

# **FOREWORD**

*Welcome to Fermilab, a U.S. Department of Energy research laboratory. Fermilab management has no higher priority than to perform research in a safe and healthful manner. We insist that every worker, experimenter, and sub-contractor make job safety and health a top priority as well.*

*This handbook is provided to give you an overview of Fermilab's Environment, Safety, and Health (ES&H) Program. It provides practical safety tips, and reviews general emergency procedures and actions. It is provided as an aid ...it is NOT a replacement for nor a supplement to the Fermilab ES&H Manual which contains "official policies and procedures". Please be aware that policies and procedures may change and this revision of the handbook may not reflect those changes.*

*As a Fermilab worker - employee, user or subcontractor - you are required to follow Fermilab's ES&H policies and procedures. You can find more policy and procedure information in the Fermilab ES&H Manual which is posted on Fermilab's ES&H home page at <http://www-esh.fnal.gov/> or hard copy in the ES&H Section on the 7th floor of Wilson Hall. You must be aware of and adhere to all safety signs and postings at the Laboratory.*

*If you have questions regarding safety and health or the environment, please contact your supervisor, spokesperson, task manager, or the safety personnel within your division/section.*

*Fermilab has no higher priority than to perform the research in a safe and healthful manner. But nobody, other than yourself, can watch over you constantly to insure that you work safely.*

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# ***POLICY AND ADMINISTRATION***

## **SAFETY RESPONSIBILITIES**

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The ultimate responsibility for safety at Fermilab rests with the Laboratory Director, and through him to your division/section head to your supervisor and finally, to you. Within your division/section, a senior safety officer is available to assist you in carrying out your safety responsibilities.

The Environment, Safety and Health (ES&H) Section is responsible for oversight of the Laboratory ES&H program and is available for technical support, special services, and consultation.

## **YOUR SAFETY RESPONSIBILITIES**

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You are responsible for the safety aspects of your activities and for following all safety procedures applicable to your work. If you become aware of conditions or behaviors which may be safety violations, it is your responsibility to report such violations to your supervisor or division/section safety personnel. If you believe an assigned task to be a hazard to safety or health you should request a pre-performance review. Such a request will NOT be cause for disciplinary action.

Complaints regarding environment, safety or health concerns, either informally or formally, may be made to the Fermilab ES&H Section by calling x8069. If you feel it necessary, a formal, written complaint of a safety violation may be filed with the Department of Energy on DOE Form 5480.4. These forms are available from the ES&H Section, Wilson Hall, 7-E.

# GENERAL INFORMATION

## EMERGENCY PREPAREDNESS

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In any emergency, Dial **x3131** from any Laboratory phone, from a pay phone or cellular phone dial **1-630-840-3131**.

Be prepared to give the Emergency Operator the following information:

- The nature of the emergency
- The location
- Your name
- Other information the operator may require

AND remember to **STAY ON THE LINE** until the operator indicates that no more information is required and that help is on the way:

You should become familiar with the alarms in the area you are working and those that are used on site.

Ask for a familiarization walkthrough of the fire evacuation routes and the route to the nearest tornado shelter.

## ALARM SOUNDS

Location	Emergency	Sound	Actions
Indoors	Fire	Steady alarm	Exit building & meet at designated assembly point.
Indoors	Tornado	Voice instructions	Go to designated shelter area.
Indoors	Hazardous atmosphere*	Whooper alarm	Evacuate the area.
Indoors	Other emergency	Voice instructions	Follow voice instructions
Outdoors	Tornado	Steady siren	Go to nearest building shelter area.
Outdoors	National emergency	Warbling siren	Go to designated shelter area.

*\*Includes ODH and radiation.*

The Outdoor Sirens are designed to alert personnel who are outdoors and must NOT be used as an indoor alerting device as the sound is greatly attenuated at a short distance and it serves to alert for only one of several potential emergency conditions that may be experienced at FNAL.

## **HAZARD WARNING LIGHTS**

<b>COLOR</b>	<b>CONDITION</b>	<b>Action or status</b>
Red	DANGER	Stop, Do not enter, or Do not touch.
Blue	CAUTION	Hydrogen may be present in the area or system. A red light used in conjunction with a blue light indicates DANGER.
Yellow or Orange	CAUTION	Some hazard is present.

## **ACCIDENTS AND ILLNESSES**

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All injuries, no matter how small, must receive medical attention. In the event a serious injury or illness occurs onsite, dial **x3131** for immediate medical assistance.

For less serious conditions, but still needing medical attention, report to the Fermilab Medical Department during regular work hours (7 a.m.-5 p.m., Monday through Friday) or the Fermilab Fire Department at other times. The Medical Office is located in Wilson Hall, ground floor west. The Fermilab Fire Department is located at Site 38.

