IARC Heavy Assembly Building Hazard Awareness Training Handout

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Overview

The installation and start-up phases of the many different types of experiments and accelerators present many hazards. This document is intended to inform you of the potential hazards you may encounter in HAB and the proper precautions to take to prevent unsafe situations. Please read the entire document. This hazard awareness training is mandatory for all personnel who enter HAB or work at HAB routinely. It is valid for one year.

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1. Introduction

This training document outlines the hazards specific to the Heavy Assembly Building (HAB).

Access to HAB is restricted to authorized personnel in compliance with additional written Hazard Analyses (HA). If you may be creating any hazards with your work, inform the HAB Coordinator (or designee) so that this information can be communicated effectively. A summary of these hazards is written on the HAB hazard board on the north side of the building near the crane control box.

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 go to 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 the HAB Coordinator or designee. In the event of an emergency, you should call extension x3131 from any Fermilab telephone.

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

1.1. Programs for Controlling Hazards

The programs for controlling the hazards that may be found within the facilities 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, users, or visitors shall be reviewed via a Hazard Analysis (HA) before work is started (see Fermilab Environmental, Safety and Health Manual (FESHM) 2060 Work Planning and Hazard Analysis). Reviews to minimize hazards in the design, construction, and operation of new systems are conducted by specific review committees or Environmental, Safety, Health, and Quality (ESH&Q) personnel. If you are involved in an operation that you feel should be reviewed, contact your supervisor or the facility coordinator. Training courses are conducted by supervisors or the Fermilab ESH&Q 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 ESH&Q personnel when necessary. http://esh-docdb.fnal.gov/cgi-bin/ShowDocument?docid=1209

At HAB, if the job you are working could affect the safety of others such as moving heavy objects overhead via the crane please notify the Building Manager, or the Area Manager. A list of these jobs will be written on the hazard board located on the North wall of HAB.

2. Hazardous Energy

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 personnel are required to have Electrical Safety Orientation [FN000387] Training, which is a brief orientation to the Fermilab Lockout/Tagout (LOTO) program and NFPA-70E for unqualified workers.

A common hazard is “daisy-chaining” of extension cords and power strips. Extension cords and power strips are designed to be used individually and not connected to others in series. Such improper installations can become a fire hazard by creating an over-current condition. Figure 1 shows examples of acceptable and unacceptable usages of extension cords and power strips. These are examples of

configurations found onsite at Fermilab, however acceptable and unacceptable configurations are not limited to these examples. Contact the Building Manager or Area Coordinator if you have any questions.

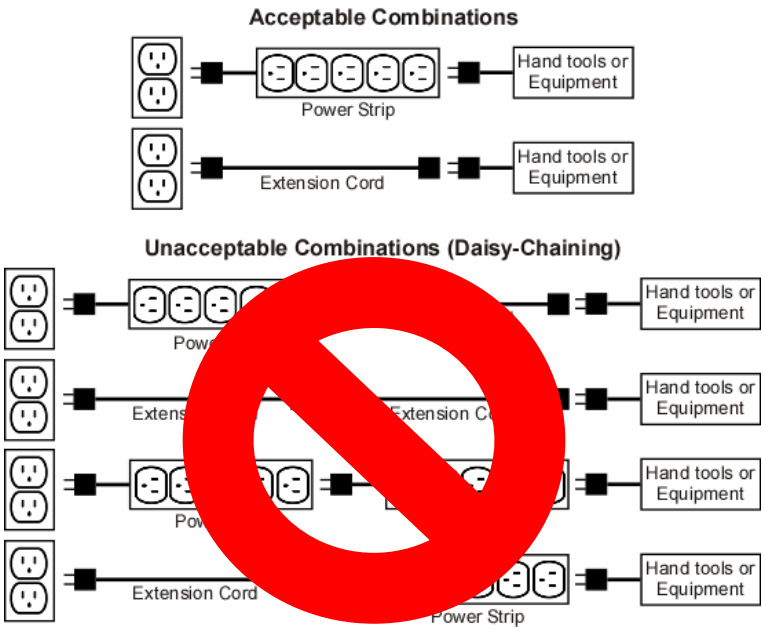

Figure 1. Examples of Acceptable and Unacceptable Combinations of Extension Cords and Power Strips.

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, water pressure, air pressure). Additional information about LOTO can be found in FESHM 2100 Fermilab Energy Control Program (Lockout/Tagout).

> *NOTE: The term "configuration control" 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. The application of "configuration control" locks should be implemented with a (non-red) padlock and a CAUTION tag. 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 the Appendix of FESHM Chapter 2100 for further details and examples of Configuration Control.)*

3. Radiation Hazards

There are potentially multiple experiments and small accelerators operating at any time. HAB ground floor and pit area, is posted as a "Controlled Area." For Controlled Areas, the Fermilab Radiological Control Manual states what necessary training is required. Generally most radiation is produced from electron beam accelerators located within shielding caves.

These shielding caves have interlocked systems that include flashing lights. For the A2D2 cave a solid red and yellow light indicates that the machine is producing and accelerating beam. A solid green light indicates that the machine is not ready to produce beam, and is safe to enter.

For general practice, when preforming tasks in these areas, please contact your supervisor or the facility coordinator with any questions you may have.

4. 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 ethanol, must be stored in a Flammable Liquids Cabinet. Figure 2 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 ESH&Q waste personnel, or HAB Building Manager, for information about proper disposal of hazardous or unknown chemicals.

Figure 2. Example of a Flammable Cabinet.

5. Environmental Hazards

An accidental release of some materials (e.g., oil, gasoline, diesel fuel) from equipment could become harmful if it is not promptly contained. Such a release can be considered harmful if it can cause adverse effects to people or the environment. 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 ESH&Q waste personnel, or the 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. Contact a Waste Generator or ESH&Q waste personnel for assistance with waste determination and disposal requirements.

