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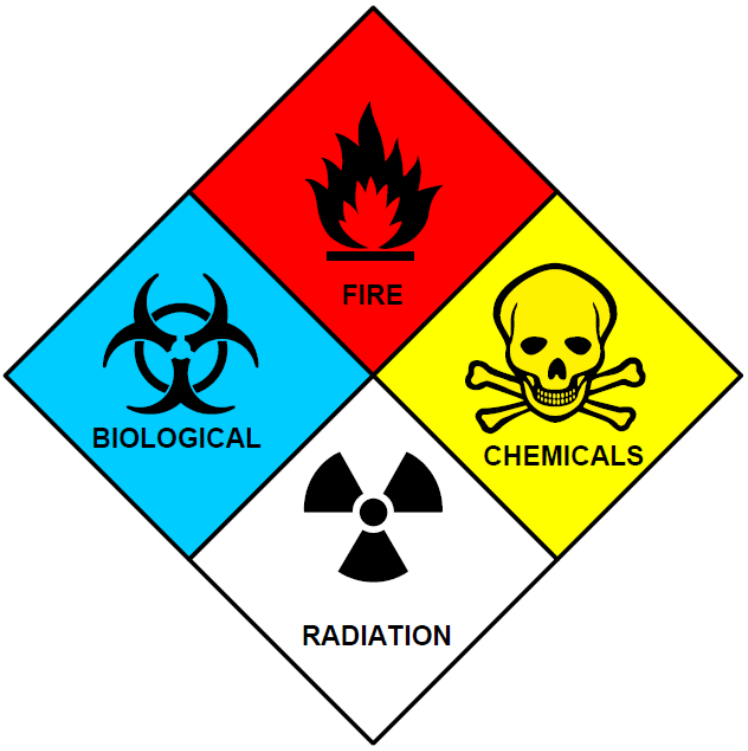
THE CENTRAL LABORATORIES



LABORATORY SAFETY MANUAL

2016

Table of Contents

Central Labs Director‘s Message

This manual is intended to be a safety reference document for laboratory workers at the University of Sharjah. It provides basic information about hazards that may be encountered in the laboratory and safety precautions to prevent laboratory accidents and minimize exposure to hazardous chemicals and equipment.

Each laboratory which uses hazardous materials or equipment is required to have a copy of this manual readily available to employees and students in the laboratory along with certain other materials described in this manual. It is important that each laboratory worker be familiar with the contents of the manual and the procedures for obtaining additional safety information needed to perform their duties safely. It is mandatory that each lab supervisor will explain all necessary material to the students in the first laboratory session to prevent laboratory accidents and minimize exposure to hazardous.

One of the most fundamental aspects of safety in practical teaching and research is good laboratory housekeeping. This includes the proper storage and handling of chemicals, gas cylinders, electrical equipment and so on. The appearance and organization of our facilities directly affects their safety and productivity as well as our University reputation. There are two golden rules in developing a safe and productive environment:

1. Whenever you use a lab, it is your responsibility to see that unsafe conditions are corrected immediately
2. Always leave a laboratory in better condition than you found it.

If we all take this level of personal responsibility, our facilities can only improve.

This manual is prepared by Central labs with the help of the concerned departments at the university.

In order to keep the contents of this manual up-to-date with current regulations and best practices, Central Labs may periodically rewrite, add or delete sections. Central Labs will notify all concerned Colleges of the changes. The manual will be published on the Central Laboratories website. Comments and suggestions for improving the manual are welcome and encouraged.

Mahmoud Abu Shammeh
Director, Central Laboratories, UoS

Chapter 1 - General Laboratory Safety

1.1 - Introduction

This section is intended to provide general guidelines for laboratory safety as the basis for maintaining a safe environment for laboratory users. Laboratory supervisors should develop rules that are specific for his or her laboratory. As a laboratory user, it is your responsibility to ensure that all regulations are observed prior to any operations.

1.2 - General Laboratory Safety Guidelines

1. Determine the potential physical, chemical and biological hazards and the appropriate safety precautions before beginning any new or modified procedures
2. Familiarize with the emergency procedures, alarms and evacuation routes. Know the location of emergency phone, emergency eyewash, safety showers and fire extinguishers and its proper operating procedures
3. Do not smoke, apply make-up, and consume food or beverages in laboratories. Never store food or drink in laboratory refrigerators
4. Know the types of and the use of personal protective equipment available for your laboratory operation
5. Wear protective clothing and gloves that are not permeable to the chemicals being used
6. Proper eye protector must be worn in laboratories when handling with hazardous chemicals, dangerous machinery, laser equipment or biological agents
7. Long hair and loose clothing should be confined when in the laboratory. Shoes must be worn at all times. Sandals or open toe shoes must not be worn in the laboratory
8. All containers of chemicals should be correctly and clearly labeled. The label should provide hazard and safety information about the chemicals to other laboratory users
9. All chemical wastes should be disposed of appropriately to the corresponding waste containers, log sheet should also be filled in properly
10. Equipment should only be used for its designed purpose and should not operate any equipment that you are not familiar with
11. Mouth pipette of chemicals must not be allowed. A pipette bulb or aspirator for pipetting chemicals should be used
12. Exposure to gases, vapors and aerosols should be minimized. Appropriate safety equipment in conjunction with fume cupboard should be used whenever such exposure is expected

13. Report any faulty equipment to laboratory staff and obtain a properly functioning unit. Faulty laboratory equipment might pose danger to laboratory users if operated unknowingly. It may result in personal injury or malfunction of other equipment
14. Mobile phones are not to be operated at any time within a laboratory. Mobile phones might cause disturbance to other laboratory users, and also cause signal interference
15. Students who fail to abide by these regulations will be told to leave the laboratory. This is necessary to keep order in the laboratory

1.3 - Housekeeping and Maintenance

1. Eliminate safety hazards by maintaining laboratory work areas in a good state of order. Clean up should follow the completion of any operation or at the end of each day
2. Chemical wastes should be kept segregated by hazard class and deposited in designated containers
3. Keep laboratory floor dry at all times. Attend to spills of chemicals / water and warn other laboratory workers of the potential slipping hazards
4. Do not use stairways and hallways as storage areas and never block access to exits, emergency equipment, or gas shut-off valve
5. Laboratory equipment such as fume cupboards, centrifuges, vacuum pumps and ovens should be inspected and maintained regularly. The maintenance work should be carried out by authorized personnel and be documented

1.4 - Warning Placard

1. A warning placard is posted at the entrance of each laboratory to provide indication of the possible hazards in that laboratory and the appropriate personal protective equipment required
2. The warning placard also includes a list of emergency contact persons. In the event of an accident, chemical spills or fire, assistance from the people on that list may be requested

1.5 - Unattended Experiments

1. Laboratory operations involving hazardous substances are sometimes carried out continuously or overnight unattended. It is the responsibility of the people who design these experiments to ensure safety precautions are taken, particularly in the

event of interruptions to utility services such as electricity, cooling water and inert gas

2. Carefully examine how chemicals and apparatus are stored, considering the possibility for fire, explosion or unintended reactions

1.6 - Use of Laboratories After Hours and Working Alone

1. In general, students are not encouraged to carry out their laboratory work after normal working hours
2. Staff and students want to work in laboratory after working hours should obtain approval from their supervisors, Department Head and Central Labs Director in advance
3. For safety reasons, staff and students must not be allowed to work alone in the laboratory after working hours, particularly when working with hazardous chemicals or equipment
4. When performing laboratory work after working hours, a form of ***Using Central Labs Outside Working Hours*** **(Appendix I)** should be completed, approved by their University officials and posted on the door of the laboratory concerned.

1.7 - Reporting Incidents

Any incident that may happen in Central Labs building has to reported directly. An ***Incident Report Form*** is available on CL website **(Appendix II)** and also available on the UoS website as e-form https://myuos.sharjah.ac.ae/en/Services/Pages/IncidentReport.aspx

It should be filled and submitted directly to Central Labs Directorate in case of work-related accidents, chemicals spillage, gas leakage, fires,……etc.

1.8 - Laboratory Safety Inspection

The Central Labs Directorate is using online labs safety inspection software "LabCliQ" to manage the safety inside central labs

This software is responsible for establishing, implementing, conducting and maintaining a variety of health, safety and environmental inspections to assure the highest possible degree of safety for all labs personnel.

All labs have to be inspected regularly each semester.