Occupationally incurred injuries and illnesses must be reported to the Fermilab Medical Department and your supervisor at the first opportunity.

## **TRAFFIC SAFETY**

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Fermilab observes State of Illinois Traffic Safety Rules and ***prohibits the use of cell phones when driving motor vehicles.*** Operators of all motorized vehicles and bicycles shall abide by these rules. Fermilab employs a corrective action process for both parking and moving violations. Corrective actions are based on a progressive disciplinary system which includes automated written warnings. Details of Fermilab Traffic Safety Rules and corrective actions can be found in the Fermilab ES&H Manual, Chapter 9010. <https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=432>

**Fermilab has identified five factors contributing to most on-site vehicle accidents:**

1. Improper Backing
2. Hazardous Weather Conditions
3. Distracted Driving
4. Speeding
5. Improper Road Sharing

**Safety tips:**

- **Backing:** Visually scan area around vehicle before entering. Check view in mirrors – right, left and rearview mirrors. Check blind spots that are not visible in mirrors. Back up no faster than a slow walk. Continue to watch over shoulder and check view in mirrors and NEVER back unless you can see clearly. **TIP:** Avoid backing by positioning your vehicle so that when you leave, you can just pull forward.
- **Hazardous weather conditions:** Remove snow and ice from all windows and roof. Allow front and rear windshields to completely defrost before driving. Watch for ice and black ice on curves. Reduce speed -- posted speeds are for dry surfaces. Drive slowly – it takes longer to accelerate, stop, or turn on slick pavement. Allow a following distance of at least ten seconds; start slowly, brake gently and cautiously.
- **Distracted driving:** *Fermilab prohibits the use of cell phones when driving motor vehicles*, pull over to a safe place to talk on the phone, text message, or email. Don't multitask and drive -- keep both hands on the wheel, eyes on the road and be ready for situations that could require quick action. Don't drive while drowsy.
- **Speeding:** Observe all posted speed limit signs; maximum speed site-wide is 40 miles per hour (mph) unless otherwise posted. Maximum speed in the village is 25 mph unless otherwise posted. Speed limit on Ring Road (Main Ring) is 20 mph. Reduce speed when approaching security guard shelters, in construction areas and where Roads and Grounds personnel are working.

- **Road sharing: *Bicyclists*** have the same rights and responsibilities as other roadway users and must observe the Illinois Rules of the Road. Bicyclists are required to travel in the same direction as vehicles and stay to the right as practical unless avoiding roadway hazards or following changes in traffic pattern. Motorists must maintain at least three feet of passing space when encountering a bicycle and not follow too closely. Vehicles should not park or drive in bicycle lanes.

***Motorcycle riders*** have the same rights and responsibilities as other roadway users. Watch for motorcycles before turning and yield right-of-way. A motorcyclist needs room to maneuver safely and is entitled to the entire lane – a motorist should not drive in the same lane next to a motorcyclist. Expect to see motorcycles in traffic at any time and include them in your visual search pattern.

- **Parking lots:** Observe timed and designated parking spaces. Drive slowly in parking lots; be aware of drive-through traffic, backing vehicles, pedestrians, and bicyclists.
- **Pedestrians:** Be aware of surroundings, stop and look in all directions before safely crossing roadway; cross in designated crosswalk areas. Don't assume vehicles will stop; make eye contact with the driver, don't just look at the vehicle. Be aware of moving vehicles, including bicyclists, while walking through parking lots. Be alert to engine noise or backup lights on cars when in parking lots and near on-street parking spaces. Watch for turning vehicles; make sure the driver sees you and will stop for you. Don't wear headphones or talk/text on a cell phone while crossing roadway or walking through parking lots.

Additional information can be found here  
[http://www.fnal.gov/pub/traffic\\_safety/](http://www.fnal.gov/pub/traffic_safety/) and  
<http://bss.fnal.gov/security/accidents.html>

## **FIRE SAFETY**

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You can help prevent fires by following these rules:

- Maintain a neat and clean work area. Prevent rubbish and other combustible materials from accumulating. Don't hoard boxes or crates; instead store them in specified storage areas or, better yet, recycle them. Store flammable and combustible materials in approved containers.
- Before starting any operation involving welding, brazing, or flame cutting, obtain a "Burn Permit" by calling the Fermilab Fire Department at x3428.
- Observe all "No Smoking" signs.
- Keep experimental areas neat.
- Keep flammable and combustible materials at least 18 inches away from appliances such as coffee makers, hot plates, space heaters, and other sources of ignition.
- Do NOT use highly flammable urethane foam or styrene without authorization by the ES&H Section. For installation of nonflammable foam for fire penetration sealing, call the Facilities Engineering Services Section at x3035.