6. Hazards Associated with Operating Machinery

6.1. 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. Inside HAB there is an overhead crane. On the trolley, there is 50 Ton primary hoist, and a 10 Ton auxiliary hoist. The crane poses many different hazards to the building. The cranes disconnect is located in the southwest corner of HAB. It should be locked out when not in use. The crane controller is position on the North wall of HAB along the rigging equipment.

Operators of 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 overhead lifts or lifts that have the potential to contact the head must wear hard hats and safety shoes. There is a series of IARC provided hardhats to be temporarily used in the case the crane is being operated. The location of the hard hats is at the bottom of the two stairwells that lead into the pit floor. Procedures for crane use can be found in FESHM 10100 Overhead Cranes and Hoists and FESHM 10140 Mobile Cranes. When the overhead crane is in use to load/unload materials from the loading dock, no one shall be under the loading dock. Crane operators are responsible for clearing personnel from the area of the lift.

Personnel lifts, scissors lifts and articulating boom lifts have been used inside HAB on prior occasions. These machines may require individual training, see your supervisor for any additional questions. At HAB please coordinate activities involving these machines with the Area or Building Manager.

6.2. Machine Shop Equipment and Power Tools

Machines in this area present hazards due to moving parts. Power tool operations present similar hazards. Training is required to work with the tech shop equipment. 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 machines. 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.

7. 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 ladders, scaffolds, personnel (aerial and scissor) lifts, etc. 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 hazard analysis.

Hard hats must be worn whenever someone is working above you or during overhead rigging activities. Hard hats are required whenever working in an area where lifts are in use. Fall protection is required when working from aerial lifts. If your work requires the use of a ladder or to be above the level of a guardrail (i.e. unloading a semi-trailer on the loading dock while standing on the bed of the trailer), a fall protection assessment must be conducted.

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.

8. 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, 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.

9. 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 FESHM 4140 Hearing Conservation. Electric and pneumatic tools can be sources of high noise levels.

Some tools and equipment 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 ESH&Q Industrial Hygiene Group, who can review the work and noise levels to determine if engineering controls or personal protective equipment is required.

10. Cryogenic Hazards

There may be areas within the facility where cryogens such as liquid nitrogen or argon 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 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).

Specific Cryogenic Hazards at the HAB Facility:
Anyone who may handle large (160 liter) dewars must complete Large Portable Liquefied Gas Dewar Handling [FN000475] Training, and use a special lifting fixture available from the Area Coordinator. The general area of HAB is an ODH-0 area, however there are only two small areas where it is ODH-1. These areas are on the diving board, and below the cryo plant. This means there is no special ODH training required to enter the area, but all personnel must exit the hall if the whooping and strobe alarms go off. The main assembly area is in the East parking lot along the berm.

11. 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 FESHM 4230 Confined Spaces.

12. Static Magnetic Fields

The primary hazard associated with static magnetic fields is difficulty handling ferromagnetic items. There is a rotational force causing objects to align with field lines. In addition, there can be a translational force that pulls objects toward the source of a magnetic field. For more information please see Fermilab Environmental, Safety and Health Manual (FESHM) 4270.

Mu2e Transport Solenoid Test Stand while in operation has a potential of creating a 5 Gauss field along the outside of its cryostat vessel. Appropriate “Danger Magnetic Field Hazard” posting signs are fixed to the surrounding platform of the test stand. Also in the event of an emergency, there are emergency stop switches around the platform. A light tree indicates when the magnetic is being energized.

The Green light indicates that the power supply is disconnected, the Orange light indicates the power supply is connected and the solenoid current is low (< 20 A). The Red light indicates the power supply is connected and the solenoid current high (> 20A).

13. 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.

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.

13.1. Fire Alarm

The fire alarm is a steady alarm that may be accompanied by a flashing strobe light. It means that smoke or fire has been detected in the area. Exit via the closest exit door; gather at the emergency assembly area, located in the parking lots to the East of HAB (see Figure 3).

Figure 3. Aerial view of OTE and HAB with Emergency Assembly Area location indicated via red 'X'.

13.2. ODH Alarm

The ODH alarm is a whooper alarm along with red flashing lights positioned in the pit and at the ground level. Once the alarm activates, it indicates an oxygen deficiency hazard (ODH) or other hazardous atmosphere. Exit via the closest exit door; gather at the emergency assembly area, located in the parking lot to the East of HAB (see Figure 3).

13.3. Power Outage

In the event of a power outage, the occupants of the HAB pit are asked to leave the area immediately. Due to a power outage, the ODH fan may not come on in the event the oxygen level falls and creates an oxygen deficient area. Please exit to the nearest stairwell that leads to the ground floor.

13.4. 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 (such as inclement weather) 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, promptly go to the designated shelter for your area. The designated shelter area for the HAB building is the Stairwell from the ground floor leading to the Northeast corner of the pit. Remain in the shelter until given directions, via the safety alert system, that it is safe to exit.

Figure 4: Stairwell in the HAB Building for SEWS Emergencies

14. Miscellaneous

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

- Smoking at facilities is permitted only outdoors and at least 15 ft. from the nearest indoor entrance.
- It is always preferred that people not work alone. When this is impractical, workers should at least insure 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.
- Appropriate PPE must be worn to protect against hazards.
    - Consult the written hazard analysis, your supervisor, the HAB Coordinator (or designee), or Safety Officer if you are unsure what PPE is necessary.
- Keep the roll up doors closed as much as possible to prevent stressing the Heating, Ventilation and Air Conditioning (HVAC) system.
- Check the bulletin board on the North side of the building near the crane controller. Here you will find information about the day's activities.