1.9 - Hazardous Waste Management

Hazardous Chemical Waste Requirements:

Within your work area, the following practices must be followed for proper management of hazardous waste:

- Determine if chemical deactivation or drain disposal is an option.
- Label containers of hazardous chemical wastes with the identity of the chemical(s) AND the words “Hazardous Waste”
- Don’t mix products together. Dangerous reactions can occur when some materials are mixed.
- Keep containers of hazardous chemical wastes closed at all times when they are not in use.
- Make sure products are properly sealed to prevent leaks and spills. If a container is leaking, secure it in a secondary leak-proof container.
- Store hazardous waste containers within the room in which they are generated in.

Hazardous Waste Pickup Procedures:

To have your hazardous waste picked up by “Wekaya”, please complete the following procedures:

- Fill the waste list form **(Appendix III)** and send it as a soft copy to CL Safety Coordinator
- Prepare a hard copy of MSDS for waste chemicals
- Try to include approximate weight/volume of material
- Keep the waste in a designated area in your lab
- Central Labs Safety Coordinator will arrange with the lab supervisor to collect the waste

Chapter 2 - Fire Safety & Emergency Evacuation Procedures

2.1 - Introduction

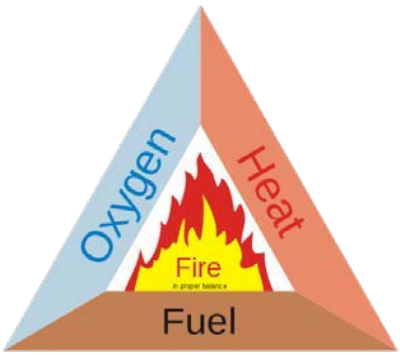
Fire in your workplace can be very dangerous. Your workplace has fire instructions. They will tell you what to do in case of fire and what are the special hazards in that place. Fire safety is important to everyone. It is everybody's responsibility. You must not tamper with firefighting equipment. Your life could depend on it.

2.2 - Main Causes of Fire

1. Most fires are caused by carelessness
2. Not putting cigarettes and matches properly
3. Careless storage of flammables materials. These can catch fire easily
4. Careless electrical maintenance

2.3 - Fire Triangle

A fire must have 3 things to continue burning. Look at the drawing below:



When these three things get together there will be a fire. Remove one of these 3 things and the fire will extinguish.

2.4 - Fire Classification

1. Class A – Ordinary Combustibles
2. Class B – Flammable Liquids
3. Class C – Electrical Fires
4. Class D – Combustible Metals
5. Class K – Combustible Cooking Media

Class	Type of Fuel
A	**Combustible Solids**
B	**Flammable Gases, Liquids and Solids**
C	**Fires Involving Energised Electrical Equipment**
D	**Flammable Metals**
F	**Combustible Cooking Media**

Sources of Ignition

- Naked flames
- Electricity (Overheating/Arcing)
- Smoking materials
- Hot work (Welding, burning)
- Chemical reactions (Giving off heat)
- Heating appliances (Hot surfaces)
- Friction (Inadequate lubrication)
- Static electricity
- Lightning
- Improper storage of flammable materials
- Lack of inspection and supervision

Causes of Fire

- Deliberate (Arson)
- Electrical faults
- Misuse of electrical equipment
- Smokers materials
- Smoking in prohibited areas
- Loss of control burning rubbish
- Heating equipment
- Unsafe storage of materials
- Flammable liquids/gases
- Welding/hot work
- Mechanical heat (Friction)

2.5 – Fire Extinguishers

There are several kinds of extinguishing agents:

1. Water Based extinguishers
2. Carbon dioxide extinguishers
3. Aqueous foam film forming (AFFF) extinguishers
4. Ordinary base (standard) dry chemical extinguishers
5. Dry powder extinguishers

Extinguishing Agents

Class	Type of Extinguisher
A	**Water, Dry Powder, CO2, Foam**
B	**Foam, CO2 , Dry Powder**
C	**CO2, Dry Powder**
D	**Sand, Soda Ash, Talc**
F	**The Foam Congeals on the Top of the Oil**

2.6 - Fire Detection System

Three common elements are:

1. Alarm Initiating Devices
2. Alarm Signal Devices
3. Electrical Circuits

Alarm Initiating Devices

1. Manual Pull Stations
2. Automatic Detectors

Automatic Detection – Four Types:

1. Heat Detection
2. Smoke Detectors
3. Flame Detectors
4. Water Flow Detectors

Central Alarm Control Unit

1. All fire detection systems are connected to the central control unit.
2. Will activate a general alarm or auxiliary system.
3. Annunciate panel shows location of initiating devises
4. Panel also shows status of entire system.

Sprinkler System

1. Wet Pipe
2. Dry Pipe
3. Pre – Action
4. Deluge

Fire Prevention

- Aim to keep the three sides of the fire triangle apart
- Eliminate or reduce storage of flammable materials
- Control ignition sources
- Control smoking materials
- Good housekeeping
- Lubrication of machinery to prevent friction
- No overloading of electrical systems
- Regular inspections of electrical systems
- Ventilation outlets not obstructed
- Controlling hot works with permit system.
- Proper storage of flammable materials
- Segregation of incompatible chemicals
- Improve security to prevent arson
- Regular Inspection and supervision

Storage of Highly Flammable Liquids and Gases

- Minimum quantities
- Suitable fixed storage tanks
- Keep upright in well ventilated area
- Clear marking of containers
- Clearly marked storage area

- Spillage controls
- Adequate ventilation
- Suitable firefighting equipment
- Trained competent staff
- Adequate warning signs

2.7 - Your Responsibility

The UoS Security & Safety Department is primarily responsible in case of a fire for the safe evacuation of people from buildings. Where possible, provide the following information to firefighting officers:

1. The Extent of the Fire
2. The Location and the Direction of the Fire.
3. The Colour of the Smoke
4. The Colour of the Flame
5. Nearby Flammable Materials

2.8 - Emergency Evacuation Procedures

Before a Fire Emergency

1. Know the location of fire alarm pull stations and how to use them
2. Know the location of the nearest stairwell in your area
3. Know the location of, and how to use, portable fire extinguishers in your area
4. Know the evacuation plan in your area

Evacuation

In the event that the building alarm is activated, staff should follow the steps listed below:

1. Remove any one in immediate danger.
2. Activate the alarm by pulling the nearest fire alarm pull station. Call the emergency number and give any information that you have.
3. Close all doors as the areas are evacuated.
4. Extinguish the fire if possible. Use a portable fire extinguisher if the fire has not spread beyond the point where it started and you know how to operate the fire extinguisher.
5. Evacuate to the Assembly Area by following the evacuation plan route.

In case of fire do the following

- Call the emergency number
- Go to the assembly area
- Give the fire department any information that you have, including:
    A. Which areas have not been evacuated
    B. The location of anyone who is unable to evacuate.
- Inform the police and fire fighters if there is anyone who refuses to evacuate
- After the emergency, obtain permission from the fire department before re-entering the building.

2.9 - Recommendations

The following is a list of general safety rules. These rules are intended as a guide to develop proper health and safety practices and procedures.

1. Before beginning work, ensure that the equipment to be used is in safe operation condition, read and follow safety rules and operation procedures
2. Operate equipment only if you are trained and authorized
3. Immediately report any potentially unsafe condition (smoke, fire, spill or unusual odors) or act to your manager, supervisor or department chairman in your organization work
4. If there is any doubt about the safe work method to be used, consult your supervisor before beginning work.
5. Maintain and orderly environment and work procedure. Store all tools and equipment in a designated place
6. Know your specific department rules regarding first aid, evacuation routs and fire department notification
7. Do not use lift in case of fire or fire drill
8. Keep all passageways and walkways clear and usable at all times. Do not block access to doors. Equipment (e.g. coffee pots, hot plates, electrical irons) should be used when plugged directly into a wall outlet. No extension cord may be used for these types of appliances. And if there is any doubt about the safe work method to be used, consult your supervisor or safety department before beginning work.

Chapter 3 - Basic Workshop Safety

3.1 – Objectives

- Selecting appropriate clothing and safety devices for any given hazard
- Perform handling and moving operations safely
- Personal hygiene and PPE
- Understanding of safety precautions and checks when using electrical equipment

3.2 - General Workshop Rules

Safety in the workshop depends upon you following the prescribed work practices and using the required safety equipment. These work practices are designed to help prevent you from harming yourself, laboratory equipment, your work, other persons in the laboratory and the environment.