If you see or smell a fire:

- Go to a safe place.
- If you pass a fire alarm box, pull the alarm.
- Call x3131 to report the fire.
- Do NOT attempt to use a portable fire extinguisher unless you have been trained to do so at Fermilab.

For more fire safety information, see Chapter 6000 of the ES&H Manual.

## **ES&H TRAINING**

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Training is designed to help you develop skills, acquire knowledge and competencies. ES&H training is provided to help you develop the skills and knowledge needed for your own protection as well as for regulatory compliance.

In order to work safely, you must be able to recognize hazards in your work environment and to respond appropriately. ES&H training is intended to prepare you to recognize hazards in your work environment and to protect yourself by responding appropriately. New employee ES&H orientation is required of everyone working at the Laboratory in an unescorted capacity. Other courses such as radiation safety training and ODH training are necessary to qualify for work in certain areas. The training you



need depends on both your work activities and the work environment. This training can be identified by completing an Individual Needs Assessment Survey (either electronically or hard copy) and the preparation of an individual training plan. Your supervisor or spokesperson will help insure you receive the ES&H training you need to work safely at Fermilab.

Other training appropriate to specific jobs should be arranged through your supervisor. See Chapter 4010 for further information.

## **SAFE LIFTING**

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Back injuries are one of the most costly injuries at the Laboratory. And certainly from the individual's perspective it is one of the most painful. It is vital that you do everything you reasonably can to prevent injuring your back. A person's ability to lift is not necessarily indicated by his/her height or weight. In some cases, a small person can lift heavier objects safely than a larger person. When in doubt, get help. Techniques that may help:

- Consider the size the weight of the object to be lifted. Do not lift more than you can handle comfortably.
- Before lifting, plan your move. How will you lift the object? Where will you move the object? Is the path clear? How will you set the object down?
- When lifting, bend at the knees. Get a good hold on the object and lift by straightening your knees. Keep the object as close to your body as possible. And NEVER, EVER twist while lifting or setting the object down.
- Never carry an object that you cannot see over or around.

## **HOUSEKEEPING**

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Good housekeeping means simply a place for everything and everything in its place. We must all do our part to keep our work areas clean and neat, not just for appearance but also to prevent accidents associated with slips, trips and falls; the prevention of fires, and for regulatory compliance. Suggestions for good housekeeping:

### **General**

- Keep your work areas clean and all aisle ways open.
- Trash and garbage should not exceed the capacity of the container.

- Observe the manufacturer's instructions on the use of space heaters, especially the placement of combustible in close proximity to the unit.
- Stairwells, air-handling rooms are not storage areas for combustible or flammable materials.
- Transformers, electrical panels, fire department risers all require the immediate area to be free of any obstructions.
- Flammable liquids cabinets, at the minimum should have a fully functional handle and latching mechanism, free of any non-manufactured holes in doors or body, shelves are to be used, containers are to be stored in an upright position, if necessary use of absorbent pads in the bottom to soak up any incidental liquids.
- Be watchful for the use the extension cords, daisy-chaining, buried under carpets, and strung across pathways.
- Areas should not host unauthorized products (automobile batteries, antifreeze, etc.) – items found in office areas.
- Filters should be checked on a periodic basis to determine if changing will be required sooner than the regular maintenance schedule.

### **Exits and Aisles**

- Exit signage and pathways must remain visible and passable and are not be obstructed by incidental objects (chairs, bikes, etc.).
- Any door that is marked as EXIT must be able to be opened and safely passed through and away from the building, especially in winter when snow and ice is an issue.
- Primary entrances to buildings should have an inclement weather plan for indoor and outdoor safety. Indoor safety-signs, mops, mats for wet, snow conditions. Outdoor safety-salt/sand shovels for snow conditions to keep main entrance, all building exits and primary path to building clear.

### **Work Issues**

- Replace or Add as needed all grating, toeboards, hole covers, guardrails, barricades, machine guards, and warning signs.
- Place oily rags in a closed container.
- Soldering should be done on an approved surface, in an area free of combustible material.
- Place waste materials in containers provided for such purposes. Never put chemical or regulated wastes into unmarked trash receptacles.
- Clean up your work area at the end of each shift or immediately after finishing a job.
- Do NOT leave equipment, tools, etc., in stairwells or on stairways as a trip hazard.

- Lead/Acid batteries- always tape the terminals to ensure there is no potential for the battery to short out during the handling and disposal process.

