

IMPORTANT SAFETY INFORMATION

INTRODUCTION

The objective of any safety program is to provide a safe working environment in which the hazards to all personnel are minimized. In order to accomplish this goal, safety must be the concern of all members of the institution. Suitable procedures must be devised and followed where potential hazards exist. Common sense must be relied upon to avoid accidents and expedience is never an excuse for unsafe activities. In the following pages, the safety regulations and procedures for the Mechanical Engineering Department are described. These procedures should be followed to ensure a safe environment for all our students, faculty and staff. Safety in our teaching and research laboratories is a direct responsibility of the faculty, staff and graduate assistants concerned with such activities.

SAFETY REGULATIONS

Posted in the Instrument Room and on the bulletin boards are the University instructions regarding accidents. These instructions include the appropriate telephone numbers and procedures to follow in case of an accident. In addition, all accidents must be reported to the Department Head's Office (137 Reber Bldg.) as soon as possible. In the case of any injury, please complete an injury report which can be obtained from boxes located near the Instrument Room (23 Reber) and the Machine Shop area. Failure to follow established Departmental safety procedures is considered to be a very serious matter and will be dealt with by the Head of the Department directly.

Employees are expected to work in a safe manner, using common sense to avoid accidents. Urgency of completing a test or the use of "expedient" procedures or equipment are no excuse for taking chances in the laboratory with unsafe conditions. However, even in situations where conscientious attention to safety is the rule, accidents can occur. When an accident does occur, it is vital to follow established procedures which will insure the safety of all personnel involved. Once these procedures have been followed, proper reporting of the accident to departmental personnel should follow.

The following safety precautions are particularly important to our operation:

1. An individual is not permitted to work alone at a potentially hazardous task. For example, graduate students or staff are not allowed to operate power tools or similarly dangerous equipment at night unless someone else is in the area.
2. Safety glasses or face shields are available at the Instrument Room. Wear them when operating power tools, around glass that might shatter, when using compressed gases, working on pressure line connections, etc.
3. Around electrical equipment, avoid chances of grounding one part of your body while using your hands near "hot" lines. "One hand in the pocket" is a good rule. Don't experiment with circuits you don't understand; call in a specialist.
4. Accumulation of fumes from volatiles such as gasoline, is a great hazard -- use proper ventilation.
5. Handling of compressed gas cylinders should be done with the respect afforded any potentially explosive material.
6. Storage of chemicals is not allowed in refrigerators unless the refrigerator is marked suitable for chemicals.

These items by no means, cover all the problem areas; they do serve as examples.

Experimental set-ups of a potentially dangerous nature (explosion, high-voltage, etc.) are not to be operated until inspected and approved by your advisor.

SAFETY IN THE LABORATORY

A. Undergraduates in the Laboratory

With the number of students approaching 600 or more each year, the introduction of new laboratory projects and exercises result in increased chances of accidents in the laboratory. It is the direct responsibility of each faculty member or teaching assistant concerned with laboratory work to:

1. Take every safety precaution in designing and directing laboratory work.
2. Continually observe students in action and to watch for unsafe practices and unsafe equipment.

Some examples of hazards are:

1. High voltages.
2. Eye hazards such as chemicals, compressed air or steam leaks, chipping and hammering. Safety glasses are required.
3. Moving machine parts, such as unguarded couplings or shaft ends, that could snap clothing.
4. Smoking with volatile, combustible liquids or gases nearby. **Smoking is prohibited in all University buildings.**
5. Compressed gas cylinders.

B. Graduate Students in the Laboratory

The Mechanical Engineering Department has a large research program which involves a wide variety of sophisticated equipment and apparatus. Some of these research activities involve potentially hazardous situations and require specific procedures for safe operation. Examples of such research areas include those involving combustion, laser diagnostics, solid propellants, high temperature and pressure conditions, etc.

It is the direct responsibility of each faculty member and graduate research student that safe procedures are observed in the laboratories. This includes:

1. Taking appropriate safety precautions in the design and operation of each experiment.
2. Assuring that students and staff engaged in operating equipment are familiar with its operation and potential hazards.
3. Providing that appropriate safety equipment is available in the laboratory. For example, safety glasses, respirators if required, etc.
4. Where appropriate, start up, shut down, and emergency shut down procedures should be developed.
5. Assuring that students are familiar with University and Departmental safety and accident procedures.

SPECIFIC LABORATORY SAFETY PROCEDURES

A. Shop Safety and Proper Use of Machines

Power tools can cause injury if precautions are not taken. The tools in the Centrum work area are there for your use. It is expected that students will follow safe shop practices when using them.