Any personnel who have a medical condition that can affect their ability to work safely need to report this to the laboratory engineer before commencing any work. All medical information is treated as confidential.

The following work practices apply to all personnel who use or enter this workshop. This includes all visitors, cleaners and maintenance staff:

- Only authorized personnel can access the workshop
- Use Personal Protective Clothing and Equipment (PPCE) and other protective devices appropriate to the type of work being carried out
- Ensure that personal clothing is suitable for workshop conditions
- Do not wear open-toed shoes in the workshop
- Workshop PPCE (lab coats/gowns & gloves) MUST be removed before leaving the workshop
- Do not bring food or drink for personal consumption into the workshop or stored in. Eating, drinking, smoking, shaving and the application of cosmetics is prohibited in the workshop
- Long hair must be tied back
- Any hazards, faults, incidents and injuries must be reported to the workshop engineer immediately
- Always wash your hands when leaving the laboratory

- Practice good housekeeping, e.g. immediately cleaning up spills and appropriately dispose of wastes including packaging

3.3 - Identified Hazards-Additional Laboratory Work Practices

Personal Hygiene

- Always wash your hands using suitable soap before meals, before and after going to the toilet and at the end of each job
- Dry your hands carefully on the clean towels or driers provided. Don't wipe them on old rags
- Paraffin, grease, petrol or similar solvents should never be used for skin cleaning purposes
- Use appropriate barrier cream to protect your skin

Personal Protective Clothing and Equipment (PPCE)

Workplace safety can be enhanced and the severity of an injury can be reduced or prevented through the use of PPCE. PPCE is widely recognized as a means of protection for individuals working in an environment where all other methods of hazard control are in place and there is still a risk of injury. You must remember that PPCE is the last barrier or line of defense between you and the hazardous material you are working with.

Minimum PPCE Requirements

The minimum PPCE you are required to wear in the Workshop is:

- Laboratory Coat / Coverall
- Enclosed Shoes
- Goggles

Housekeeping

- Never throw rubbish on the floor
- Keep walkways and work areas free of metal bars, components, etc
- If oil, water or grease is spilled, wipe it up immediately or someone might slip and fall

Moving About

- Always walk – never run
- Keep to gangways-never take shortcuts
- Look out for and obey warning notices and safety signs
- Never ride a vehicle not made to carry passengers, e.g. forklifts

Machinery

- Ensure you know how to stop a machine before you start the machine
- Keep your concentration while the machine is in motion
- Never leave your machine unattended while it is in motion
- Take care not to distract other operators
- Never clean a machine while it is in motion
- Keep your hair short or under a cap- it can become tangled in drills or shafts
- Avoid loose clothing
- Do not wear rings, chains, or watches at work-they have caused serious injury when caught accidently on projections
- Do not allow unguarded bar to protrude beyond the end of a machine, e.g. lathe
- Always ensure that all guards are correctly fitted and in position

Electricity

- Make sure you understand all instructions before using an electrical equipment
- Do not use electrical equipment for any other purpose or in any area other than which is intended
- Always switch off or isolate before connecting or disconnecting any electrical equipment

First Aid

- Have first aid treatment for every injury however trivial
- Know the first aid arrangements for your workplace

Eye and Face Protection

Our eyes are precious. Therefore, we must protect them when we are working. We must wear safety glasses or goggles to protect our eyes when we are using machines.

Each person in the laboratory has been issued with appropriate eye protection:

- Safety glasses shall be worn according to the nature of work
- Over-glasses will be provided to those who wear prescription spectacles

Equipment which needed a face shield

- Autoclave
- Drilling Machine
- Welding machine
- Lathe machine
- Milling Machine
- Grinding machine

How to Lift Heavy Objects

- Evaluate the object you are lifting to see if it is unequally balanced, if it has handles and where the best place to grasp it is. Know where you are going with the object before you begin
- Stand directly in front of the item that you wish to lift. Center your body over it and position your feet shoulder width apart
- Tighten your stomach muscles and stand straight and tall, keeping your back as straight as possible
- Bend your knees. Without moving your upper body, squat down to the floor
- Grab the item you wish to lift firmly with one hand on either side of it. Hold on to it firmly and in such a way that it is balanced
- Use your leg muscles to raise your body to a standing position while lifting the object off the floor at the same time. Lift slowly, not with a sudden jerk upward. Keep the item close to your torso, using your body to help balance the object
- Walk with the item without twisting your body. Stand straight and take small steps. Have someone help you by leading the way if you cannot see where you are going to avoid running into someone or something

Chapter 4 - Electrical Safety

4.1 - Electrical Hazards

Safety in the electrical laboratory, as everywhere else, is a matter of the knowledge of potential hazards, following safety precautions, and common sense. Observing safety precautions are important due to pronounced hazards in any electrical/computer engineering laboratory. Death is usually certain when 0.1 ampere or more flows through the head or upper thorax and have been fatal to persons with coronary conditions. The current depends on body resistance, the resistance between body and ground, and the voltage source. If the skin is wet, the heart is weak, the body contact with ground is large and direct, then 40 volts could be fatal. Make sure that you have handy emergency phone numbers to call for assistance if necessary. If any safety questions arise, consult the lab demonstrator or technical assistant/technician for guidance and instructions. Observing proper safety precautions is important when working in the laboratory to prevent harm to yourself or others. The most common hazard is the electric shock which can be fatal if one is not careful.

4.1.1 - ELECTRIC SHOCK

DEFINITION AND DESCRIPTION

Shock is caused by passing an electric current through the human body. The severity depends mainly on the amount of current and is less function of the applied voltage. The threshold of electric shock is about 1 mA which usually gives an unpleasant tingling. For currents above 10 mA, severe muscle pain occurs and the victim can't let go of the conductor due to muscle spasm. Current between 100 mA and 200 mA (50 Hz AC) causes ventricular fibrillation of the heart and is most likely to be lethal.

What is the voltage required for a fatal current to flow? This depends on the skin resistance. Wet skin can have a resistance as low as 150 Ohm and dry skin may have a resistance of 15 kOhm. Arms and legs have a resistance of about 100 Ohm and the trunk 200 Ohm. This implies that 240 V can cause about 500 mA to flow in the body if the skin is wet and thus be fatal. In addition skin resistance falls quickly at the point of contact, so it is important to break the contact as quickly as possible to prevent the current from rising to lethal levels.

4.1.2 - CAUSES OF ELECTRIC SHOCK

1. **Exposed Live Conductors**

   An exposed conductive part is referred to as the metalwork surrounding electrical equipment. There are two types of contact that cause electric shock:

   - The first one is **indirect contact**, where the shock is received from live metalwork casing. This occurs when there is a partial elevation of voltage during the passage of an electrical fault current to earth, or a full elevation when the casing is not earthed.
   - The other type of contact is **direct contact**, where the shock is received from exposed energized parts which are normally at live voltage.

2. **Improper Equipment Earthing**

   The purpose of equipment earthing is to ensure that all exposed metal equipment surfaces will be maintained at substantially earth potential [equipotential bonding], even during a fault condition when substantial current flows to earth.

   If the equipment is properly earthed, the circuit over current protection device will trip in the case of a low-resistance internal fault to an exposed metal surface. This will remove the hazard.

3. **Electric Currents Involving Water**

   Electric shocks might occur when an individual is in water and electric currents are present. This is due to the energized conductor being exposed to the water. Residual current device (RCD) or earth leakage circuit breaker de-energizes wet equipments if there is a path to earth, hence preventing electrocution.

4.1.3 - EFFECTS OF ELECTRIC SHOCK

Depending on the current path through the body and the magnitude and duration of current transmitted, electric shock may have the following effects on the human body:

1. **Damage and burns to tissue** Electric current can result in severe tissue damage through burning. They are mostly third-degree burns. If vital internal organs are involved, the burns can be fatal.
2. **Involuntary muscle contraction** Involuntary muscular contraction is an effect of the current. At low currents the contraction may cause the “no-let go” effect where the hand is unable to release a live conductor when grasped. If the lung muscles are affected, respiration might stop and asphyxiation occurs.

3. **Ventricular fibrillation**

   The last of the body's muscles to be affected are the heart muscles. If the heart is affected, ventricular fibrillation or irregular heartbeats can occur and result in electrocution.

EFFECTS OF ALTERNATING CURRENT IN THE RANGE OF 15 – 100 Hz:

1. **Threshold of perception**

   The threshold of perception is the minimum value of current that causes any sensation for the person through which it is flowing. Some factors that affect the threshold of perception are: contact area, conditions of contact (dry, wet, pressure, temperature), and physiological characteristics of individual.