### **In Case of an Emergency**

- Immediately clean up any spills which may cause a slip hazard or an environmental impact. If the spill is too large for you to clean up or contain immediately, call **x3131**.

## **BLOODBORNE PATHOGENS**

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Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBV) are two of the most serious bloodborne viruses. HIV and HBV are normally transmitted through contact with blood or other body fluids from an infected person. Normally this occurs by sexual contact, shared drug needles, and sticks from used needles, etc. They are not transmitted by coughing or sneezing; by touching an infected person; or even by using the same equipment, facilities, showers, toilets, etc. To protect yourself against HIV and HBV, avoid direct contact or exposure to infectious blood or body fluids. The best way to do this is by not attempting to clean up other people's blood or other potentially infectious materials unless you have been trained to do so.

The most common scenario at the Laboratory is when a worker is injured by cutting or puncturing themselves and blood drips onto the floor or equipment. When possible the injured worker should clean up the blood or body fluid. This eliminates the risk of infection for others and no training is required to do this. Kits containing gloves, eye protection, swabs, and labeled bags are provided by the Medical Department for this purpose. For additional information, see Chapter 5072 in the Fermilab ES&H Manual.

# **INDUSTRIAL SAFETY**

## **RADIATION SAFETY**

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There are areas at Fermilab where exposure to man-made radiation can occur. These areas, designated as RADIATION AREA, HIGH RADIATION AREA, VERY HIGH RADIATION AREA, CONTROLLED AREA and RADIOACTIVE MATERIAL AREA, are posted with black (or magenta) and yellow signs indicating their boundaries.

Some areas of the Laboratory contain removable radioactivity, typically in the form of radioactive dust, rust, or grease, which could be picked up on shoes, hands, or clothing. Such areas are posted as CONTAMINATION AREAS. Contact a Radiation Safety Officer (RSO) or the ES&H Section for information on the training necessary to enter specific areas or work with specific materials. Certain areas, as specified by the Radiation Safety Officers, also require the wearing of a radiation badge to measure the radiation received. Instruction on how to procure such a badge and how to properly wear it is incorporated into the special training for radiation workers.

Some areas, such as experimental enclosures or target areas, are kept locked. When the accelerator is operating, the radiation levels in these areas may be high enough to cause serious injury or even death. Do NOT attempt to circumvent this security system.

Call x3131 to report all incidents/accidents involving radiation.

For more comprehensive information, refer to the Fermilab Radiological Control Manual.

## **ENVIRONMENTAL PROTECTION**

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Fermilab is committed to maintaining or improving the quality of community life by controlling the release of harmful materials and radiation, as well as by the conservation of natural resources located on site. In addition, the Lab has an extensive monitoring program to assure that potential environmental problems are identified and can be promptly addressed. For further information, see Chapter 8010 (Environmental Protection Program) of the ES&H Manual.

## **WASTE DISPOSAL**

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Several different types of wastes, i.e., hazardous waste, radioactive waste, and special non-hazardous regulated chemical waste, are generated from activities on site which support Fermilab's research program. The waste generator - person creating the waste - is responsible for packaging, labeling and characterizing his/her waste at the point of generation, and the ES&H Section is responsible for collection, temporary storage and shipment for disposal. Each division/section is responsible to train and assist waste generators to properly manage their waste. Ask your Waste Coordinator or contact ES&H Section staff for further information about identifying waste types and waste management procedures.

Never place hazardous, radioactive, or, special non-hazardous waste materials into trash receptacles or dumpsters. Never dispose of non-hazardous, non-radioactive liquid waste in surface waters or the sanitary sewer. Check with your Senior Safety Officer or ES&H Department before disposing of any waste. Ignoring these prohibitions is a violation of state and federal regulations which can result in serious environmental damage, expensive remediation, civil penalties, and criminal prosecution.

Additional information may be found in Chapter 8025 of the ES&H Manual.

## **PESTICIDES**

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Improper use of pesticides can present a significant threat to the environment. Therefore, Fermilab has contracted with a licensed pesticides applicator for controlling insects and rodents. Some pesticides are also applied by the Roads and Grounds Group in the Facilities Engineering Services Section. The small quantities of commercial pesticides available through the Laboratory stock system should only be used in accordance with instructions given on their labels. See ES&H Manual Chapter 8040.2 for more information.

## CHEMICAL HAZARDS

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You work with many hazardous substances during the course of your lifetime, both on the job and at home. Each chemical you encounter has its own risk. You need to know about hazardous materials before you work with them so you can protect yourself.

