



# Laboratory and Workshop Safety Guidelines



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## Introduction

Laboratory work is an important component of science and science education. It is in the laboratory where one learns and observes the application of theory and experimentation. Careful, logical thinking can make laboratory work a joyful and enriching experience.

This guide has been prepared to provide the laboratory personnel, staff, and students, in AAST with the information necessary to protect them and the surrounding environment.

## Responsibilities

The responsibility for implementation of safety procedures is shared among head of department, staff members, and students.

### 1. Head of Department

Heads of department has an overall responsibility for ensuring that occupational health and safety standards and practices are implemented and maintained in the teaching facilities (i.e. laboratories and studios) by their respective supervisory staff.

- Staff and students receive the appropriate information, and instructions necessary for them to perform work safely
- Local occupational health and safety procedures are developed, documented and issued to staff and students as appropriate
- Facilities and equipment provided for staff and students are safe and suitable for the types of work to be carried out
- Financial provisions are made for occupational health and safety equipment and materials and the maintenance of occupational health and safety standards
- Hazard identification and risk assessment procedures are developed, documented and maintained for the use, handling, storage, transport and disposal of equipment, materials and substances and that appropriate risk controls are implemented and maintained

### 2. Staff and Students

All staff and students who undertake work in laboratories must take reasonable care of their own health and safety and the health and safety of others by:

- Taking action to avoid, eliminate or minimize hazards of which they are aware.
- Complying with all occupational health and safety instructions, policies, and procedures

- Making proper use of all safety devices and personal protective equipment
- Not willfully placing at risk the health and safety of any other person
- Seeking information or advice where necessary before carrying out new or unfamiliar work
- Maintaining dress standards appropriate for the work being done. Appropriate protective clothing and footwear must be worn at all times
- Being familiar with emergency and evacuation procedures and the location of emergency equipment
- Reporting all incidents and hazards through the appropriate emergency telephone number
- Near the main entrance of each laboratory you can find labels of special safety regulations specific to this lab. It is your responsibility to be aware of them.

## Fundamentals of Laboratory Safety

The laboratory contains many potential safety hazards. However, with proper control these hazards can be controlled. These guidelines outline general laboratory safety requirements

### 1. Safe practices

These are standard behavior for all personnel entering a laboratory.



- Food and drink are prohibited in all lab rooms.



- Non-slip, closed-in footwear and laboratory coat must be worn when in a laboratory. Open footwear such as open-toed shoes is not allowed.
- Long pants or long skirts are required when working with chemicals. You must limit exposed skin as much as possible. If you wear inappropriate clothing for lab, you will not be allowed to participate. Lab coats and protective gloves as well as goggles, are recommended at all times when handling chemicals.
- Hair that is shoulder length or longer must be pulled back. Long, loose sleeves, jewelry, etc. must also be secured to prevent being caught or dragged.
- Loose or torn clothing can fall into chemicals or become ensnared in equipment and moving machinery.



- Wash hands thoroughly after working in the lab.
- Wash skin areas which come in contact with chemicals, irrespective of concentration.



- Eye protection and any other protective equipment (e.g. gloves) is defined by the individual



- Never run in the laboratory or along corridors.
- Never indulge in reckless behavior in the laboratory.
- Do not carry out hazardous work in isolation in a laboratory.
- Lab activities require your undivided attention. No music allowed in student labs. Radios (including Walkman type) and other entertainment devices are not permitted. No cellular phone use.



- Never undertake any work unless the potential hazards of the operation are known as precisely as possible, and the appropriate safety precautions are adopted.
- Read all labels carefully. Be certain that the proper chemical is being dispensed. Check the warning labels for toxicity/hazards
- Follow the written lab procedure - laboratory activity at this level is not meant to be creative. Improper combinations or amounts of chemicals can be very dangerous. No unauthorized experiments are to be performed. If you are curious about trying a procedure not covered in the experimental procedure, consult with your laboratory instructor.
- When first entering a lab room, do not touch any

equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.