   The general accepted value is 0.5 mA, independent of time.

2. **Threshold of let-go**

   This is the maximum value of current at which a person holding electrodes can let go of the electrodes. Threshold of let-go depends on: contact area, shape and size of electrodes, and physiological characteristics of individual.

   The general accepted value is 10 mA.

3. **Threshold of ventricular fibrillation**

   This is the minimum value of current that causes ventricular fibrillation. It depends on physiological factors, such as anatomy of the body, state of cardiac function, as well as electrical factors, for example contact area, duration and pathway of current flow and type of current. Above 500 mA, fibrillation may occur for shock duration below 0.1 s. It may also occur for current magnitude of several amperes, if the shock falls inside the vulnerable period. Reversible cardiac arrest may result when shocks last longer than one cardiac cycle.

4.1.4 - Treatment of Electric Shock

GENERAL PROCEDURES FOLLOWING AN ELECTRICAL ACCIDENT:

1. Switch off the power source and separate the person from the energy source immediately without causing further damage
2. If the power source is not able to be isolated and the person is still in contact with electrical source, insulate yourself from the person before making contact, e.g. use rope or any other suitable article. You should only do this after you have evaluated the risk and have taken all precautions to prevent a further electric shock occurring

3. Check on breathing. If present, keep the person warm and comfortable, and call for medical attention
4. If breathing is not present, urgent resuscitation is required:
    - Clear airways by pulling tongue from throat
    - Lay person on back, tilt head backwards so that mouth opens
    - Attempt mouth-to-mouth resuscitation
5. If breathing is restored, arrange for medical attention
6. If breathing is not restored:
    - Feel for pulse in the neck
    - Attempt to diagnose cardiac arrest (the combination of unconsciousness and loss of arterial pulse). Cardiac arrest (or ventricular fibrillation) results in:
        - Loss of consciousness
        - Cessation of respiration
        - Dilatation of pupils
    - Call an intensive care (cardiac) ambulance
7. Attempt to restart the heartbeat by applying external cardiac massage in combination with artificial ventilation:
    - Place person on firm surface
    - Place palm of one hand on the lower part of the sternum and the heel of the other hand immediately above it
    - Depress the sternum firmly (3-5 cm) once every second
    - Do not apply force to any other area except the sternum – pressure on the ribcage can fracture ribs leading to lung, liver or spleen damage
    - If the cardiac compression procedure is effective in circulating the blood, the pupils should become smaller
    - Artificial ventilation must be maintained by the mouth-to-mouth resuscitation procedure throughout the cardiac massage
    - The whole procedure may continue for about 30 minutes
8. If the casualty has suffered burns, wash and cool the burned area under gently running cold water. Apply a clean, dry, non-adherent dressing to the burned area
9. In a hospital or ambulance situation, use a defibrillator

4.2 - Preventing Electrical Hazards

There are various ways of protecting people from the hazards caused by electricity, including insulation, guarding, grounding, and electrical protective devices. Laboratory workers can significantly reduce electrical hazards by following some basic precautions:

- Inspect wiring of equipment before each use. Replace damaged or frayed electrical cords immediately
- Use safe work practices every time electrical equipment is used
- Know the location and how to operate shut-off switches and/or circuit breaker panels. Use these devices to shut off equipment in the event of a fire or electrocution
- Limit the use of extension cords
- Multi-plug adapters must have circuit breakers or fuses
- Place exposed electrical conductors (such as those sometimes used with electrophoresis devices) behind shields
- Minimize the potential for water or chemical spills on or near electrical equipment
- Power must be switched off whenever an experiment or project is being assembled disassembled, or modified. Discharge any high voltage points to grounds with a well insulated jumper. Remember that capacitors can store dangerous quantities of energy
- Make measurements on live circuits or discharge capacitors with well insulated probes keeping one hand behind your back or in your pocket, Do not allow any part of your body to contact any part of the circuit or equipment connected to the circuit
- Never touch electrical equipment while standing on a damp or metal floor
- Never touch even one wire of a circuit; it may be hot
- Take extreme care when using tools that can cause short circuits if accidental contact is made to other circuit elements. Only tools with insulated handles should be used
- Never plunge for a falling part of a live circuit such as leads or measuring equipment
- Avoid simultaneous touching of any metal chassis used as an enclosure for your circuits and any pipes in the laboratory that may make contact with the earth, such as a water pipe. Use a floating voltmeter to measure the voltage from ground to the chassis to see if a hazardous potential difference exists
- Chairs and stools should be kept under benches when not in use. Sit upright on chairs or stools keeping the feet on the floor. Be alert for wet floors near the stools

- Do not work alone while working with high voltages or on energized electrical equipment or electrically operated machinery like a drill
- Check wire current carrying capacity if you will be using high currents. Also make sure your leads are rated to withstand the voltages you are using. This includes instrument leads
- Wearing a ring or watch can be hazardous in an electrical lab since such items make good electrodes for the human body
- Horseplay, running, or practical jokes must not occur in the laboratory
- In an emergency all power in the laboratory can be switched off by depressing the large red button on the main breaker panel. Locate it. It is to be used for emergencies only

4.2.1 - Rotating machine precautions (for laboratory machine ratings over100 watts)

- All operation of rotating machinery must be done with more than one person present
- An instructor must approve any circuit designs before construction and operation in the lab. The instructor or designee must examine lab setup prior to initial energizing
- All rotating parts must be shielded or appropriately located to prevent the possibility of inadvertent contact
- All metering and wiring must be of appropriate capacity for the expected loads
- Visually inspect the rotating equipment for proper mounting and loose parts prior to energizing
- Layout equipment to eliminate the need for reaching over it to adjust or read instruments when the circuit is operating
- When using rotating machinery, place neckties or necklaces inside your shirt or, better yet, remove them
- Never open field circuits of D-C motors because the resulting dangerously high speeds may cause a "mechanical explosion"
- If a person comes in contact with a high voltage, immediately shut off power. Do not attempt to remove a person in contact with a high voltage unless you are insulated from them. If the victim is not breathing, apply CPR immediately continuing until he/she is revived, and have someone dial emergency numbers for assistance

4.3 - Safe Work Practices

The following practices may reduce risk of injury or fire when working with electrical equipment:

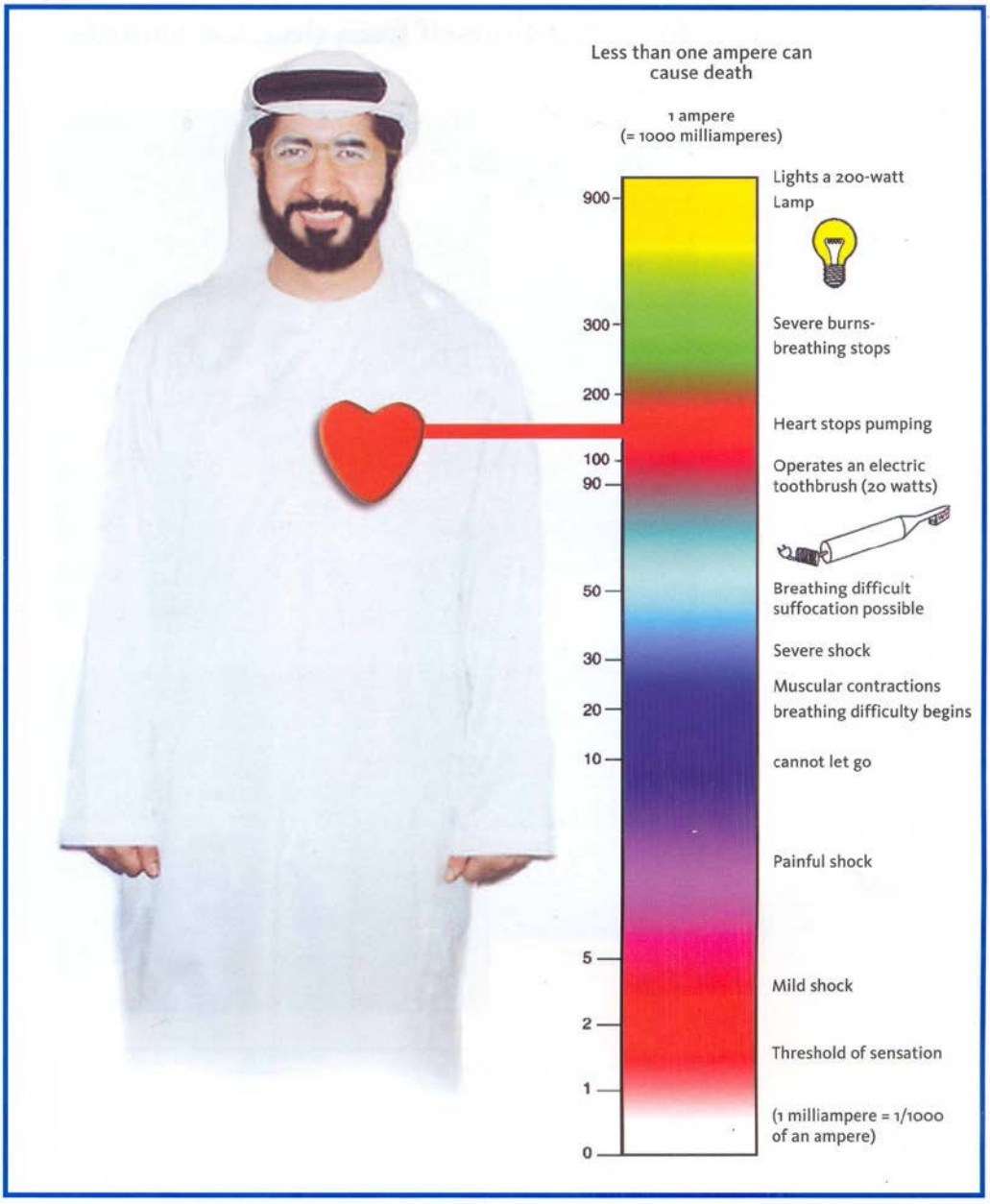
- Avoid contact with energized electrical circuits
- Use guarding around exposed circuits and sources of live electricity
- Disconnect the power source before servicing or repairing electrical equipment
- When it is necessary to handle equipment that is plugged in, be sure hands are dry and, when possible, wear nonconductive gloves and shoes with insulated soles
- If it is safe to do so, work with only one hand, keeping the other hand at your side or in your pocket, away from all conductive material. This precaution reduces the likelihood of accidents that result in current passing through the chest cavity
- If water or a chemical is spilled onto equipment, shut off power at the main switch or circuit breaker and unplug the equipment
- If an individual comes in contact with a live electrical conductor, do not touch the equipment, cord or person. Disconnect the power source from the circuit breaker or pull out the plug using a leather belt

4.4 - High Voltage or Current

Repairs of high voltage or high current equipment should be performed only by trained electricians. Laboratory workers who are experienced in such tasks and would like to perform such work on their own laboratory equipment must first receive specialized electrical safety related work practices training.

4.5 - Altering Building Wiring and Utilities

Any modifications to existing electrical service in a laboratory or building must be completed or approved by either the CENTRAL LABORATORIES, an engineer from the Facilities department or the building's Special Facilities staff. All modifications must meet both safety standards and Facilities Engineering design requirements. Any unapproved laboratory facilities modifications discovered during laboratory surveys or other activities are reviewed by central laboratories staff to determine whether they meet design specifications.



The effect of electric current on the body

Chapter 5 – Chemicals Safety

5.1 - Chemical Spills

The chemistry laboratory must be a safe place for conducting research and teaching. The major potential hazards in the chemical laboratory come from the exposure to dangerous chemical and spills. Therefore, people working in the laboratory must take the necessary precautions and steps to protect themselves and others.

The first line of action to have safe environment in the laboratories is to minimize and contain chemical spills which may occur at anytime. Sometimes, even a small spill of chemical can cause much harm to the public health. All chemical spills irrespective whether it is a major or minor spill must be officially reported to the chairman of the Department. A chemical spill is considered serious and urgent to care for if it causes injuries, fire, breathing problems, airborne contaminants, or requires an extended cleaning efforts. Generally, when such major chemical spills occurs the following steps must be followed:

- The proper authority as the security and the chairman of the Department must be informed immediately
- If the spill is causing an immediate danger to the health, leave the spill and the proper authorities must be contacted from a safe place. The personal health is most important to care for, so notify persons in the nearby vicinity of spill.
- All electrical and gas supplies must be turned off.
- If the spill does not pose any immediate threat, containing the spill will be highly recommended. Using adsorbents and special kits as directed to contain such spill and reduce the production of vapors. In addition to containing and covering the spill, it is highly recommended to increase ventilation in the area by opening the doors and windows to the and fume hoods.

The most occurring chemical spills are:

Inorganic acids or bases

- Small amounts: use neutralizing agent as soda or an adsorbent like vermiculite, dry sand or towels.

- Large amounts: flush with large amounts of water if water does not pose any danger like reacting violently with other chemicals which might occur in the area of the spill. Make sure that the floors must be dry after the cleanup process is over.

Volatile materials

With fully functional hood equipped with appropriate filters, allow the spill to evaporate.

Solids

If the spilled solid is not dangerous and does not pose any threat to the health, the spill should be swept and placed in the proper chemical waste container for appropriate treatments. High power vacuum cleaner with appropriate filter must be used to clean up the solid toxic spill. If the solid spill has caused staining, always give priority to the manufacturer's stain removal guideline if available.

Mercury spills

Due to its severe effect to public health, special care must be taken when dealing with mercury spills. Mercury can get into the body through inhaling its vapor or getting absorbed through the skin. The use of mercury must be kept to the minimum. Mercury spills must be covered completely with adsorbent and properly and fully cleaned. Mercury spill kits are available in all chemistry labs. Protecting clothing, cloves, and breathing devices must be used when with mercury spills.

Since students breaking Mercury Thermometers is one of the main reasons of Mercury spills in laboratories, we need special precautions when cleaning up broken mercury thermometers:

- Remove students from the area.
- Clean up the spill promptly to avoid accumulation on surfaces and evaporation causing inhalation. Because of the very small amount of mercury involved (less than 0.5 ml), it is usually not necessary to use a respirator in these cases. Use a mercury absorption sponge to collect the liquid beads from your **Mercury clean-up kit**. Wash the affected area with a detergent soap and allow to air dry before it is safe to reuse the area.
- **Do not** touch the liquid mercury with your hand and **Do not** flush down the drain nor use a broom or vacuum to clean up mercury.

5.2 - Storage of Chemicals and House Keeping

Major risks in the chemistry laboratory are coming from poor housekeeping and improper storage of chemicals. Untidy laboratory space usually poses a great threat to public health and safety. Another risk factor on the safety is storing incompatible reagents and chemicals in the same place. For instance, oxidizing agents cannot be stored in the same cabinets with reducing agents and flammable solvents and chemicals must be stored in fire cabinets. Therefore, it is very important to maintain a good state of tidiness in laboratory facilities to significantly minimize risk of accidents.

Chemical Storage

Toxic and hazardous chemicals must be stored according to their compatibility and in safety or ventilated base cabinets. None-toxic and none-hazardous chemicals may be stored in regular cabinet. The following guideline might be considered when organizing the laboratory space:

- Minimization of the quantities of chemicals that to be stored in the laboratories.
- Large quantities of chemical must be stored in a separate central storage area.
- The temperature and humidity level in the storage facilities must carefully regulated especially during the warm seasons. Chemicals should never be stored near heat sources like ovens or in direct sunlight.
- Chemicals should be dated when received and when opened.
- Special care must be adopted when dealing with **peroxide-formers:**
    - It is known that just the friction from unscrewing the cap of a container of an ether that has peroxides in it can provide enough energy to cause a severe explosion. Therefore, chemical container where suspected peroxide is being formed must be handled with care. ***Diisopropyl ether, divinyl acetylene, sodium amide,*** *and* ***vinylidene chlor**ide* should be discarded after three months form the reagent bottle and ***dioxane, diethyl ether,*** and ***tetrahydrofuran*** should be disposed after one year. Such chemicals must not be stored in glass containers with screw caps and be stored way from any heat or sunlight and other sources of ignitions.
- All chemicals must be returned to their storage place after use.
- Liquids or corrosive chemicals must never be stored on shelves above the working areas and benches.
- Chemicals must be kept in the designated places and never left on the floor.

- Explosion-proof or flammable material refrigerators must be used to store flammable and highly volatile liquids. All containers stored in the refrigerator must be properly labeled. ***Peroxide*** formers (i.e., ***ether***) must not be stored in refrigerator!
- Gas cylinders must be securely strapped to a permanent structure (wall, lab bench, etc.). When they are not in use they should be capped off. When they are empty gas cylinder must be labeled as such.