Some basic procedures to follow to prevent abuse of the machines and possibly yourself are:

1. Safety Goggles - Must be worn when operating any power tool. Also, when hammering or using a punch, chips can fly off these tools. Goggles are available from the Instrument Room.
2. When operating any power tool, jewelry, such as rings, bracelets, earrings, etc., should be removed.
3. Individuals who have long hair should use a hair net or other suitable means to prevent hair from being caught while operating any power tools.
4. Drill press - Material being drilled should be secured to the table using a drill vise or other suitable clamping arrangement. Wear goggles, drill bits can shatter. Be especially careful when drilling sheet metal or any thin material. Drill bits frequently grab the material when the bit "breaks through." This will instantly spin the work piece.
5. Bandsaw - The bandsaw is equipped with a multi-purpose blade. It can be used for wood, plastic, and metal. Avoid cutting sheet metal, it tends to grab the teeth on the blade, removing them in short order. Never push a work piece with your hand or fingers in the same plane as the blade. Should your hand slip, you may find yourself cutting your hand or fingers. Always adjust the blade guide so it is just above your work piece. This keeps the blade in alignment and vertical. The blade may come off its rollers if this isn't done.
6. Grinder - ALWAYS wear goggles. Never stand directly in front of the wheel, your piece can be grabbed or thrown by the wheel, often quite violently. Also, never grind wood, aluminum, or other soft metals or plastics on a grinder. Particles of these materials become clogged in the wheel, ruining its effectiveness. Also from a safety standpoint, this clogging can unbalance the wheel which could cause it to break, or more likely, explode, throwing pieces in the direction of the operator. Similarly, do not grind on the side of the wheel, the sideways stress can shatter the wheel.
7. General - Be courteous and professional. Horseplay doesn't belong around power tools; someone could fall into the machine and the distraction could cause another to have an accident, etc. Also, clean up after yourself when you are done. The debris left behind could lead to an accident.

B. Laser Safety

Lasers are utilized in a variety of research programs within the Department and when operated in a proper manner they do not pose a significant safety hazard. However, if operated improperly, they can pose significant electrical hazards as well as obvious hazards to eyesight. The following guidelines should be used when operating any laser system:

1. Do not attempt to use any laser unless you are familiar with its operation and potential hazards.
2. Where appropriate, use laser safety goggles designed for the wavelength and power output of that laser.
3. Never override the safety interlocks intended to prevent operation of the laser. For example, most laser systems prevent operation with the cover off the power supply or laser cavity.
4. When optical elements such as lens, prisms, etc., are used with the laser, be careful about spectrally reflected beams which result at each surface. These should be blocked to prevent personnel in the lab from potential hazards from reflected beams.
5. Never look directly into the laser beam.

C. Compressed Gas Cylinders

1. General Use

Compressed gas cylinders are safe for the purpose for which they are intended. Serious accidents connected with their handling, use and storage can almost invariably be traced to abuse or mishandling. The following rules cover the main safety rules to be observed in handling compressed gas cylinders. Information specific to certain gases follows.

- a. Compressed gas cylinders should always be moved using a cylinder cart. A cylinder cart is provided for that purpose next to the instrument room. The cart must be returned to that area immediately upon completion of the transfer.
- b. All compressed gas cylinders should be securely chained and stored only in approved areas.
- c. Where caps are provided for valve protection, such caps should be kept on cylinders except when cylinders are in use.
- d. Do not drop cylinders or permit them to strike each other violently.
- e. Make sure the regulator to be used is appropriate for the gas and cylinder pressure. Regulators or pressure gauges provided for use with a particular gas must not be used on cylinders containing different gases. Make sure that the threads on the regulator or other union are the same as those on cylinder valve outlet. Never force connections that do not fit or tamper with safety devices on valves, cylinders or regulators.
- f. After attaching the regulator and before the cylinder valve is opened, see that adjusting screw of the regulator is released. Open the cylinder valve slowly, never permit gas to enter the regulator suddenly.
- g. Before the regulator is removed from cylinder, close the cylinder valve and release all gas from the regulator.
- h. Never store cylinders near highly flammable substances, such as oil, gasoline, etc.
- i. All cylinders should be protected against excessive rise of temperature. Cylinders may be stored in the open, but in such cases should be protected against extremes of weather (ice, snow, direct sunlight in summer, radiators or open flames, etc.).
- j. Store full and empty cylinders apart to avoid confusion. When returning empty cylinders, provide documents, as required. Close the valve and see that the protective caps and nuts for valve outlets are replaced before shipping empties.
- k. Never attempt to mix gases in a cylinder.