- Questions regarding safety/good lab practice should be immediately posed to the instructor. ***When in doubt, ask before acting!***
- Report any equipment failure to the instructor. Never attempt to adjust it without guidance.



- Clean up spills immediately.



- Contact lenses are discouraged



- Never pour unused chemicals back into the reagent bottle
- If last to leave the laboratory, make sure equipment is turned off
- Pipetting by mouth is not allowed; pipette pumps must be used.

## 2. Housekeeping

The following precautions are to be taken to ensure the safety of personnel within laboratories:



- Neatness in the laboratory is imperative. It is not only essential to successful work, but also effective in the reduction of accidents. The work area should be kept clear of all materials except those needed for the immediate task
- Keep drawers and cabinet doors closed and electrical cords off the floor

- Dust pans and brushes are available in each teaching laboratory for cleanup of broken glass. Broken glass containers are available in each laboratory for proper disposal of these materials. Never place broken glass in the trash can.
- Beware of glass/porcelain. The vast majority of lab accidents involve cuts from glass or burns from hot glass/porcelain. In the rush to clean up after a lab, students often neglect to allow sufficient time for equipment to cool down.
- Floors are to be kept tidy and dry

## SAFETY

- Keep all fire-escape routes completely clear at all times.
- Label all safety equipment and maintain it in good operating condition.
- Ensure that all safety equipment remains accessible to the laboratory personnel at all times.
- Learn where the safety and first-aid equipment is located
- Access to all emergency equipment (fire extinguishers, first aid kits, chemical spill kits, and eye washes) is to be kept free from obstruction

### 3. Glassware

The largest single cause of injury in the laboratory is broken glassware. The following precautions should be taken:



- Bottles and glassware are to be kept off the floor.
- Do not use broken or chipped glassware.
- All broken glass should be placed in bins that are marked broken glass only; broken glass should not be placed in normal waste bins.

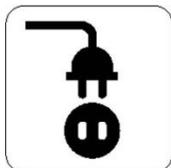
## 4. Emergency Management

In the event of fire or other emergency that may endanger staff and students the following procedures apply:

- In the event of a fire, alert others in the immediate area. Call Security on the telephone number indicated in the lab and they will contact and direct appropriate emergency personnel
- If you are a student, inform the nearest staff member
- When an alarm is raised proceed quickly to the nearest exit as directed by exit signs
- After leaving the building do not return to the building until the "All Clear" is given

## 5. Electrical and electronic aspects

### a. General aspects



- Electrical equipment must be properly grounded.
- Do not use electrical wires as supports.
- Inspect all equipment before use, checking for plugs and cords in good condition (not frayed), and that plugs are three wire grounded.
- Be aware of sources of sparks and static electricity when around or using any flammable materials and vapors. These sources include equipment with switches and running motors.

### b. UV lamps

UV lamps produce radiation that is damaging to the eye and skin and can cause severe sunburns. These lamps also can get hot and can cause burns.



- Wear goggles or glasses with side shields and brow bar. Be sure they are approved for UV use.
- Intense UV lamps produce ozone and must be used in a ventilated area.
- Do not touch glass portions of UV lamps. The oils from your skin can cause the lamps to overheat and crack.

### c. Laser



- Never look directly into the beam or pump source. Be sure you know what type of laser you are using (visible or invisible).
- Beware of objects that will reflect laser beam. Never point the laser into the room or out a window (lasers reflect off glass).
- Keep room light level HIGH. Low levels dilate pupils and increase eye damage hazard.

## First aid basics

**Eyes:** In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.

**Skin:** In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.

**Ingestion:** Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.

**Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

## Fundamentals of workshop safety

Never operate any equipment or perform any task with which you are not trained and familiar. Always wear the appropriate protection for the equipment you are working with.

