UNIVERSITI MALAYA

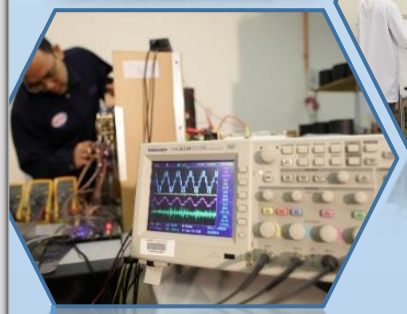
UMPEDAC

GUIDELINES

FOR SAFETY LABORATORY PRACTICES

2023

First Edition



Higher Institution Centre of Excellence (HICOE)
UM Power Energy Dedicated Advanced Centre (UMPEDAC)

TABLE OF CONTENTS

1.0 INTRODUCTION

The UM Power Energy Dedicated Advanced Centre (UMPEDAC) Guidelines for safety laboratory practices are provided as a guide and reference for every laboratory staff, student, researcher, lecturer, visitor, and all staff dealing with the UMPEDAC Laboratory. It should not be interpreted as a complete code of practice.

2.0 OBJECTIVES

The objectives of these guidelines are to:

i. provide a set of rules and procedures that aim to minimize the risks and hazards associated with laboratory work;

ii. ensure that laboratory workers are aware of potential hazards and are equipped with the necessary knowledge and skills to work safely in a laboratory setting;

iii. protect the health and well-being of laboratory workers, students, and visitors by preventing accidents and minimizing the potential for exposure to hazardous materials;

iv. safeguard the environment by reducing the risk of contamination or pollution resulting from laboratory work;

v. promote a culture of safety, responsibility, and accountability in laboratory settings.

This UMPEDAC Guideline for safety laboratory practices should be read together with the UM Laboratory Safety Guideline (LSG), 2021.

3.0 ROLES AND RESPONSIBILITIES

i. Employers (UMPEDAC): Employers are responsible for providing a safe working environment for their employees. They should implement safety guidelines and procedures, ensure that safety equipment is available, and train employees on safe laboratory practices;

ii. Employees: Employees have a responsibility to follow safety guidelines and protocols, use personal protective equipment when necessary, and report any unsafe conditions or incidents;

iii. Occupational Safety and Health (OSH) Committee: Responsible for implementing and monitoring safety guidelines and procedures, conducting safety training for employees, and conducting regular safety inspections;

iv. Researchers: Researchers have a responsibility to conduct their experiments safely and to follow safety guidelines and protocols to ensure the safety of themselves and others in the laboratory;

v. Equipment Manufacturers: Manufacturers of laboratory equipment are responsible for ensuring that their products meet safety standards and are safe for use in laboratory settings.

4.0 LIST OF UMPEDAC LABORATORY

No.	Laboratory Name	Level	Coordinator
1	Smart Grid Research Lab	LG	Dr. Tan Chia Kwang
2	Smart Transportation Research Lab	LG	Dr. Che Hang Seng
3	PV Solar Energy Testing Lab (MS ISO/IEC 17025)	G	Dr. Mohamad Fathi Mohamad Elias
4	Energy Research Lab	L4	Prof. Ir. Dr. Nasrudin Abd Rahim
5	Advanced Power Electronics Lab	L4	Prof. Ts. Dr. Jeyraj Selvaraj
6	Solar Cell Testing Lab	L4	Dr. Azimah Omar
7	PV Module Testing Lab	L4	Dr. Mohd Syukri Ali
8	Printed Circuit Board Research Lab	L4	Mr. Anuar Hamzah
9	Solar Thermal Research Lab	L15	Assoc. Prof. Dr. Md Hasanuzzaman
10	Hydrogen Research Lab	L15	Dr. Muhammad Shakeel Ahmad
11	Power Electronics Research Lab	L15	Dr. Jafferi Jamaludin & Dr. Siti Rohani Sheikh Raihan
12	Computer Lab	L15	Dr. Siti Rohani Sheikh Raihan

The duties and responsibilities of the laboratory coordinator are as follows:

i. planning to improve the development/upgrading of laboratory facilities according to the function aligned with PTj's role as a Higher Institution Centre of Excellence (HICoE);

ii. monitor the inventory of equipment/facilities in the laboratory;