2. Oxygen Use

- a. Never permit oil and greases to come in contact with oxygen cylinders, valve regulators, gauges and fittings. This is an explosive mixture.
- b. Do not handle oxygen cylinders or apparatus with oily hands or gloves.
- c. Never use oxygen from a cylinder without reducing the pressure through a suitable regulator intended for that purpose.
- d. After removing the valve cap, open the valve an instant to clear the opening of particles of dust or dirt.
- e. If the valve is difficult to open, point the valve opening away from you and use greater force. Avoid the use of a wrench on valves equipped with hand wheels.

- f. After attaching the regulator and before the cylinder valve is opened, see that the adjusting screw of the regulator is released.
- g. Never permit oxygen to enter the regulator suddenly. Open the cylinder valve slowly.
- h. Before the regulator is removed from the cylinder, close the cylinder valve and release all gas from the regulator.
- i. Avoid sparks or flame from welding or cutting torch from coming in contact with cylinders.
- j. Never interchange oxygen regulators, hose, or other appliances with similar equipment intended for use with other gases.
- k. Where oxygen cylinders are connected to manifolds or headers, such manifolds must be of proper design and equipped with one or more pressure regulators. Oxygen manufacturers will be glad to furnish specifications for construction and installation of proper oxygen manifolds and pipelines.
- l. Fully open the cylinder valve when the cylinder is in use.
- m. Never attempt to mix gases in an oxygen cylinder.
- n. Never use oxygen as a substitute for compressed air. It is dangerous to use oxygen for pneumatic tools, to start Diesel engines, for imposing pressure in oil reservoirs, for paint spraying, for blowing out pipelines, etc.
- o. Do not store cylinders near inflammable material, especially oil, grease, or any substance likely to cause or accelerate fire. Oxygen is not flammable, but supports combustion.
- p. Do not store reserve stocks of cylinders containing oxygen with reserve stocks of cylinders containing combustible gases. They should be separately grouped.

3. Acetylene Use

- a. Acetylene cylinders should be used and stored in an upright position to avoid possibility of drawing out acetone.
- b. Acetylene should never be used at a pressure exceeding 15 psi.
- c. Keep sparks and flame away from acetylene cylinders.
- d. Never use acetylene from cylinders through torches or other devices equipped with shut-off valves on the acetylene supply connections without reducing the pressure through a suitable regulator attached to the cylinder valve.
- e. After removing the valve cap, open valve an instant to clear opening of particles of dust or dirt.
- f. After attaching the regulator and before the cylinder valve is opened, see that the adjusting screw of the regulator is released.
- g. Before the regulator is removed from a cylinder, close the cylinder valve and release all gas from the regulator.
- h. Never interchange acetylene regulators, hose, or other appliances with similar equipment intended to be used with other gases.
- i. Never attempt to transfer acetylene from one cylinder to another nor to mix any other gas with it in the cylinder.

- j. Never use manifolds for acetylene cylinders unless constructed upon the advice of a qualified acetylene engineer.
 - k. The wrench used for opening the cylinder valve should always be kept on the valve spindle when the cylinder is in use.
 - l. When returning empty cylinders, see that valves are closed to prevent evaporation of acetone.
 - m. Never under any circumstances, attempt to refill an acetylene cylinder.
 - n. The pressure in an acetylene cylinder does not accurately indicate the amount of gas contained therein. The amount is determined by weight.
 - o. Never test for acetylene leaks with an open flame. Use soapy water.
 - p. Do not store reserve stocks of cylinders containing acetylene with reserve stocks of cylinders containing oxygen. They should be separately grouped.
4. Combustible Gas Use

Such as Blaugas, Butane, Calorene, Carbo-Hydrogen, Compressed Natural Gas, Hydrogen, Nugas, Pintsch Gas, Propane, Pyrogene, Thermoline, etc.

- a. Keep sparks and flames away from cylinders.
- b. Connections to piping, regulators, and other appliances should always be kept tight to prevent leakage.
- c. Never use an open flame to detect combustible gas leaks.
- d. When cylinders are not in use, keep valves tightly closed.
- e. Never use combustible gases from cylinders without reducing the pressure through a suitable regulator attached directly to the cylinder.
- f. After removing the valve cap, open the valve an instant to clear the opening of particles of dust or dirt.
- g. If the valve is difficult to open, point the valve opening away from you and use greater force. Avoid, however, the use of a wrench on valves equipped with hand wheels.
- h. After attaching the regulator and before opening the cylinder valve, see that the adjusting screw of regulator is released.
- i. Never permit the gas to enter the regulator suddenly. Open the cylinder valve slowly.
- j. Before a regulator is removed from a cylinder, close the cylinder valve and release all gas from the regulator.
- k. Manifolds for combustible gases should be used only if they are designed by qualified engineers. Gas manufacturers will furnish specifications for construction and installation of suitable manifolds.
- l. Never interchange combustible gas regulators, hose, or other appliances with similar equipment intended for use with other gases.
- m. Store all cylinders containing combustible gases in a well-ventilated place.
- n. Do not store reserve stocks of cylinders containing combustible gases with cylinders containing oxygen. They should be separately grouped.