### 1. Gas Cylinders

Compressed, liquefied or dissolved gases are categorized as Class 2 dangerous goods and sub-categorized as:

Class 2.1 Flammable gases identified by a red dangerous goods diamond (e.g. butane)

Class 2.2 Non-flammable and non-toxic gases identified by a green dangerous goods diamond (e.g. helium)

Class 2.3 Poisonous gases identified by a white dangerous goods diamond (e.g. ammonia)

In instances where the gas presents multiple hazards, additional diamonds indicate the subsidiary risks. For example, Chlorine Class 2.3 (toxicity) and Class 5.a (oxidizing agent)

## 2. Moving Cylinders

The majority of accidents involving gas cylinders occur while moving them from one location to another. The following control measures should be used to reduce the potential for an accident:

- The use of purpose-built trolleys or other suitable devices for gas cylinder transportation.
- Securing the gas cylinder valve, disconnecting and removing associated distribution equipment
- Shutting the cylinder valve, disconnecting and removing associated distribution equipment

## 5. Personal Protection

In all cases, eye and hand protection should always be worn. The need for additional safety protection, outlined below, will depend upon the operation being carried out and the quantity of liquid involved.

- Eye protection glass when transferring liquid or immersing objects when splashing may occur.
- Use appropriate safety clothing that minimizes the formation of traps capable of holding liquid near the skin
- Use enclosed footwear.
- Use earplugs to protect your hearing from high noise levels.
- Use dust masks for respiratory protection when needed

## Appendix A: Fire fighting

You should be aware of the following:

- The behavior of fire and how it spreads
- Classes of fires
- Proper selection and use of a fire extinguisher
- What to do in the event of fire

### General Fire prevention

Nothing is more true of fire than the old adage "prevention is better than cure".

- The value of the nightly routine of switching off and unplugging electrical equipment (unless the equipment concerned is designed to run continuously)
- Checking that gas fires and gas taps are turned off
- Welding and cutting equipment should never be used near flammable liquids or combustible materials

### Classes of Fires

#### **Class A:**

Fires are those which involve ordinary combustible materials such as wood, paper or cloth. These fires should be extinguished by using a dry chemical extinguisher. Water is effective in extinguishing these type fires.

#### **Class B:**

Fires are those which involve flammable liquids, gases, oil, paint and greases. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these type fires.

Note: flammable liquids may re-ignite after being extinguished. DO NOT USE WATER

#### **Class C:**

Fires are those which involve electricity. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these type fires. DO NOT USE WATER!

#### **Class D:**

Fires are those which involve combustible metals such as magnesium or sodium. Water can react with sodium and other alkali metals explosively, therefore DO NOT USE WATER! Also understand that CO<sub>2</sub> extinguishers are unlikely to be able to contain a Class D fire.

## Fire Extinguishers

There are three basic types of portable fire extinguishers. These include dry chemical, carbon dioxide and halotron extinguishers. These devices are to be used to extinguish small or beginning fires.

### CO<sub>2</sub> Fire Extinguishers

The carbon dioxide extinguisher is rated to extinguish Class B and C fires. The carbon dioxide is in the extinguisher as a liquid under pressure, and is discharged as a gas. Extinguishing is accomplished by removing the oxygen from the fire. Carbon dioxide is a “clean” agent which will evaporate and leave no residue.

### Dry Chemical Extinguishers

Dry chemical extinguishers are intended for use on Class A, B or C fires. Best results are obtained by attacking the near edge of the fire and progressing forward, moving the nozzle rapidly with a side-to-side sweeping motion. Discharge should be continued after flames are extinguished (especially on Class A fires) to prevent possible re-ignition.

All employees should be familiar with the location of extinguishers in his or her work area.

## Fire fighting procedure

Personnel in the area of the fire’s point of origin must follow the steps outlined in the **RACE** procedures:

**R** : Remove all persons in immediate danger to safety. This includes patients, visitors, students, or employees.

**A** : Activate manual pull station/dial emergency number.

**C** : Close all doors, windows to prevent the spread of smoke and fire.

**E** : Extinguish the fire.

To extinguish a fire, one should implement the **PASS** acronym which stands for:

**P** : Pull the pin

**A** : Aim the nozzle at the base of a fire

**S** : Squeeze the handle

**S** : Sweep the base of the fire

**WARNING:**

- Protection of human life must take priority over fighting fires.
- Lifts must not be used in the event of a fire.

