work and their supervisors, in consultation with ES&H personnel when necessary.

2 General Hazards

The Mu2e building has many features which open to the lower levels. The large openings are covered or protected with standard railings. Additional fall protection measures and barricading may be needed when covers or railings are removed; contact the PPD DSO or Mu2e ES&H Coordinator before removing railings or covers so that the need for fall protection or barricading can be assessed. Covers and railings need to be put back into position when work requiring their removal is complete. Use caution leaning over the edges of the openings so that hard hats, phones, or other objects are not dropped below. Openings over the trenches in the experimental area are covered with trench cover plates that can be trip hazards due to clearance fits. Take care not to trip on the edges of the trench plates and ensure that the trench plates covering walking surfaces are replaced when not working in the area. There are many conduit penetrations in the floors that may or may not be terminated at this stage of the project. Take care especially around the perimeters of the building for these trip hazards.

3 Electrical Hazards

Many components utilize potentially dangerous high voltages and/or currents. In addition, certain electrical devices/components may retain significant electric charge after their high-voltage sources are removed. These sources of energy can cause electric shock to personnel if work on these devices is carried out improperly. All employees and users are required to have taken New Employee/User ES&H Orientation (or a prior equivalent), which includes Electrical Safety Orientation [FN000387] Training, a brief orientation to the Fermilab Lockout/Tagout (LOTO) program and NFPA-70E for unqualified workers.

4 Control of Hazardous Energy

The servicing and/or maintenance of machines and equipment are frequent activities that can be hazardous. The related hazards may include energized electrical circuits, capacitors or batteries; pneumatic systems; chemicals which may release energy or pose a biological hazard, the mechanical movement of levers, presses, hydraulic systems, pump shafts or fan blades; vacuum vessels, chambers, or pipelines; and pressurized fluids released from vessels, tanks, pipes or valves.

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 tag to isolate the hazardous stored energy source (e.g., electricity, gravity, springs). Additional information about LOTO can be found in Chapter 2100 of the FESHM.

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.)

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. As a general practice, the use of combustibles should be limited. 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 acetone, must be stored in a Flammable Liquids Cabinet. Below is an example of a Flammable Cabinet. Rags or Kim Wipes used in the application or cleanup of such solvents must be collected in flammable rag containers. 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 Chapter 4110 of the FESHM.



Example of a Flammable Cabinet.

6 Environmental Hazards

An accidental release of some materials (e.g., oil, gasoline, diesel fuel) from certain equipment could become harmful if it is not promptly contained. Such a release can be considered harmful if it can potentially cause adverse effects to people or the environment. If you know or suspect that such a release has occurred or is likely to 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 the PPD DSO, the ES&H Section Environmental Protection Group or the facility building manager for information regarding the proper disposal of such items. Whenever possible, please recycle rather than throw away materials that are no longer of use.

Specific Environmental Hazards at the Mu2e Facility:

Contact the PPD DSO or the ES&H Section Environmental Protection Group for assistance with waste determination and disposal requirements.

7 Hazards Associated with Operating Machinery

7.1 Cranes and Forklifts

Improper use of certain equipment, such as cranes and forklifts, 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 warn others of approaching loads. All personnel are prohibited from the area near or under any suspended load. Procedures for crane use can be found in the FESHM.

Specific Hazards Associated with Cranes and Forklifts at the Mu2e Facility:

Crane operators are responsible for clearing personnel from the area of the lift.

Hard hats are required in the area of crane operation, as defined by the crane operator, whenever the crane is in operation.