Categorization of Chemicals

It is highly advised that chemicals are stored based on the following categories:

- Toxic
- Other Regulated Materials
- Low Hazard
- Flammables
- Oxidizers
- Corrosives
- Highly Reactive

See **(Appendix IV)** Chemical Compatibility Table.

5.3 - Safety Equipment

All chemistry laboratories equipped with fume hoods, eyes wash stand, safety showers, fire extinguishers and emergency phones.

Fume Hoods

Fume hoods are very essential for the safety in the chemistry laboratories because they prevent the inhalation of harmful substances and remove flammable vapors from the indoor atmosphere. Fume hoods must be used when working with chemical which pose a threat to the health and have unknown properties. Pouring and mixing chemicals must be done in the hood.

Eyewashes and Safety Showers

All chemical laboratories have eyewashes and safety showers which are periodically checked. Safety showers are located in appropriate places inside the laboratories and can be reached immediately. Portable eyewash stations are also available.

Fire Extinguishers

Fire extinguishers are also installed and available in all chemistry laboratories.

5.4 - Chemical Waste Management

Minimization of chemicals is needed to decrease the exposure to toxic substances, protect the environment, and reduce the cost of purchase and disposal. Hence, proper waste minimization must always be considered.

The following are suggestions for minimizing waste:

- Purchasing only the quantity of chemical that is needed. Hazardous waste is often a result of outdated and/or unused chemicals. Hazardous waste costs much more to dispose of than the cost of purchasing smaller quantities of chemicals.
- Substituting less or non-hazardous materials for hazardous ones.
- Using dilute rather than concentrated solutions
- Using micro or semi-micro techniques in the teaching and research laboratories whenever it is possible.

5.5 - Safety Rules and Regulations

Working safely in the chemistry laboratory is always the first priority. To ensure the safe environment in the laboratory spaces, the following guidelines must be strictly followed by all people who enter any laboratory (teaching or research):

1. Try not to work alone in the laboratory. If it happens that a person needs to do certain experiments, other colleagues or instructors must be aware of that so they can to do the proper action in a timely manner in case of emergency. However, undergraduate students must never work alone in the lab without proper supervision.
2. Stay away from equipment that you do not need to use. If a person does not know how to use an instrument, seeking assistance is a must for proper and safe operation of instruments.
3. Books, stationeries, and laboratory note books must be kept in a designated areas in the lab.
4. Eating and drinking is strictly banned in the laboratories.
5. Protecting our bodies is the major priority in the chemistry labs. Therefore, proper laboratory coats must be worn at all times while working in the laboratory. No shorts, short skirts and very loose clothing (especially loose long sleeves) is totally prohibited in the laboratory. Shoes which adequately cover the whole foot must be worn too in the lab. Moreover, long hair or scarves should be tied back while working out an experiment.
6. Safety goggles must be worn whenever you work in laboratory.

7. Appropriate type of gloves should be worn whenever chemicals are used. The used gloves must be disposed in the properly labeled waste containers.
8. Know the locations and operating procedures of all safety equipment including the first aid kit, eyewash station, safety shower, spill kit, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located.
9. Keep hands away from your face, eyes, mouth, and body while using chemicals.
10. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the proper authority immediately, no matter how trivial it may appear.
11. Check the label on chemical bottles carefully noting the name of the reagent to be used and date when the reagent bottle was opened or prepared.
12. Unused chemicals are treated as waste and should be disposed in the assigned waste bottle and never returned to their original containers.
13. Never dispense flammable liquids anywhere near an open flame or source of heat. Microbiology students decontaminating their work area using 70% Ethanol need to do so before lighting the Bunsen burner and allow sometime for it to evaporate.
14. Never leave experiments unattended while in progress.
15. Do not leave lit Bunsen burners unattended; turn off all heating apparatus, gas valves, and water faucets when not in use
16. All chemicals in the laboratory are treated as if they are highly toxic. Therefore, never touch, taste, or smell any reagents.
17. Use the laboratory chemical hood when there is a possibility of release of toxic chemical vapors, dust, or gases.
18. Dispose all chemical waste properly. To protect our environment, never throw chemicals in sink and sewage drains. Segregate your waste according to its compatibility with other chemical waste and the material of the container. For instance, corrosive waste may need special type of containers. Also Waste containers need to be labeled accurately (e.g. Organic Waste, Inorganic waste, etc.)
19. Wash your hands thoroughly with soap and water after removing gloves, and before leaving the laboratory.
20. Work area should be kept clean and tidy at all time.
21. Keep track of your prepared chemicals. Properties of these chemicals can change over time. Use labels listing the Name of the prepared Chemical, its concentration and the date at it which it was prepared.

Chapter 6 - Biological Safety

This section describes policies and procedures that are required for the safe conduct of Biological Testing in the laboratories. It will provide guidance, information, review, monitoring, and training regarding biological safety, when appropriate. It will act as a reference for departments regarding implementation and enforcement of biological safety programs; evaluating work practices and personal protective equipment and providing educational materials for students and staff.

6.1 - Principles of Biological Safety (Containment)

The term "containment" is used in describing safe methods for managing infectious agents in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce or eliminate exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents. Both good laboratory technique and the use of appropriate safety equipment provide primary containment, the protection of personnel and the immediate laboratory environment from exposure to infectious agents. Therefore, the elements of containment include laboratory practice and technique, safety equipment, and facility design. The risk assessment of the work to be done with a specific agent will determine the appropriate combination of these elements.

6.2 - Laboratory Practice and Technique

The most important element of containment is strict adherence to standard biological practices and techniques. Persons working with infectious agents must be aware of potential hazards, and must be trained and proficient in the practices and techniques required for handling such material safely. The lab supervisor or the department in charge of the laboratory is responsible for providing or arranging for appropriate training of personnel. Trained personnel should ensure that students are aware of the practices and procedures followed in the lab.

6.3 - Safety Equipment (Primary Barrier)

Safety equipment includes biological safety cabinets (BSCs) designed to remove or minimize exposures to hazardous biological materials. The biological safety cabinet (BSC) is the principal device used to provide containment of infectious splashes or aerosols generated by many biological procedures. Three types of biological safety cabinets (Class I, II, III) used in biological laboratories. Open- fronted Class I and Class II biological safety cabinets are

primary barriers which offer significant levels of protection to laboratory personnel and to the environment when used with good biological techniques. The Class II biological safety cabinet also provides protection from external contamination of the materials (e.g., cell cultures, microbiological stocks) being manipulated inside the cabinet. Safety equipment also may include items for personal protection such as gloves, coats, safety glasses, or goggles. Personal protective equipment is often used in combination with biological safety cabinets and other devices that contain the agents, animals, or materials being worked with. All of the labs are Biosafety Level 1 and 2 which are appropriate for undergraduate and secondary educational training and teaching laboratories.

6.4 - Biosafety Level 1& 2

Biosafety Level 1 is suitable for work involving well-characterized agents not known to cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment. The laboratory is not necessarily separated from the general traffic patterns in the building. Work is generally conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required nor generally used. Laboratory personnel have specific training in the procedures conducted in the laboratory and are supervised by a scientist with general training in biological science. The following standard and special practices, safety equipment, and facilities apply to the handling of agents assigned to Biosafety Level 1 (BSL1):

A. Standard Biological Practices

1. Access to the laboratory is limited or restricted at the discretion of the laboratory supervisor when experiments or work with cultures and specimens are in progress
2. Persons wash their hands after they handle viable materials and animals, after removing gloves, and before leaving the laboratory
3. Eating, drinking, use of tobacco products, handling contact lenses, and applying cosmetics are not permitted in the work areas where there is reasonable likelihood of exposure to potentially infectious materials. Persons who wear contact lenses in laboratories should also wear goggles or a face shield. Food is stored outside the work area in cabinets or refrigerators designated and used for that purpose only
4. Mouth pipetting is prohibited; mechanical pipetting devices are used
5. All procedures are performed carefully to minimize the creation of splashes or aerosols

6. Work surfaces are decontaminated at least once a day and after any spill of viable material
7. All cultures, stocks, and wastes are decontaminated before disposal by an approved decontamination method, such as autoclaving. Materials to be decontaminated outside of the immediate laboratory are to be placed in a durable, leak-proof container and closed for transport from the laboratory. Materials to be decontaminated off-site from the laboratory are packaged in accordance with applicable local, state, and federal regulations, before removal from the facility