There are some actions you can take to keep yourself safe:

- Read the Safety Data Sheet (SDS) that outlines the hazards, handling procedures, and emergency actions for that chemical.
- Wear the required personal protective equipment to refuse your exposure to the hazard.
- Wash your hands and face before you eat, drink or smoke.
- Read the container label for information that can help you protect yourself. Every container must be properly labeled.
- Talk to your supervisor, spokesperson, Task Manager, or Senior Safety Officer if you have questions regarding the chemical, how to work with it properly or what to do if you spill or splash it on you.

## NOISE

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At Fermilab there are many noise sources such as compressors, heavy equipment (electric motors, diesel engines, etc.), sirens and air conditioning for computers. The majority of personnel exposures are not of sufficient intensity and/or duration to cause hearing damage, but communication may be difficult and the environment may be annoying. The limit for "continuous" noise is 85 dBA over eight hours. At this noise level, verbal communication is difficult at a distance of one foot. At this level, hearing protection - ear plugs or ear muffs - should be worn. In many work areas, signs requiring hearing protection are posted. ALWAYS wear hearing protection in these areas. Some people mistakenly think that they will "get used to the noise". They have been told that the human ear will "toughen up" and that the noise will not hurt. THIS IS A TOTAL MISCONCEPTION! In reality you will be losing your hearing. Don't take chances, use your hearing protection. The Laboratory provides ear plugs and ear muffs to all employees and users. See ES&H Manual Chapter 5061 for more information.

## **VIDEO DISPLAY TERMINALS**

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It has been demonstrated that video display terminals (VDT's) do not emit hazardous levels of radiation. Nonetheless, prolonged use can lead to eyestrain and sore muscles in the back, neck and shoulders. These problems can be controlled by minimizing glare and optimizing posture. There should be no reflections on the screen and there should be nothing else in the visual field which is significantly brighter than the screen. Your viewing distance should be about 18 inches, the screen should be tilted up 10-20° and you should make sure you can clearly focus on the characters. Sit up straight with your back and forearms well supported. If you still have problems, ask your supervisor for help.

## **LASER SAFETY**

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Lasers are employed extensively at Fermilab for alignment, as calibration sources and in holography. Radiation from Class I lasers cannot cause injury while that from Class II lasers can only damage the eye upon prolonged direct viewing. Accordingly, precautions for using these devices are minimal. Class III lasers are capable of causing eye injury before an exposed person can react and Class IV lasers can cause skin injury and even diffuse reflections from such devices can cause eye injuries. A special medical exam and training are required in order to use these more hazardous lasers. Precautions include direct supervision by a qualified laser operator, warning signs, locking the laser when not in use and protective eyewear. Lasers new to the Laboratory, whether purchased or borrowed, must be registered with and approved by the Laser Safety Officer.

See Chapter 5062.1 (Lasers) of the ES&H Manual for more information.

## **ELECTRICAL SAFETY**

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Electrical and electronic installations at the Laboratory must conform to the intent of the current edition of the National Electric Code. The standards of nationally recognized testing agencies, such as Underwriters Laboratory, must be observed in the selection of electric wiring, electrical/electronic devices and equipment. When no existing code or standard applies, the design of electrical and electronic installations must give prime consideration to the safety of personnel.

If you work on or around equipment with the potential of electrical shock, you should attend training about the hazards involved and actions which you should follow to prevent injury. Whenever possible, electrical equipment must not be worked on until it has been reliably deenergized.

## **MAGNETIC FIELDS**

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Although Fermilab makes extensive use of large magnets, most do not present an exposure hazard since the fields are usually constrained to the interiors of the magnets. The most important exceptions to this are the analyzing magnets which are used in fixed target research. Items containing ferrous materials should be used with great care in the vicinity of such magnets since there may be a strong rotational or attractive force. In addition, if you have a cardiac pacemaker stay away from any area where the magnetic field exceeds 5 gauss as the pacemaker may inappropriately switch operating modes. Also, if you have metallic implants, metallic prostheses, medical electronic devices or active sickle cell anemia you should not work in areas where there are obvious magnetic forces on ferrous objects. See Chapter 5062.2 (Static Magnetic Fields) for more information.



## **MATERIAL HANDLING EQUIPMENT**

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Powered Material Handling Equipment such as lift trucks (forklifts) and cranes, may be operated only by persons who have been formally qualified through training and by supervisor approval.

Lifting and moving of heavy objects should be done by mechanical devices whenever this is practical. The equipment used must be appropriate in size and design for the lifting and moving task. Heavy objects that require special handling or rigging must be moved by Fermilab contracted riggers or under the guidance of employees specifically trained to move such objects. The rated load capacity of the equipment must be displayed and must not be exceeded. In addition, each lifting device must be inspected before lifting.