7.2 Power Tools

Power tool operations present hazards due to moving parts. Work with some machines requires the use of Personal Protective Equipment (PPE). Any loose clothing or jewelry that might become entangled must be removed prior to operating these tools. Hair that might become entangled should be covered or tied back. All hammering, drilling, cutting, grinding, and power tool operations require the use of protective eyewear (e.g. safety glasses or goggles) with side shields that fit snugly to the face. In addition to glasses

or goggles, grinding operations also require the use of a full-face shield. Some operations may require other forms of PPE (e.g., hearing protection, gloves). Manufacturer's recommended operating instructions are a good source of information on how to operate equipment safely. Any cutting, drilling or coring in concrete requires special precautions associated with silica exposure (FESHM 4195) and the potential for striking embedded utilities (FESHM 7040).

7.3 Aerial Lifts

Aerial lifts are devices used to elevate personnel to sites above ground and include articulating or extensible boom platform lifts, scissor lifts, and manlifts. See FESHM 10180 for requirements pertaining to aerial lifts.

Improper use or poor maintenance of aerial lifts can pose a serious safety hazard. Fermilab employees and users who will utilize aerial lifts must take the Fermilab course on the proper operating procedures, and hazards associated with the equipment and operating the equipment (FN000532).

Specific Hazards Associated with Aerial and Scissor Lifts at the Mu2e Facility:

Hard hats are required whenever working in an area where lifts are in use. Anyone working from a telescoping and or articulating boom lift must wear a personal fall arrest system attached to the manufacturer's designated anchorage point. The use of a personal fall arrest system is not required on scissor lifts if the guardrail system is intact.

8 Hazards Associated with Working at Heights

There are unusual places throughout the facility from which people or things have the potential to fall. These include work taking place near one of the hatches or near the level change in the beamline and work from ladders, scaffolds, and aerial lifts, etc.. The physical condition of the hatch railings should always be inspected prior to working near or leaning on them. The physical condition of ladders and scaffolds should always be inspected prior to their use and must be used in accordance with all posted instructions and/or safety precautions. Personnel lifts are available in some areas for workers trained in their use. Work from elevated platforms that have no railings requires Fall Protection Orientation [FN000304] Training, the use of a body harness and lanyard, and a written rescue plan in the associated hazard analysis. Hard hats must be worn whenever someone is working above you or during rigging activities. Additional requirements and procedures regarding the use of aerial lifts can be found in Chapter 10180 of FESHM.

It is common for work to be conducted at elevations above floor level. When working with ladders, a number of rules 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.
- Do not climb on the cable trays. Use the appropriate equipment (e.g. ladder, scissors lift) as needed to safely access the tray.

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

9 Hazards Associated with Compressed Gas and Pressure Vessels

Many facilities contain 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 down at all times, for example by securing them to a storage rack or other solid object. Only trained personnel should handle compressed gasses. You can find the Fermilab Compressed Gas Training [FN000213] here: http://www-esh.fnal.gov/pls/default/class_sched.html. Additional requirements and procedures regarding compressed gas systems and pressure vessels can be found in Chapter 5031 of the FESHM.

10 Radiation hazards

The appropriate radiation protection postings are in place in the Mu2e building. The postings are maintained by the Radiation Physics Operations Dept. (RPO) in the ES&H Section. Currently, the entire building is posted as a Controlled Area/Radioactive Material Area. Personnel are required, depending upon the work they will perform and the areas they will enter, to take either General Employee Radiation Training (GERT) or Radiological Worker training bi-annually. The Radiation Safety Officer assigned to the Muon Campus, Nino Chelidze (x2995, chelidze@fnal.gov), can be contacted regarding any questions about radiation protection postings or other aspects of the radiation protection program.

11 Emergencies

Call ext. 3131 in the event of an emergency situation, such as personnel requiring medical treatment for any reason. Stay on the phone until the emergency operator indicates that s/he has all of 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.

Take note of the exits in the areas where you are working; exits are marked with illuminated signs. 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.

11.1 Steady Alarm

This is a fire alarm and it means that smoke or fire has been detected in the area.

Specific Procedures for a Steady Alarm at the Mu2e Facility:

Exit via the closest exit door; gather at the emergency assembly area, located in the Mu2e parking lot.

