

**6**

# LABORATORY SAFETY AND STANDARDS PRECAUTIONS

## 6.1 INTRODUCTION

Working in a laboratory usually involves working with various chemical, physical, and biological hazards. Because the hazards vary from laboratory to laboratory, employers must address the hazards specific to their laboratories. Standard precautions are meant to reduce the risk of transmission of blood borne and other pathogens from both recognized and unrecognized sources. They are the basic level of infection control precautions which are to be used, as a minimum, in the health care settings.



## OBJECTIVES

After reading this lesson, you will be able to

- describe preparing the laboratory
- explain about common symbols used in laboratories
- explain fire safety and prevent fire accidents in the laboratories
- describe and follow equipment safety
- explain and follow universal standard precautions

## 6.2 PREPARING FOR LABORATORY WORK

Before starting to work in a laboratory, you must familiarize with the following:

- The hazards of the materials in the lab, as well as appropriate safe handling, storage and emergency protocols. Read labels and material safety data

## MODULE

Microbiology



Notes

### Laboratory Safety and Standards Precautions

sheets (MSDSs) before moving, handling or opening chemicals. Never use a product from an unlabeled container, and report missing labels to your supervisor.

- The agents, processes and equipment in the laboratory. If you are unsure of any aspect of a procedure, check with your supervisor before proceeding.
- The location and operation of safety and emergency equipment such as fire extinguishers, eye wash and shower, first aid and spill response kits, fire alarm pull stations, telephone and emergency exits
- Emergency spill response procedures for the materials you will handle

#### During laboratory work

- Restrict laboratory access to authorized persons only. Children are not permitted in labs.
- Smoking; eating; drinking; storing food, beverages or tobacco; handling contact lenses are not permitted in laboratories.
- Wear lab coats (knee length) and safety glasses in laboratories employing chemicals, biohazards or radioisotopes. Open shoes, such as sandals, should never be worn in the lab.
- Keep work places clean and free of unwanted chemicals, biological specimens, Avoid leaving reagent bottles, empty or full, on the floor.
- Work only with materials once you know their safe handling and storage.
- Never pipette by mouth; use mechanical transfer devices.
- Keep exits and passageways clear at all times.
- Ensure that access to personal protective equipments are not blocked.
- Report accidents and dangerous incidents (“near-misses”) promptly to your supervisor
- Wash your hands thoroughly before leaving the laboratory.
- Perform procedures that liberate infectious bio-aerosols in a biological safety cabinet
- Handle all human blood and body fluids as if potentially infectious.

#### Cleaning up before leaving

Perform a safety check at the end of each experiment and before leaving the lab. make sure to:

- Turn off gas, water, electricity, vacuum and compression lines and heating apparatus

## Laboratory Safety and Standards Precautions

- Return unused materials, equipment and apparatus to their proper storage locations
- Dispose of all waste material.
- Remove defective or damaged equipment immediately, and arrange to have it repaired or replaced
- Decontaminate any equipment or work areas that may have been in contact with hazardous materials.
- Leave behind protective clothing (lab coats, gloves, etc.) when leaving the laboratory.

## MODULE

Microbiology



Notes

### 6.3 SYMBOLS TO BE IDENTIFIED BY ALL LABORATORY TECHNICIANS

Compressed Gas



Flammable and Combustible Material



Oxidizing Material



Poisonous and Infectious Material  
(Materials Causing Other Toxic Effects)



Poisonous and Infectious Material  
(Biohazardous Infectious Materials)



Corrosive Material



Dangerously Reactive Material



## 6.4 FIRE SAFETY

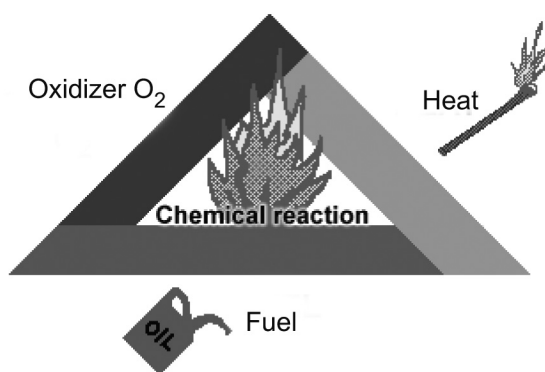


Notes

Laboratory fires can be caused by Bunsen burners, runaway chemical reactions, electrical heating units, failure of unattended or defective equipment, or overloaded electrical circuits. Familiarize yourself with the operation of the fire extinguishers and the location of pull stations, emergency exits and evacuation routes where you work. In the event that the general alarm is sounded use the evacuation routes established for your area and follow the instructions of the Evacuation Monitors. Once outside of the building, move away from the doors to enable others to exit.