5. Summary

Though they are somewhat similar to the preceding rules the following procedures given by the U.S. Department of Labor are more specific on some points:

Cylinders containing compressed gases should be examined upon receipt. If they show signs of damage or leakage, they should be moved to a safe area and be returned to the supplier as soon as possible. Great care is needed in handling all cylinders. They must not be dropped or bumped against each other, and other objects must not be allowed to fall on them. They should be stored and used in safe areas where they will be protected against falling objects, removed from any source of heat, and from electrical wiring. Cylinders intended for use from an upright position should always be stored and used in an upright position and secured by chain, cable, or other suitable means to prevent their falling over.

Most cylinders are provided with a steel protective cap that screws on over the valve. These caps should be kept in place at all times except when cylinders are in use.

A safe means of handling must be devised in order to avoid rough treatment while they are being transported. This would include providing special hand trucks, substantial racks or platforms with guard rails for vertical lifting by mechanical means, or other safety devices. When transported in motor vehicle, they should be fastened inside the body of the truck to reduce the possibility of being struck in the event of a traffic accident. Cylinders should not be lifted more than one at a time in slings and they should never be lifted by the valve protection cap.

Storage areas should be in fire-resistant structures, and should be kept clean, free of combustible materials, well-lighted, and well-ventilated. Cylinders of oxygen should not be stored near cylinders containing flammable gases. If they have to be stored in the same area, they should be separated by a fire-resistant wall. Empty cylinders should be so marked and kept separate from the full ones.

Cylinders should be positively identified as to the gases they contain. When a cylinder is empty, no attempt should be made to fill it with another kind of gas. Gases should never be mixed in a cylinder.

D. Mercury Spills

The following steps should be taken in case of an accident involving mercury spill.

1. Do not attempt to clean the mercury in the contaminated area. Mercury breaks into tiny particles and further contaminates the area. Special equipment is needed to insure contamination is controlled.
2. Mark the contaminated area.
3. Do not walk on the contaminated area.
4. Turn on the air exhaust if available.
5. Leave the room immediately.
6. Contact the University Environmental Health and Safety Office immediately (865-6391) and notify the Department Office as soon as possible.

E. Chemicals

When using any chemicals, be sure that you are knowledgeable concerning their properties and hazards. Material Safety Data Sheets (MSDS) are available and should be read for all chemicals. The University Environment Health and Safety Office (865-6391) has a large collection of MSDS and should be contacted for copies. Always wear safety glasses, and if appropriate, suitable gloves or

other required clothing. Information pertaining to MNE Chemical & Chemical Waste Management & Handling can be found on the MNE chemical waste website <http://www.mne.psu.edu/waste>.

Further general rules are:

1. Flammable liquid should be stored in and dispensed from approved safety containers and should be kept away from heat and open flames.
2. All chemicals should be stored in suitable cabinets.
3. Strong bases and acids which are supplied in glass bottles should be transported only in suitable bottles carriers (available in chemistry storeroom in Chandlee Lab 865-2351).
4. Smoking is not permitted anywhere in Reber Building or while handling chemicals or in storage areas containing chemicals.
5. Chemical storage areas, hoods and work space should be neat and well organized.
6. All containers containing chemicals must be labeled including waste materials.
7. Disposal of all chemicals should be done in a proper and safe manner. The University Safety Department should be consulted concerning proper disposal procedures.
8. The consumption of food and drinks is not permitted in chemical laboratory or storage areas.
9. If any spills or leaks (e.g. water) occur, please inform personnel in areas below or adjacent to the spill so that appropriate measures to protect personnel and equipment can be made.

F. Electrical Hazards

1. Only qualified personnel are allowed to work on electrical equipment or energized lines.
2. Sparks or smoke from a motor or other electrical equipment can mean a shock or fire hazard. Turn off the power at once and report the condition promptly.
3. Electrical equipment should not be operated in wet areas.
4. Electrical equipment possessing frayed or cracked cords should not be used until the cord is replaced.
5. Remove rings and jewelry which may result in electrical contact while working on electrical equipment.