11.2 Whooper Alarm

This is a hazardous atmosphere (i.e., ODH) or interlock alarm. During the initial installation period no ODH system is in place and there are no ODH hazards in the Mu2e building.

Specific Procedures for a Whooper Alarm at the Mu2e Facility:

Exit via the closest exit door; gather at the emergency assembly area, located in the Mu2e parking lot.

11.3 Sitewide Emergency Warning System (SEWS)

This is a verbal communication system broadcast throughout all areas of the laboratory. It is used to notify personnel when hazardous conditions exist and what protective actions to take. It is very important that you respond to its warning tones and messages and that you follow the transmitted instructions. If the nature of the message indicates severe weather (e.g. a tornado), promptly go to the designated shelter for your area.

Specific Procedures for a SEWS Message at the Mu2e Facility:

The designated shelter areas are any of the stairwells. Proceed to the bottom of the stairwell, without exiting the stairwell. Remain in the shelter until given directions via the safety alert monitor that it is safe to exit.

11.4 Fire Suppression System

Specific Fire Suppression System at the Mu2e Facility:

Mu2e utilizes an automatic sprinkler system. Manual pull stations are located at building exits (use in the event that the alarm system has not activated but signs of fire are present). Smoke detectors are also located throughout the building.

12 Magnetic Field Hazards

Specific Magnetic Field Hazards at the Mu2e Facility:

None exist during the initial installation period.

13 Hazards Associated with Sustained High Noise Levels

Extended exposure to certain areas where high noise levels are common can cause hearing damage to people without proper hearing protection. These areas are posted accordingly and have the appropriate hearing protection available. Additional information on hearing conservation can be found in Chapter 4140 of the FESHM.

Specific Hazards Associated with Sustained High Noise Levels at the Mu2e Facility:

Some tools and equipment used during the installation period may generate high noise levels. Signs that the noise level is hazardous include if you are unable to hear a person talking (without shouting) standing

3 feet from you. If you believe the noise levels are excessive, contact the PPD DSO or the ES&H Section Industrial Hygiene Group, who can review the work and noise levels to determine if engineering controls or personal protective equipment is required.

14 Cryogenic Hazards

There may be areas within the facility where cryogenics such as liquid nitrogen or helium may be routinely 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 possible. 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 Chapters 5032 and 4240 of the FESHM.

Specific Cryogenic Hazards at the Mu2e Facility:

Anyone who may handle large (160 liter) dewars must complete Large Portable Liquefied Gas Dewar Handling [FN000475]. Requirements for transporting compressed gas cylinders and cryogenic dewars in elevators are found in FESHM Chapter 5032.3.

15 Confined Spaces and Limited Access Areas

Confined spaces are locations in which hazards, such as poor illumination, difficult emergency escape and ODH, can be intensified. A written permit and Fermilab Confined Spaces [FN000003] Training is required for access to any confined space. Additional policies and procedures regarding access to confined spaces can be found in Chapter 4230 of the FESHM.

Specific Confined Spaces and Limited Access Areas at the Mu2e Facility:

The sump pits, elevator pit, and the neutron generator pit are confined spaces. Do not enter unless you have a completed entry permit. Contact the PPD DSO or the ES&H Section Industrial Hygiene Group for entry permit approval.

16 Miscellaneous

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

- 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 (WH1E, ext. 3111) upon their arrival.
- It is always preferred that people not work alone. When this is impractical, workers should at least ensure that another person, such as their supervisor, is aware of when and where they are working, and they should make arrangements 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.
- Proper personal protective equipment (PPE) may be required for various situations. Consult the written hazard analysis, your supervisor, the Mu2e Floor Manager (or designee), the Mu2e ES&H Coordinator, or the PPD DSO if unsure what PPE is necessary.
- Keep the roll-up door closed as much as possible to reduce the burden on the Heating, Ventilation and Air Conditioning (HVAC) system and help keep the area clean.