Lift trucks, cranes and hoists are designed to move material not passengers. The operator is the only person permitted on the equipment. When loads are moved, they must never be moved over any personnel. Walking under a suspended load is strictly prohibited.

When powered material handling equipment is not available or necessary, remember that according to the National Safety Council, overexertion is the third leading cause for non-fatal injuries in the United States.\* Pacing yourself and moving properly can help make you more productive in the end. It's important to:

- Stretch and/or warm up before heavy lifting or strenuous activity.
- Know your limits. Don't be afraid to slow your pace or take a break if your body needs one.
- Lighten your load with a co-worker. Take the strain off with half the load and make extra trips.
- Avoid bending, reaching and twisting when lifting
- Lift with your legs bent and objects close to your body.

## **MACHINERY AND MACHINE TOOLS**

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Machinery and machine tools are by definition power driven equipment used to shape material by cutting or impact. Included in this category are lathes, mills, punches, presses, radial saws, planers, sanders, drills, and grinders. The operation, adjustment, or repair of any machinery or machine tool is restricted to experienced and trained personnel. All areas where machine tools

are used should be placarded to indicate that eye protection is mandatory for all persons in the area whether operating the equipment or not.

Never leave machinery running if you are not there to operate it. Materials such as metal stock or lumber must be removed from the machine and the power-down procedure carried out before leaving the area. Proper grounding and machine guards are required where applicable. Removing or circumventing machine guards which have been installed is strictly prohibited without approval of your supervisor.

## LADDERS

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All ladders used at Fermilab must meet the requirements set forth by the Occupation Safety & Health Administration (OSHA). Ladders must be appropriate for the job - proper length and type; e.g., metal ladders must never be used for electrical work or in areas where there is any probable contact with live electrical parts. Arrangements must be made for transporting tools and materials up and down ladders (i.e., use canvas bag or tie into bundles, etc.) so that you will have both hands free for climbing.

Misuse of ladders and the use of improvised ladders are responsible for a large percentage of the injuries resulting from falls. When a ladder is to be used, the following basic safe practices should be observed:

- Before use, visually inspect your ladder for obvious defects such as cracked or damaged side rails; missing, loose, or cracked rungs; loose, bent, or broken steps or spreaders; and worn or missing shoes.
- Never use a defective ladder.
- Straight ladders shall extend at least 3 feet above the highest landing to which access is intended.
- Climb no higher than the third rung from the top of a straight ladder, or the second step from the top of a step ladder.
- Work no more than an arm's length from the upright position. A good rule is to keep your belt buckle between the ladder side rails.
- Only one person at a time shall be on a ladder.
- Select firm footing. Place the feet of a straight ladder at least 1 foot out from the vertical plane for each 4 feet of height between the base and the support.
- Remove ladders at the end of your work. **Do not** climb or stand on improvised ladders such as chairs, barrels, drums, desks, or boxes.

- Select the right ladder for the job.

## **SCAFFOLDS**

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All scaffolds must conform to OSHA requirements. They are to be inspected and approved by a competent person prior to use. See your Senior Safety Officer for more information.

Climbing on handrails, midrails, or brace members as a means of access to the scaffold is forbidden. Use a secure ladder for entry. Fall protection is required if you are unable to erect proper guardrails or need to work from the rails. Check with your Senior Safety Officer to insure your work plan is appropriate.

## **GAS AND VESSEL SAFETY**

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Whenever a gas is pressurized or liquefied, its intrinsic toxicity, flammability and reactivity hazards are enhanced. In addition, there is an added risk of violent energy release via flying materials, whipping pipes and high velocity gas flow. (Related oxygen deficiency considerations are discussed in the Oxygen Deficiency Hazard Section in this Handbook.) With large vacuum systems, damage can lead to a rapid influx of air and entrainment of nearby objects including people.

NEVER smoke in compressed gas storage area - hydrogen, acetylene, or oxygen storage areas.

Information about intrinsic gas hazards can be found on manufacturer provided Safety Data Sheets (SDS's). In general, compressed/liquefied gases should only be used in large well-ventilated areas. Most liquefied gases also present a hazard of frostbite. Special precautions such as personal protective equipment, gas detectors or detailed risk-analyses may be required for high hazard applications.

See Section 5030 of the ES&H Manual for detailed gas and vessel safety information.

## **COMPRESSED AIR**

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One hazard of using compressed air in proximity to the human body involves the accidental injection of air under the skin. Proper procedures for use of compressed air in industrial applications include inspection of all connections to make sure they are secure, reducing the pressure to less than 30 psi for cleaning machinery, and the mandatory use of eye protection. Compressed air should never be used to clean personal attire or to direct against someone else in "horseplay".