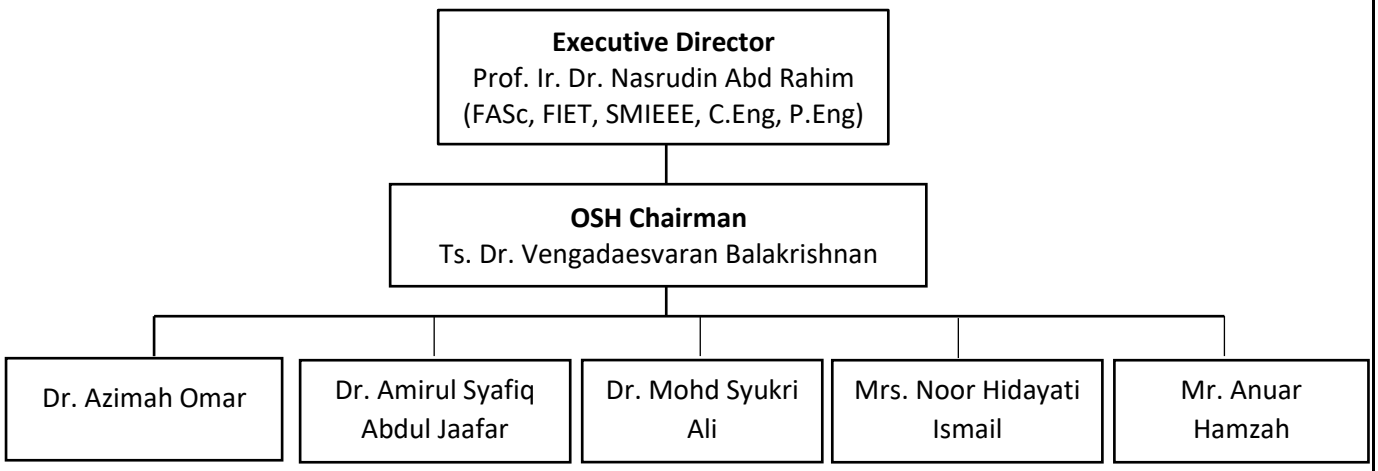
iii. manage and maintain laboratory hygiene from time to time;

iv. coordinating laboratories according to shared functions;

v. monitor the requirements and implementation of laboratory safety and regulations;

vi. obtain the Executive Director's approval before carrying out any upgrades or maintenance in the laboratory.

5.0 UMPEDAC OCCUPATIONAL SAFETY AND HEALTH (OSH) COMMITTEE



This committee is headed by a chairman who has been appointed by the Executive Director of UMPEDAC. The UMPEDAC OSH Committee plays an essential role in ensuring workplace safety and health. The primary responsibility of the OSH Committee is to promote and maintain a safe and healthy working environment for staff and students.

i. Identify and assess all potential workplace hazards and determine the necessary steps to minimize/eliminate them;

ii. Assist in developing safety and health systems and safe work systems;

iii. Review the effectiveness of the occupational safety and health program at UMPEDAC;

iv. Reviewing and evaluate the trends of accidents, dangerous incidents, near accidents, occupational poisoning, or occupational diseases that occur at the workplace, and reporting to the University management unsafe or unhealthy conditions or practices at the workplace together with recommendations for remedial action;

v. Review any report related to occupational safety and health;

vi. Hold meetings as often as necessary equivalent to the risks found;