B. Special Practices: None

C. Safety Equipment (Primary Barriers)

1. Special containment devices or equipment such as a biological safety cabinet are generally not required for manipulations of agents assigned to Biosafety Level 1
2. It is recommended that laboratory coats are worn to prevent contamination or soiling of street clothes
3. Gloves should be worn if the skin on the hands is broken or if a rash exists
4. Protective eyewear should be worn for anticipated splashes of microorganisms or other hazardous materials to the face

D. Laboratory Facilities (Secondary Barriers)

1. Each laboratory contains a sink for hand washing
2. The laboratory is designed so that it can be easily cleaned.
3. Walls and floors must be constructed of water impervious materials that will stand up to hard disinfectants
4. Carpeting is not allowed in laboratories
5. Bench tops are impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat
6. Laboratory furniture is sturdy and should not be cloth upholstered. Spaces between benches, cabinets, and equipment are accessible for cleaning

BSL2 adopts the same basic safety principles as outlined in BSL1, but provides for additional worker and environmental protection. BSL2 involves work with agents of moderate potential hazard to personnel and the environment. It differs from BSL1 in that:

- Laboratory personnel have specific training in handling pathogenic agents and are directed by competent scientists
- Additional precautions are taken with contaminated sharp items
- Procedures in which infectious aerosols or splashes are created should be conducted in biological safety cabinets

6.5 - Biological Safety Cabinets

Biological safety cabinets (BSC) are designed to contain biological hazards and to allow products to be handled in a clean environment. They are suitable for work with biohazardous agents (i.e. animal cell cultures).

BSCs have the following characteristics

- Inward airflow for personal protection
- HEPA-filtered exhaust air for environmental and personal protection
- HEPA-filtered supply air for product protection.

6.6 - Biological Waste Disposal Policy

This policy is intended to provide guidance and insure compliance of appropriate disposal of biological waste.

6.6.1 - Infectious/ potentially infectious/ Recombinant-DNA

- Human Pathogens
- Animal Pathogens
- Plant Pathogens
- Recombinant DNA
- Human and Primate Blood, Blood Products and other Body Fluids
- Human and Primate Tissue
- Any Material Containing or Contaminated With any of the above (Test Tubes, Needles*, Syringes, Tubing, Culture Dishes, Flasks, etc.)

This waste must be inactivated prior to disposal. The preferred method is steam sterilization (autoclaving). Storage of non-inactivated waste is restricted to within the generating laboratory. The material may not be stored longer than 24 hours prior to inactivation.

6.6.2 - Non-infectious waste

This category includes waste that is not contaminated with any of the biological wastes listed in category 1. It includes solid waste and sharps generated in clinical or laboratory settings. Sterile or unopened biomedical materials that require disposal are also considered biological waste.

- IV Packs
- Needles*
- Syringes
- Scalpels*
- Broken Glass and Plasticware**
- Test Tubes
- Razor Blades*
- Culture Dishes
- Flasks
- Pipettes
- Petri Dishes
- Tissue Culture Flasks

This material does not require sterilization prior to disposal.

**must be packaged in plastic sharps boxes.*

***must be within a box or other puncture proof container before adding to waste.*

6.6.3 - Mixed chemical/biohazardous waste

The biohazardous component of mixed chemical/biohazardous waste shall be inactivated prior to its release for chemical disposal. Precautions should be taken to prevent the generation and release of toxic chemicals during the inactivation process. In general, autoclaving is not recommended because flammable or reactive compounds should not be autoclaved due to the explosion hazard.

6.7 - Disinfectants

"Disinfectant" refers to an agent that is applied to treat (usually) inanimate objects to render them free of pathogenic or infectious microorganisms.

Disinfectants such as 10% bleach are used in the biological laboratory to:

1. Treat a surface or an item before or after routine use
2. To treat a surface or an item after a spill or "contaminating event"

6.8 - Packaging

1. Biohazard bags: These are used for the initial collection of certain biological wastes. All biohazard bags must meet impact resistance (165 grams) and tearing resistance (480 grams)
2. Sharps: Needles, scalpels and razor blades are required to be containerized in red plastic sharps containers

6.9 - Training

All employees who handle biological waste shall be trained annually regarding its proper handling. All new employees shall be trained before they are allowed to handle biological waste.

Chapter 7 - Radiation Safety

7.1 - Introduction

The basic principle of the workers in any radiation lab is to avoid all unnecessary exposure to radiation. Where exposure is unavoidable, any exposure should be kept as low as reasonably achievable (ALARA principle). To achieve ALARA principle workers should follow three important points:

- **Time**

  Minimize the time of staying in a radiation area as less as possible.

- **Distance**

  Maximum distance from a radiation source. The dose rate decreases according to the inverse square law, where the dose rate is inversely proportion to the square of the distance from the source.

- **Shielding**

  Use proper shielding material for radioactive Substances. The person who deals with radioactive material must wear appropriate protective clothes, such as lab coat, gloves, masks, boots, etc. whereas the person who deals with x-ray machine must always stand behind lead protective screen while exposing.

7.2 - Lab Protection Procedure

1. Eating, drinking or smoking in the lab is prohibited
2. Don't store food in the lab
3. The area has to be labeled by a caution radiation sign **"Caution Radiation"**
4. No items should be removed from the lab, or from the secure place without the permission of the in-charge person
5. A form has to be filled in case of shifting items from the lab

6. Checking the radiation activity outside the lab, regularly, to make sure that it is safe for the public
7. The Office of Radiation Safety (ORS)/ in-charge contact number has to be on the main door of the lab and inside as will
8. Personnel who work with radioactive materials, laser, X-Ray and Ultraviolet ray have to be trained by (ORS)/ in-charge
9. All x-ray producing equipment will be operated only by trained faculty, staff, or students. NO x-ray producing equipment will be left operating unattended without prior approval from the RSO/ in-charge
10. X-ray producing equipment must be locked and exposure key should be secured and kept in safe place if it is not in use
11. The laboratory entrance/exit doors must be locked while the machine is operating
12. Radioactive material must be locked and secured if it is not in use
13. The radioactive material has to be labeled by the caution statement and the radiation symbol, and has to have details of the radioactive material, type of radiation, date, activity, quantity
14. All radioactive waste is to be kept separate and labeled appropriately
15. Ultraviolet ray is considered to be dangerous if its wavelength is shorter than 3000^{o}A. It can cause painful burns

7.3 - Personnel Protection Procedure

1. Personnel dosimetry or badge must be worn always before entering any radiation lab
2. In case of any emergency notify the Office of Radiation Safety (ORS)/ in-charge
3. Never use an X-Ray machine if it is not working properly
4. Analyze the hazards of each job in advance
5. Post any warning or suspicious signs you noticed inside the lab or outside
6. Avoid exposure to the primary beam, by making sure you and others are outside the x-ray room, door closed or stand behind lead protective screen
7. Radioactive material has to be handled with care and with proper protective clothes and gloves
8. In case of skin cut, personnel have to cover it by a waterproof tape, and wear gloves before manipulating radioactive materials

9. Personnel must monitor themselves frequently during the work in the lab. This includes hand, hair, shoes, body and clothes, if any of these contaminated then it must decontaminated before leaving the lab
10. If you use laser beam don't look directly to the beam or its pattern, use image converter
11. While you are working with laser beam wear goggles
12. Wear eye protection appropriate to the type of radiation that you use
13. Don't make alignment of primary X-Ray with the sample by your eye

7.4 - Personnel Dosimetry

1. Your dosimetry (badge) must be worn between your waist and neck. If part of your body is exposed more than the waist, wear the badge at that part
2. The badge is personal so do not wear another person's badge, no one has to use it except the person to whom it was issued for
3. Clip the dosimeter on your clothes face away from your body
4. Keep the dosimeter with you while you are in work; don't use it if you will be exposed to radiating treatment, like dental X-Ray
5. Make sure that your dosimetry (badge) is been measured and result should be checked regularly

Appendix (I)

Using Central Labs Outside Working Hours

جامعة الشارقة
UNIVERSITY OF SHARJAH

Using Central Labs outside UoS Working Hours

المختبرات المركزية

The Central Laboratories

Policies for Operating Labs outside Working Hours

1) In general, laboratory activities after normal University working hours should only be considered when necessary. For Safety reasons, a faculty or a student must be accompanied by another person preferably a laboratory staff member when working outside the UoS working hours particularly when working with hazardous materials or equipment.
2) Applicant must have the form endorsed by the Supervisor, Department Chair and CL Director.
3) UoS Security unit will be responsible for opening the labs that Student / Faculty staff are authorized to access.
4) Security unit contact: **050 - 586 80 63**.
5) The applicant is responsible to keep all the equipment and lab facilities in working order before leaving the labs.
6) The accompanying person must be of the same gender.
7) Students can stay from Sunday till Thursday and Saturday up to **9:00 PM**.