## **WELDING AND CUTTING OPERATIONS**

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Only experienced personnel will be allowed to perform welding and cutting operations. Welding goggles and hoods, gloves, and aprons must be worn while welding and cutting. Shields and screens constructed of approved materials must be used to contain sparks, hot slag that could start a fire, and to avoid exposing others to harmful light rays. When welding and cutting equipment is not in use, the valves must be shut off at the cylinders and the torch. Flashback arresters are required on oxyacetylene systems. Ventilation in the area must be adequate to exhaust any toxic fumes produced in the operation. A Welding, Cutting, Brazing Permit which covers the specific location and job must be obtained from the Fire Department, Extension 3428, and displayed at all times. See ES&H Manual Chapter 2020 for detailed welding information.

## **FERMILAB WORK PERMITS**

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A Fermilab Work Permit is required for all construction projects conducted on the Fermilab premises unless the requirement has been waived by the division/section head for specific kinds of low-hazard projects. The individual responsible for obtaining the permit (and the necessary approvals) is that person who, as a Laboratory representative, authorizes the work to begin. A copy of the completed permit must be in possession of this person before work begins.

The Fermilab Work Permit includes: job identification, name of laboratory representative, name and address of contractor, location of job, brief description of job, starting and estimated completion dates, list of approval signatures and dates, and special conditions or requirements of the job. In order that the information is timely, the dates for the Fermilab Work Permit signatures should not be earlier than one week before the job actually begins.

## **CONFINED SPACES**

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A confined space is any enclosure for which entry and exits are limited and hazards may be present. Identifying characteristics include small opening(s) - ingress/egress is restricted, poor ventilation, infrequent access, isolation from help, and a relatively small volume. Typical confined spaces at the Lab include manholes, tanks, pipes, sump pits and Cerenkov counters. The atmosphere within a confined space may be oxygen deficient, toxic or flammable. There may also be physical hazards such as poor visibility, poor communication, poor footing, heat, radiation, rotating

equipment and electrical wiring. Some confined spaces require a permit before entering. You must complete a special training course to qualify to enter these spaces. Confined spaces can be deceptively dangerous. Do NOT enter a confined space unless necessary and you have the appropriate training and monitoring. See ES&H Manual Chapter 5063 for detailed information.

## HYDROGEN AREAS

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Hydrogen is colorless, odorless, non-toxic, highly flammable and explosive in the presence of air or oxygen in the right concentration. It forms a flammable mixture when it exists at 4 to 74% in air or 4 to 94% in oxygen. If ignited, unconfined hydrogen/air mixtures usually burn, but confined mixtures can be expected to explode. While hydrogen is not toxic, it can displace the air in a confined, unventilated space and cause asphyxiation. In addition, hydrogen will tend to form pockets of gas along ceilings which can lead to an explosion or fire hazard.

- In the design of experimental apparatus for use with hydrogen, special attention should be given to hydrogen embrittlement, a means of purging by vacuum or inert gas when necessary, a safe means of detecting leaks, the use of explosion-proof electrical equipment and proper ventilation to avoid the collection of pockets of gas.
- A flashing or rotating blue light is used at the Laboratory to indicate that hydrogen is present in experimental apparatus in the area.
- **Only trained personnel may be allowed to work in hydrogen areas.** Approval for incidental workers, i.e., maintenance personnel, janitorial and subcontractor personnel, must be obtained from the crew chief, department head or other responsible supervisory personnel.
- Welding, cutting and the use of open flame for burning are PROHIBITED in hydrogen areas without the express, written authorization of a division/section safety officer and the issuance of a Welding, Cutting and Brazing Permit.
- Hydrogen areas are designated NO SMOKING areas. Employees shall refrain from taking smoking materials (cigarettes, cigars, pipes, matches and lighters) into hydrogen areas.

## CRYOGENIC SAFETY

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Cryogenics involves the use of gases which liquefy at low temperatures. These include:

- Liquid Hydrogen: for targets for physics experiments and for bubble chambers.
- Liquid Argon: for detectors used for physics experiments and as a source of argon gas.
- Liquid Helium: for cooling superconducting magnet coils to the very low temperatures they require for operation.
- Liquid Nitrogen: for cooling traps in vacuum systems, for precooling and shielding helium refrigerated systems, for cold shocking equipment to test its low temperature integrity, and as a source of nitrogen gas.
- Liquid Oxygen: for cutting and welding operations.

See Chapter 5032 for additional information.