### The fire triangle

Fire cannot occur without an ignition source, fuel and an oxidizing atmosphere (usually air), the three elements that comprise what is called the “fire triangle”:



Fire will not be initiated if any one of these elements is absent, and will not be sustained if one of these elements is removed. This concept is useful in understanding prevention and control of fires. For example, the coexistence of flammable vapours and ignition sources should be avoided, but when flammable vapours cannot be controlled elimination of ignition sources is essential.

Learn how to use the extinguisher in your lab, as there will be no time to read instructions during an emergency. Attempt to fight small fires only, and only if there is an escape route behind you. Remember to have the extinguisher recharged after every use.

- **P:** Pull and twist the locking pin to break the seal.
- **A:** Aim low, and point the nozzle at the base of the fire.
- **S:** Squeeze the handle to release the extinguishing agent.
- **S:** Sweep from side to side until the fire is out.
- Be prepared to repeat the process if the fire breaks out again

## 6.5 GLASSWARE SAFETY

Use a dustpan and brush, not your hands, to pick up broken glass. Discard broken glass in a rigid container separate from regular garbage and label it appropriately.

### Equipment Safety

Every effort should be made to prevent equipment from becoming contaminated. To reduce the likelihood of equipment malfunction that could result in leakage, spill or unnecessary generation of aerosolized pathogens:

- Review the manufacturer's documentation. Keep for future reference.
- Use and service equipment according to the manufacturer's instructions.
- Ensure that anyone who uses a specific instrument or piece of equipment is properly trained in setup, use and cleaning of the item.

Ensure that equipment leaving the laboratory for servicing or disposal is appropriately decontaminated. Complete a Certificate of Equipment Decontamination.

### Centrifuges

- Check glass and plastic centrifuge tubes for stresslines, hairline cracks and chipped rims before use. Use unbreakable tubes whenever possible.
- Avoid filling tubes to the rim.
- Use caps or stoppers on centrifuge tubes. Avoid using lightweight materials such as aluminum foil as caps.
- Use sealed centrifuge buckets (safety cups) or rotors that can be loaded and unloaded in a biological safety cabinet. Decontaminate the outside of the cups or buckets before and after centrifugation. Inspect o-rings regularly and replace if cracked or dry.
- Ensure that the centrifuge is properly balanced.
- Do not open the lid during or immediately after operation, attempt to stop a spinning rotor by hand or with an object, or interfere with the interlock safety device.
- Decant supernatants carefully and avoid vigorous shaking when re-suspending.

### Heating baths, water baths

- Never use laboratory ovens for preparation of food for human consumption
- Glassware that has been rinsed with an organic solvent should be rinsed with distilled water before it is placed in a drying oven.



Notes

**6.6 UNIVERSAL / STANDARD PRECAUTIONS****Notes****Universal Precautions**

These guidelines refer to the precautions, consistently used for all patients regardless of their infection status and diagnosis. The main objective is to prevent exposure of staff and patients to blood and body fluids.

- Don't eat, drink, smoke or apply cosmetics (including lip balm).
- Don't insert or remove contact lenses.
- Don't bite nails or chew on pens.
- Don't mouth pipette.
- Limit access to the laboratory to trained personnel only.
- Assume all patients are infectious for HIV or other blood borne pathogens.
- Use appropriate barrier precautions to prevent skin and mucous membrane exposure, including wearing gloves at all times and masks, goggles, gowns or aprons if there is a risk of splashes or droplet formation.
- Wash hands thoroughly and other skin surfaces after gloves are removed and immediately after any contamination.
- Avoid injuries to sharps such as needles and scalpels.

**Standard Precautions**

In 1996, CDC developed a new system of standard precaution synthesizing the features of universal precautions and body substance isolation. Standard precautions are used in the care of all patients and apply to blood, all body fluids, secretion and excretion except sweat regardless of whether they contain visible blood.

Standard precautions are guidelines and procedures designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in healthcare settings.

**Standard Precautions Include**

- Hand washing
- Barrier protection
- Safe handling of sharp items
- Safe handling of specimen (blood etc)
- Safe handling of spillage of blood/body fluid
- Use of disposable/ sterile items

### Hand Washing

Single most important method to limit cross transmission of nosocomial pathogens

Multiple opportunities exist for HCW hand contamination by Direct patient care and Inanimate environment

**This is an ideal safety precaution and gloves should not be regarded as a substitute for hand washing.**



Notes

### For General Patient Care (Hand Contamination)

- Wash hands thoroughly in running water with soap without missing any area. For effective hand washing first wash palms with fingers followed by back of hands, knuckles, thumbs, fingertips and wrists,. Rinse and dry thoroughly.
- Wash hand immediately after accidental contamination with blood/body fluid, before eating and drinking and after removing gowns/coats and gloves.
- Leave soap bars in dry containers to prevent contamination with microorganism.