**Clothing fires:** If clothing catches fire, call for help, get under the shower and pull the chain. If not near a shower, grab the nearest fire blanket, drop to the floor and roll in it.

*Note:* Never wrap vertically in a fire blanket as the chimney effect might draw flame upward toward the face. If neither safety shower nor fire blanket is close by, drop to the floor and roll.

*Important:* Never use a carbon dioxide fire extinguisher on a person as the intense cold may result in severe injury.

## Appendix B: Safety Guidelines for General Workshop Tools

### Air Compressor

POTENTIAL HAZARDS : High Pressures, Accelerated debris, & Noise

PROTECTIVE EQUIPMENT REQUIRED: Protective clothing, Eye protection, Hearing Protection

#### PRE-OPERATION

- Ensure good housekeeping in work area
- Do not wear loose clothing or Jewells
- Inspect Hoses, fittings, regulators, and valves before use, for damage
- Ensure all guards and shields in place
- Pipes that carry compressed air need to be labeled the direction of air flow marked.
- Shutoff valves should be identified so air can be isolated in an emergency situation.

#### OPERATIONAL SAFETY

- Use correct pressure rated hoses and fittings
- Flexible air hoses should be kept as short as possible to minimize tripping hazards and reduce whipping action from hose failure.
- High pressure lines should be anchored to prevent whipping
- Use a vacuum system rather than compressed air for cleaning.
- When using compressed air, direct air away from eyes and skin.
- To reduce noise exposure and prevent exhaust from the equipment or tool, direct the pressure relief valve away from work areas.

#### POST-OPERATION

- Always isolate tool before servicing or when not in use
- Ensure you clean up work area
- Place all tools used back where they belong

#### PROHIBITED

- DO NOT use compressed air to clean clothes, hair, or skin.

### Angle Grinder

POTENTIAL HAZARDS: High speed particles, Noise, Potential source of ignition, & Abrasions/lacerations

PROTECTIVE EQUIPMENT REQUIRED: Goggles Face shield, Hearing protection,

Dust, coat/overalls, Steel capped boots, & Long hair restrained

PRE-OPERATION:

- Ensure good housekeeping in work area Do not wear loose clothing, gloves or jewellery
- Inspect equipment before use for damaged parts and cords
- Check distance between work rest and wheel
- Choose the right size grinder for the job required
- Inspect wheels for nicks, cracks or damage
- Ensure all guards and shields in place
- Ensure you are familiar with the emergency stop position
- Use screens to protect others in area from debris

OPERATIONAL SAFETY:

- Ensure grinder is up to speed before contacting work piece
- Always grind so sparks are directed away from you or others
- Do not bump the disk into the work piece
- Use minimum pressure to avoid kicking or digging in
- Always work with proper lighting

POST-OPERATION:

- Always unplug tool before changing disks or when not in use
- Ensure you clean up work area
- Place any tools used back where they belong

PROHIBITED:

- Never use gloves while grinding

**Linisher**

POTENTIAL HAZARDS: Entanglement, Med velocity particles, Grazing, Burns, & Dust

PROTECTIVE EQUIPMENT REQUIRED: Protective clothing, Eye Protection, Steel capped boots, Long hair restrained, & Dust mask

PRE-OPERATION:

- Ensure good housekeeping in work area

- Do not wear loose clothing or jewellery
- Inspect equipment before use, for damaged parts and cords
- Ensure all guards and shields in place
- Check distance between work rest and wheel.