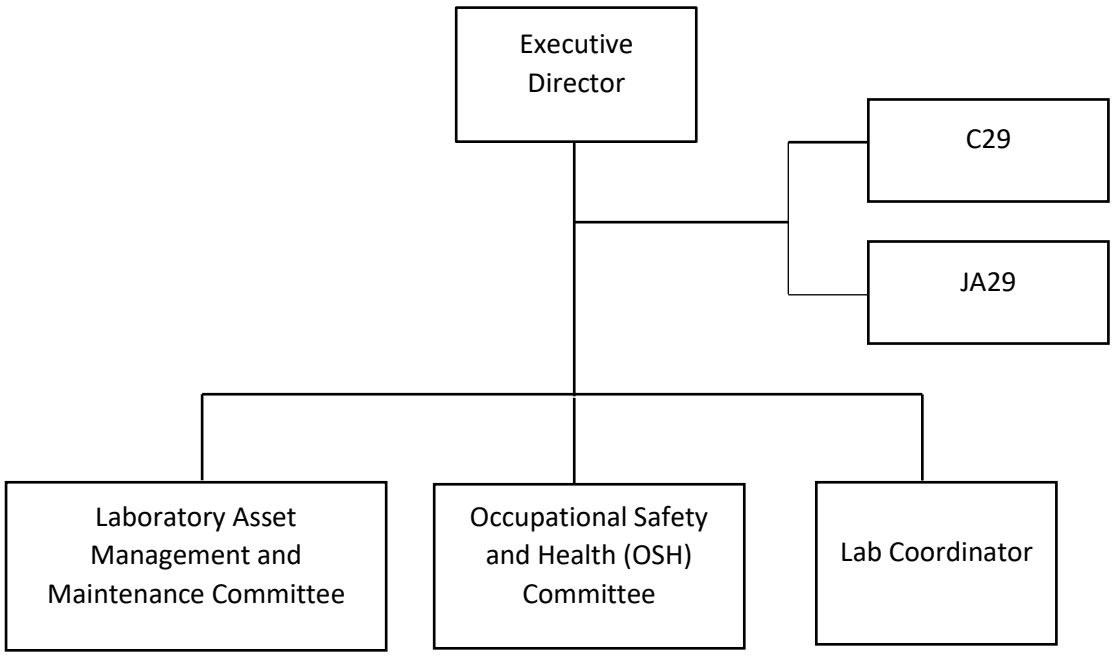
vii. Conduct regular workplace inspections;

viii. Participate in safety-related investigations and audits to identify areas for improvement and implement corrective actions;

ix. Provide safety education to employees, supervisors, and students to increase awareness of workplace hazards and how to prevent them;

x. Serve as a liaison between employees and UMPEDAC management, ensuring that employees' safety concerns are addressed and management takes appropriate actions to promote a safe and healthy environment.

6.0 UMPEDAC LABORATORY MANAGEMENT



The duties and responsibilities of the laboratory asset management and maintenance committee are as follows:

i. Assist in planning, coordinating, and evaluating the existence/abolition of laboratories and reporting to UMPEDAC management;

ii. Developing and implementing an asset management plan for all laboratory equipment, facilities, and resources;

iii. Conducting regular inspections on laboratory equipment and facilities;

iv. Managing inventory of laboratory equipment and supplies and accurately recording in the system;

v. Ensuring all equipment is properly stored and secured.

7.0 GENERAL LABORATORY SAFETY RULES

7.1 Operation Hours

The operating hours for UMPEDAC laboratories are as follows:

Monday - Thursday	8.00 am – 1.00 pm
	2.00 pm – 5.00 pm
Friday	8.00 am – 12.15 noon
	2.45 pm – 5.00 pm

7.2 Laboratory Procedures After Office Hours and Weekend Use

i. Working after office hours is not recommended;

ii. Students are not allowed to work alone; **MUST** have at least one (1) students who want to work in the laboratory on the same day and time;

iii. Students are only allowed to prepare samples. Any attempt to use the chemical substance is prohibited **EXCEPT** with the written permission of the Executive Director;

iv. The operating hours for laboratory use after office hours and on weekends are as follows:

Monday - Friday	5.00 pm – 10.00 pm
Saturday - Sunday	8.00 am – 5.00 pm

7.3 Laboratory Procedures for Public Holiday Use

i. Application email to enter the laboratory **MUST** be submitted to UMPEDAC Office at least **THREE** (3) working days before the intended lab work;

ii. All students **MUST** be accompanied by a supervisor/at least one (1) other student when working in the laboratory;

iii. Students must register in (check-in) and out of the laboratory (check-out) by filling in the laboratory log book provided in each laboratory;

iv. Only students with an approved application are allowed in the lab. Outsiders or unauthorized individuals are prohibited from entering the lab.