Palm to palm



Right palm over left dorsum and left palm over right dorsum



Palm to palm fingers interlace



Backs of fingers to opposing palms with fingers interlocked



Rotational rubbing of right thumb clasped in the left palm and vice versa



Rotational rubbing backwards and forwards with clasped fingers on right hand in left palm and vice versa

The 6 stages of effective hand hygiene

**Notes****For Hand Disinfection (Hygienic Hand Wash)**

Required in high risk health care settings (ICU, neonatal units, nursery)

- Use 2-4% chlorhexidine gluconate/ detergent solution, povidone iodine/ detergent solution containing 0.75% available Iodine.
- Do not use alcoholic hand rubs as substitute for hand washing except for rapid hand decontamination between patient contacts.

**Barrier Protection****Gloves**

- Wear while collecting/ handling blood specimens and blood soiled items.
- Wear while disposing waste.
- Remove before handling door knobs, telephone, pens performing office work.
- Discard if cracked, discoloured or punctured.
- Discard if blood spills on them.
- Don't reuse disposable gloves.
- Wash hands when gloves are removed or changed.

**Masks**

- Wear masks and protective glasses if splashing or spraying of blood/body fluids is expected.
- Mask of cotton wool, gauze, or paper masks are ineffective. Paper mask with synthetic material for filtration are an effective barrier against microorganism.

**Caps**

- Cover hair completely in aseptic units, operating rooms, or performing selected invasive procedure.

**Gown and Aprons**

- Wear clean clothes made up of a material easy to clean.
- Change after exposure to blood and body fluids.
- Wear gown or apron of plastic or water resistant paper when splashes of blood or other body fluids are likely to occur e.g. during surgery, obstetric procedure, invasive procedure, post mortem and embalming.



### Occlusive Bandage

- Cover all skin defects e.g. cuts, scratches or other breaks with waterproof dressing before patient care.

### Safe Handling of Sharps

- Take extreme care to avoid autoinoculation.
- Discard all chipped or cracked glassware in appropriate containers.
- Don't manipulate disposable needles. Never bend, break, recap or remove needle from syringe.
- Dispose your own sharps. Don't pass used sharps directly from one person to another.
- Discard needles in puncture proof rigid containers (Plastic or cardboard boxes) after disinfection in 0.5-1% sodium hypochlorite solution. Use needle shredder if available for needles or needles along with syringe nozzle.
- Send sharp disposable containers for disposal when three-fourth full.

### Safe Handling of Specimen

- Collect specimens, specially blood and body fluids in pre sterilized containers properly sealed to prevent leakage or spillage.
- Use autoclaved/ pre-sterilized disposable syringes and needles for venepuncture and lancets/ cutting needles for finger pricks.
- Cover cuts in hands properly with waterproof adhesive bandages.
- Wear disposable gloves while collecting blood/body fluids and maintain proper asepsis.
- Wash hands thoroughly with soap and water, particularly after handling specimens.

### Safe Handling of Blood/Body Fluid Spills

- Cover spills of infected or potentially infected material on the floor with paper towel/ blotting paper/ newspaper.
- Pour 1% sodium hypochlorite solution on and around the spill area and cover with paper for at least 30 minutes.
- After 30 minutes, remove paper with gloved hands and discard.



Notes



Notes

**Use of Disposable Sterile Items**

- Ensure proper handling of disposable/ sterile item before use.
- There should be no recirculation of disposable items.

**WHAT HAVE YOU LEARNT**

- The laboratory needs to be prepared for work both before and during the work
- Laboratory fires can be caused by bunsen burners, runaway chemical reactions, electrical heating units, failure of unattended or defective equipment, or overloaded electrical circuits
- Fire cannot occur without an ignition source, fuel and an oxidizing atmosphere (usually air), the three elements that comprise what is called the “fire triangle”:
- Every effort should be made to prevent equipment from becoming contaminated.
- Take appropriate measures to reduce the likelihood of equipment malfunction that could result in leakage, spill or unnecessary generation of aerosolized pathogens
- Glassware that has been rinsed with an organic solvent should be rinsed with distilled water before it is placed in a drying oven.
- Standard precautions include Hand washing, Barrier protection, Safe handling of sharp items, Safe handling of specimen (blood etc), Safe handling of spillage of blood/body fluid, Use of disposable/ sterile items
- Hand Washing is an ideal safety precaution and gloves should not be regarded as a substitute for hand washing.
- Wash hands thoroughly in running water with soap without missing any area. For effective hand washing first wash palms with fingers followed by back of hands, knuckles, thumbs, fingertips and wrists,. Rinse and dry thoroughly.
- Wash hand immediately after accidental contamination with blood/body fluid, before eating and drinking and after removing gowns/coats and gloves.
- Use barrier protection like Gloves, Masks, Caps, Gown and Aprons, Occlusive bandage
- Sharps must be handled safely and injury must be prevented

## Laboratory Safety and Standards Precautions

- Safety precautions are to be followed while handling specimens and Blood/body fluid spills



### TERMINAL QUESTIONS

1. What are standard precautions
2. How would you handle blood/body fluid spills
3. Write measures to prevent fire accidents
4. Explain steps of hand washing

## MODULE

Microbiology



Notes