#### OPERATIONAL SAFETY:

- Check visually that finishing pad surface is in good condition.
- Wear dust mask if required
- Dip work piece in water or allow cooling regularly if getting hot

#### POST-OPERATION:

- Always isolate tool before servicing or when not in use
- Ensure you clean up work area
- Place all tools used back where they belong

#### PROHIBITED:

- Do not wear gloves while finishing

### **MIG Welder**

POTENTIAL HAZARDS: Hot materials, Burns to skin & eyes, Fire, Eye injuries, Fumes, & Falling objects

PROTECTIVE EQUIPMENT REQUIRED: Welding mask, Eye protection, Protective clothing, Steel capped boots, Long hair restrained, & Leather gloves

#### PRE-OPERATION:

- Ensure good housekeeping in work area
- Clear area of any flammable liquids and materials
- Ensure there is adequate ventilation/extraction and lighting in the area of operation.
- Do not wear loose clothing or jewellery
- Inspect equipment before use, for damaged parts lenses and gas lines
- Ensure all guards and shields in place

### OPERATIONAL SAFETY:

- Instruct others to avoid working close to the area where welding is to take place - if they are not associated with that operation.
- Position the flash blind in appropriate area to lessen the ultra violet light effect on other personnel.
- Locate cables away from the areas where there is a possibility of falling objects, which may damage cables.
- Adjust the welder to the appropriate settings to suit the job.

### POST-OPERATION:

- Always isolate tool before servicing or when not in use
- Ensure you clean up work area
- Place all tools used back where they belong

### PROHIBITED:

- Use near Flammable liquids vapours or substances

## **Milling Machine**

POTENTIAL HAZARDS: Debris, Entanglement, & Falling objects

PROTECTIVE EQUIPMENT REQUIRED: Protective clothing, Eye protection, Steel capped boots, Long Hair Restrained

### PRE-OPERATION:

- Ensure good housekeeping in work area
- Do not wear loose clothing or jewellery
- Inspect equipment before use, for damaged parts and cords
- Ensure all guards and shields in place
- Ensure you are familiar with the emergency stop.
- Use correct milling bit for job.

### OPERATIONAL SAFETY:

- Clamp work piece securely in vice and / or to table.
- Ensure to always use sharp milling bits and cutting fluids where possible to reduce friction and cutting forces.
- Use the correct cutting speed for Milling bit size and material.

#### POST-OPERATION:

- Always isolate tool before servicing or when not in use
- Ensure you clean up work area
- Place all tools used back where they belong

#### PROHIBITED:

- Do not handle swarf with bare hands

### **Oxy Welder**

POTENTIAL HAZARDS: Hot materials, Burns to skin & eyes, Fire, Eye injuries, Fumes, Falling objects

PROTECTIVE EQUIPMENT REQUIRED: Welding mask, Eye protection, Protective clothing, Steel capped boots, Long hair restrained, Leather gloves

#### PRE-OPERATION:

- Ensure good housekeeping in work area
- Clear area of any flammable liquids and materials
- Ensure flash back arrestors are fitted to both gas lines
- Ensure there is adequate ventilation and lighting in area of operation.
- Check for damage to handpieces which can allow heat transfer to hand.
- Check for damage to face shield lenses and gas lines
- Do not wear loose clothing or jewellery
- Inspect equipment before use, for damaged parts lenses and gas lines

#### OPERATIONAL SAFETY:

- Instruct others to avoid working close to the area where welding is to take place - if they are not associated with that operation.
- Position the flash blind in appropriate area to lessen the ultra violet light effect on other personnel.
- Locate gas lines away from the possibility of falling /sharp objects
- Adjust the welder to the appropriate settings to suit the job.

#### POST-OPERATION:

- Always isolate tool before servicing or when not in use
- Ensure you clean up work area

- Place all tools used back where they belong

PROHIBITED:

- Use near Flammable liquids vapours or substances

## Appendix C: Safety signs



Wear protective shoes



Laser beam



Wear protective gloves



Electric Shock hazard



Wear protective goggles



Ultra Violet radiation



Wear ear protection



Corrosive material



Respiratory protection



Radioactive material



Fire extinguisher



No Food or drink



Fire hose reel