EMERGENCY TELEPHONE NUMBERS

FIRE OR ACCIDENT - 911

POLICE SERVICES - 863-1111

AMBULANCE - 911 OR 863-1111

PHYSICAL PLANT (STEAM, ELECTRICITY, ETC.) - 865-4731

MECHANICAL EMERGENCY CONTACTS, PLEASE SEE

<http://www.mne.psu.edu/EmergencyContacts.html>

EMERGENCY PROCEDURES

IN CASE OF FIRE:

LOCATION OF NEAREST FIRE EXTINGUISHER _____

LOCATION OF NEAREST ALARM _____

- (1) SOUND THE FIRE ALARM
 - (2) DIAL 911
 - (3) GIVE YOUR NAME AND THE LOCATION OF THE FIRE
(Room number, Mechanical Engineering - Reber Building)
 - (4) SOUND THE FIRE ALARM
 - (5) PROCEED TO THE FIRST FLOOR LOBBY OUTSIDE ROOM 115 ELECTRICAL ENGINEERING WEST - THIS IS THE MECHANICAL ENGINEERING STAGING AREA (EVACUATION MEETING AREA). DO NOT LEAVE THIS AREA UNTIL INSTRUCTED TO DO BY APPROPRIATE UNIVERSITY OFFICIALS.
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IN CASE OF GAS LEAK/ODOR:

- (1) CALL POLICE SERVICES - 863-1111
 - (2) GIVE YOUR NAME AND DESCRIBE THE NATURE AND LOCATION OF THE EMERGENCY
 - (3) USE YOUR JUDGMENT ON SOUNDING THE ALARM
 - (4) IF BUILDING EVACUATION IS IN ORDER PROCEED TO THE MECHANICAL ENGINEERING STAGING AREA - THE LOBBY OUTSIDE 115 ELECTRICAL ENGINEERING WEST. DO NOT LEAVE THIS AREA UNTIL INSTRUCTED TO DO SO BY APPROPRIATE UNIVERSITY OFFICIALS
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IN CASE OF A TELEPHONE BOMB THREAT:

- (1) CALL POLICE SERVICES - 863-1111
 - (2) GIVE THEM ANY REQUIRED INFORMATION CONCERNING THE NATURE OF THE THREAT
 - (3) GIVE THEM THE NAME AND TELEPHONE NUMBER OF THE MECHANICAL ENGINEERING EMERGENCY CONTACT PERSON CLOSEST TO YOUR AREA (SEE <http://www.mne.psu.edu/EmergencyContacts.html>)
 - (4) CARRY OUT ANY INSTRUCTIONS GIVEN TO YOU BY POLICE SERVICES
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OTHER TYPES OF EMERGENCIES/ACCIDENTS:

- (1) CONTACT THE APPROPRIATE AUTHORITY USING THE TELEPHONE NUMBERS LISTED UNDER "EMERGENCY TELEPHONE NUMBERS" BELOW
 - (2) ALWAYS GIVE YOUR NAME, THE LOCATION, AND THE NATURE OF THE EMERGENCY
 - (3) IF POSSIBLE, NOTIFY THE MECHANICAL ENGINEERING EMERGENCY CONTACT PERSON CLOSEST TO YOUR AREA (SEE <http://www.mne.psu.edu/EmergencyContacts.html>)
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MECHANICAL ENGINEERING STAGING AREA (REPORT HERE IN THE EVENT OF BUILDING EVACUATION):

LOBBY ADJACENT TO 115 ELECTRICAL ENGINEERING WEST

MECHANICAL ENGINEERING EMERGENCY CONTACTS

<http://www.mne.psu.edu/EmergencyContacts.html>

IMPORTANT INFORMATION

1. Telephone Numbers

- a. Fire or Accident : 911
- b. Ritenour Health Center: 865-6556
- c. Ambulance: 911 or 863-1111

2. Mechanical And Nuclear Engineering Emergency Safety Coordinator

Mr. Jack Brenizer Jr.
138-A Reber Building
863-6384

3. College of Engineering Facilities Administration Officer

Clark W. Colborn
101 Hammond Bldg.
863-7137

4. Contents of First Aid Kit

Band Aid Adhesive Bandages
Adhesive Tape
Anti-bacterial Cleaning Wipes
1 in. Bandage (Roll)
2 in. Bandage (Roll)
8 ply Gauze
Sterile Gauze Pads
Tweezers

Ammonia Inhalants
Triangular Bandage
Eye Pads
Scissors
First Aid Book
Foile Ointment for minor burns
Merthiolate Tincture

5. First Aid Supplies Are Located in the Following Rooms and Areas

8 Reber - Mechanical Engineering Shop
23 Reber - Instrument Room (2 boxes)
137 Reber - M.E. Office