Name of Applicant **(s)** : **(1)**..... ID # :..... Tel :.....

(2)..... ID # :..... Tel :.....

(3)..... ID # :..... Tel :.....

Name of accompanying : ..... ID # :.....

College : ..... Dept.....

Period : From:..... /...../..... To:..... /...../.....

Lab**(s)** to be used : .....

Reason : .....

.....

.....

(I hereby agree to abide by the above policies)

Name of Applicant(s) (1) :..... Signature:..... (2)

:..... Signature:.....

(3) :..... Signature:.....

Supervisor in charge : Name:..... Signature:.....

Head of Department : Name:..... Signature:.....

CL Director : .....

Signature : .....

Date : ..... /...../.....

Appendix (II)

Incident Report Form

جامعة الشارقة
UNIVERSITY OF SHARJAH

THE CENTRAL LABORATORIES DIRECTORATE

Incident Report

Report any incident including injury, property damage: immediately following the incident, call/fax/e-mail to the Central Labs Directorate: (Tel: 06-5053453, Fax: 06-5050444, E-mail: centrallabs@sharjah.ac.ae)

Date : .....

COLLEGE : .....

DEPARTMENT : .....

INCIDENT INFORMATION

Lab Name of the incident:	Building:	Room No: .....
Nature of the activity:		
Date of the incident : / /	Time of the incident:	
Name of Person(s) involved:		

Description of the incident:

(Describe in details what happened - Mark on the picture any injuries to the person)

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Action Taken :

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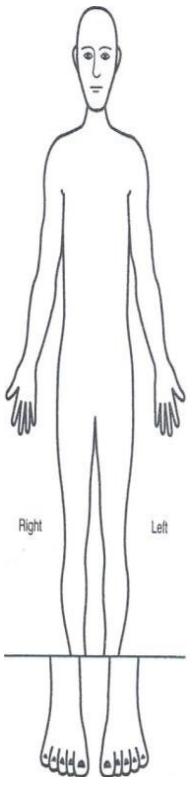

جامعة الشارقة
UNIVERSITY OF SHARJAH

THE CENTRAL LABORATORIES DIRECTORATE

Witnesses:	
Name:	Mobile: .....
Name:	Mobile: .....
Name:	Mobile: .....

REPORTING PERSON

Name :		Designation: .....
Building:		Room No : .....
Ext :	Mobile:	E-Mail: .....

STAFF / FACULTY INCHARGE AT THE TIME OF INCIDENT

Name :		Designation: .....
Building:		Room No : .....
Ext :	Mobile:	E-Mail: .....

Declaration: We hereby declare that the above reported information is true as what happened.

Faculty In charge
Name: .....
Sign : .....

Reporting Person
Name: .....
Sign : .....

For CENTRAL LABORATORIES DIRECTORATE		
Director: Engr. Mahmoud Abu Shammeh	Date: / /	Sign:

Comments and Follow up:

Appendix (III)

Hazardous Waste List

Waste List

Lab No.:	
Staff name:	
Contact	

Date:

#	Item	Qty	Unit*	Nature			State		
				Flammable	Corrosive	Toxic	Solid	Liquid	Other
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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18									
19									
20									

ATTACH MSDS FOR EACH ITEM IF NEEDED

* Unit:- e.g. Box, Bottle,Litres,Kgs...etc.

PLS. MARK NATURE & STATE APPROPRIATELY WITH AN "X"

Appendix (IV)

Compatibility Table

Compatibility Table

Chemicals listed on the same row (Group A and Group B) are not compatible and must not be stored together in the same location.

Group 1-A	Group 1-B	Potential Consequences
• Acetylene sludge • Alkaline caustic liquids • Alkaline cleaner • Alkaline corrosive liquids • Alkaline corrosive battery fluid • Caustic wastewater • Lime sludge & other corrosive alkalis • Lime wastewater • Lime and water • Caustic	• Acid sludge • Acid and water • Battery acid • Chemical cleaners • Electrolyte, acid • Etching acid liquid or solvent • Pickling liquor and other corrosive acids • Acid, including mixtures of acids and sulfuric acid •	• Heat generation; violent reaction
Group 2-A	**Group 2-B**	**Potential Consequences**
• Aluminum • Beryllium • Calcium • Lithium • Magnesium • Potassium • Sodium • Zinc powder • Other reactive metals and metal hydrides	• Any Group 1-A or 1-B	• Fire explosion; generation of flammable hydrogen gas
Group 3-A	**Group 3-B**	**Potential Consequences**
• Alcohols • Water	• Any concentrated item from Groups 1-A or 1-B • Calcium • Lithium • Metal hydrides • Potassium • SO2Cl2, SOCl2, PCl3, CH3SiCl3 • Other water-reactives	• Fire, explosion, or heat generation; generation of flammable or toxic gases

Group 4-A	Group 4-B	Potential Consequences
• Alcohols • Aldehydes • Halogenated hydrocarbons • Nitrated hydrocarbons • Unsaturated hydrocarbons • Other reactive organic compounds and solvents	• Concentrated Group 1-A or 1-B • Group 2-A	• Fire, explosion, or violent reaction
Group 5-A	**Group 5-B**	**Potential Consequences**
• Cyanide and sulfide solutions	• Group 1-B	• Generation of toxic hydrogen cyanide or sulfide gas
Group 6-A	**Group 6-B**	**Potential Consequences**
• Chlorates • Chlorine • Chlorites • Chromic acid • Hypochlorites • Nitrates • Nitric acid, fuming • Perchlorates • Permanganates • Peroxides • Other strong oxidizers	• Acetic acid and other organic acids • Concentrated mineral acids • Group 2-A • Group 4-A • Other flammable and combustible waste	• Fire, explosion, or violent reaction

Appendix (V)

Central Labs Emergency Action Plans:

- **Fire Action Plan**
- **Gas Leak Action Plan**

Fire Action

All staff, students and visitors are required to follow the directions on these notices.

IF YOU DISCOVER A FIRE (NO MATTER HOW SMALL)

- Operate the fire alarm using the nearest call point.
- Turn off the gas shut-off valve.
- Call Fire Emergency Response Team:
    - Security Office: 050 5868 063 (24hrs)
    - Civil Defense: 997
    - Central Labs Safety Coordinator: 050 1056 540
- Warn people in the immediate vicinity.
- Attack the fire "IF possible" with the available appliances (i.e. Fire Extinguishers, Fire blanket,...) but without taking personal risk.
- Leave the building using the nearest available exit by following the Emergency Exit Signs.
- Go directly to the Assembly Point.

ON HEARING THE ALARM

- Leave the building using the nearest available exit by following Emergency Exit Signs.
- Do not use lifts.
- Do not stop to collect personal belongings.
- Go directly to the Assembly Point.
- Do not re-enter the building until you are told by Authorized member that it is safe to do so.

Remember: Fire spreads quickly!

Gas Leak Action

All staff, students and visitors are required to follow the directions on these notices.

IF YOU SMELL LIQUEFIED PETROLEUM GAS(LPG) ODOR

- Extinguish all naked flames.
- Do not turn on or off any electrical appliances or devices.
- Turn off the gas shut-off valve.
- Open all windows.
- Call Gas Emergency Response Team On:
  - 050 762 6469, Ext: 3458, Mr. Ramadan "Gas technician"
  - 050 814 7121, Ext: 3447, Eng. Shibu "Electromechanical Engineer"
  - 050 5868 063, (24hrs) Security Office
  - 800 4446, 24hrs Emergency Hotline Number for Gulf Gas Company
  - 050 105 6540, Ext: 3428, Mr. Ahmed "CL Safety Coordinator"
- Warn people in the immediate vicinity.

IF THE GAS ESCAPE PERSISTS

- Evacuate the building immediately using the nearest available exit.
- Go directly to the Assembly Point.
- Do not re-enter the building until you are told by Authorized member that it is safe to do so.

- Do not search for the leaks with naked lights.
- Do not operate any electrical switch, light or appliance.
- Do not turn gas back on until the escape has been repaired.