## OXYGEN DEFICIENCY HAZARDS (ODH)

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Air normally contains 21% oxygen. If the concentration at normal atmospheric pressure falls below 18%, harmful effects can occur - such as reduced senses, poor reasoning ability, dizziness, loss of consciousness and even death. The nature of, and the time to, a particular effect depends on how far below 18% the oxygen concentration gets. For instance, at 13% it may take several hours before a person will pass out, while at 6% or less it will take less than 15 seconds.

Certain operations have the potential to expose you to atmospheres which are oxygen deficient. In particular, those occurring near liquefied gas (cryogenic) systems such as superconducting magnets and associated equipment. If there is a leak in these systems, the escaping liquefied gas will expand about 700 times and push out the oxygen near the system. **To enter or work in these areas requires special medical screening and training.** See Chapter 5064 for additional information.

## **SUBCONTRACTOR SAFETY**

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Fermilab subcontractors conducting work on site are required to take all precautions necessary to protect the environment, health and safety of their employees, as well as that of other persons on and around the site. In part, this requires compliance with the Fermilab ES&H Manual and this Safety Handbook, the Illinois Rules of the Road and all DOE mandatory safety standards, especially OSHA, NEC and NFPA standards prescribed by DOE.

Subcontractors must provide any necessary safety training, medical surveillance, PPE, and other safety equipment required to perform their work. In cases where the potential hazards are not inherent to the subcontracted work activity, but rather a part of Fermilab activities (i.e., custodial subcontractors in radiation or ODH areas), the Laboratory may provide the appropriate training, medical surveillance, and safety equipment.

## **TRANSPORTING HAZARDOUS MATERIAL**

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**ONSITE:** Fermilab is a restricted-access site. Therefore, transportation of hazardous material on Fermilab roads is exempt from State and Federal Department of Transportation (DOT) regulations. Fermilab is committed to transporting hazardous material, including hazardous waste and hazardous substances, in a manner that ensures the protection of Laboratory personnel, the surrounding communities, and the environment. See ES&H Manual Chapter 9010 for more information.

**OFFSITE:** The offsite transportation of hazardous material, including hazardous waste and hazardous substances, shall be done in accordance with applicable Federal Department of Transportation regulations (49 Code of Federal Regulations).

Contact the ES&H Section x8386 for additional information.

## **PERSONAL PROTECTIVE EQUIPMENT**

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Personal Protective Equipment (PPE) is designed to protect you from obvious hazards within the working environment. There is no way of knowing just when and where an accident will occur; therefore, you should take the necessary precaution of protecting yourself at all times. Hard hats, safety glasses, safety shoes, gloves, face shields, etc. are passive protective devices which are designed to be worn at all times while in the presence of a hazard. This equipment will do you no good taking up space in your desk drawer or your locker when you should be wearing them. Personal protective equipment is one of the most important elements of the Fermilab safety program and provides you with the last barrier between you and the hazards in your work area. Using the equipment provided is obviously a personal decision; however, it cannot be stressed enough that this equipment can protect you and every effort must be made to ensure that you have the proper equipment which is comfortable to wear and available when you need it. Yes, management has the responsibility to identify the hazards in your work area and to provide the appropriate equipment but you must make a commitment to protect yourself by wearing it at all times when exposed to the hazards of the work environment.

Common items of PPE available at the Lab are identified in the chart on the next page. If you need an item of PPE which is not maintained at the Lab, see your Safety Officer.



Item	Stockroom Site 38	Some divisions/sections	ES&H Section WH7E	Offsite vendor locations	Village Machine Shop	Fire Department	Vendor "Shoemobile"
Aprons							
Clothing, Protective							
Dosimeter, Pocket							
Ear Muffs							
Ear Plugs							
Face Shields							
Glasses, Prescription Safety							
Glasses, Non-Prescription							
Gloves							
Goggles, Chippers							
Goggles, Welders							
Hats, Hard							
Respirators, Filter (incl "Dust Masks")							
Respirators, Self-Contained Breathing Apparatus							
Respirators, Self-Rescue ("Escape Packs")							
Shoes, Safety							

## LAB CLOSINGS

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If you want to know if the Laboratory is closed due to inclement weather or some physical condition (power outage, storm damage, etc.) information is available through the following sources.

Radio		Television	
WMAQ	670 AM	CBS 2	Ch. 2
WGN	720 AM	WGN	Ch. 9
WBBM	780 AM	FOX-TV	Ch. 32

You may also call the Laboratory for a pre-recorded message at (630) 840-5995. In the event of severe weather, i.e. blizzard, heavy snow accumulations, flooding, etc., there will be a message as to the status of the Lab. If you do not hear a recorded message and the phone continues to ring, assume the Lab is open for business.