7.4 Guide for User

7.4.1 **SAFETY IS A PRIORITY**. Please make sure that you have read, understood, and obeyed all the rules in the laboratory;

7.4.2 Laboratories are considered **PROHIBITED AREAS** for students. Students are **NOT ALLOWED** to enter the laboratory without asking any permission from the supervisor/laboratory staff;

7.4.3 Do not remove anything from the laboratory without permission;

7.4.4 Do not work alone in the laboratory, and always inform someone of your location and activities;

7.4.5 An ongoing experiment should not be left unattended;

7.4.6 Eating, drinking, or smoking is **NOT ALLOWED** in the laboratory;

7.4.7 Lab coats should be worn as appropriate in all laboratories;

7.4.8 Joking, playing, and other similar actions are **NOT ALLOWED**;

7.4.9 Closed-toe shoes are **MANDATORY**. Students are **NOT ALLOWED** to wear open shoes or sandals or high-heeled or open-toed shoes in the lab;

7.4.10 Safety equipment such as gloves, masks, safety glasses, safety helmets, and respirators must be used when instructed to do so;

7.4.11 For those with long hair, it should be tied back and the headscarf should be inside your lab coat. Loose clothing, jewelry, and shoes made of woven materials are not recommended;

7.4.12 Students should be aware of the correct location and use of all safety equipment including:

- First aid kit;
- Fire extinguishers and fire alarms;
- Safety/Emergency showers;
- Eyewash;
- Exit door.

7.4.13 Always read and understand the safety procedures for different materials and equipment. Please refer to Material Safety Data Sheets (MSDS), lab manuals, lecturers, demonstrators, or lab staff for more information;

7.4.14 Do not use your mouth when using a pipette;

7.4.15 Do not throw solid waste into the sink. Pour the organic solvent into the prepared chemical waste collection container;

7.4.16 Avoid touching any part of your face or body after handling hazardous chemicals;

7.4.17 Even if you have worn gloves, wash your hands and other parts of your body exposed to chemicals/reagents with soap and water before leaving the laboratory;

7.4.18 Never carry out laboratory work that uses electricity near the water source. Make sure the floor and all work surfaces are dry;

7.4.19 Before leaving the laboratory, please make sure that:

- All gas, electricity, and water sources have been shut off;
- All equipment is packed and arranged in an orderly manner;
- All chemicals and reagent bottles are stored;
- All work areas are cleaned and chairs are stored.

7.5 Guide for Laboratory Staff

7.5.1 Must ensure that all safety instructions in the laboratory are followed by users. Safety briefings must be given to laboratory users;

7.5.2 Safety posters and laboratory regulations should be displayed in a place that is easy to see and read;

7.5.3 Must ensure that users comply with the dress code set by the University. This includes enforcing the mandatory use of lab coats and fully cover shoes while in the lab;

7.5.4 A special place or locked cabinet to store laboratory user items should be provided;

7.5.5 Must ensure that the lights in the laboratory work properly to avoid any accidents;

7.5.6 Must provide a special container for all residues after conducting experiments or analysis work;

7.5.7 All reagent bottles must be clearly labeled. Old and faded labels should be replaced immediately,

7.5.8 Must ensure users know the position of emergency equipment such as first aid kits, fire extinguishers, emergency showers and eye washes, and others;

7.5.9 Prepare an emergency route plan in case of fire and display it clearly in a strategic place;

7.5.10 Must ensure that any equipment damage and accidents are reported to the responsible office immediately;

7.5.11 Must ensure the laboratory has good ventilation and is equipped with an exhaust system;

7.5.12 Make sure the emergency number is displayed in the laboratory and each lab is provided with a first aid kit.

8.0 LABORATORY SAFETY GUIDELINES

8.1 ELECTRICAL SAFETY

8.1.1 The electrical equipment shall be operated and maintained following the manufacturer's operating and maintenance instructions and recommendations;

8.1.2 Users shall be aware of the location of the electrical distribution/panel boards;

8.1.3 Wear appropriate PPE such as safety glasses, insulated gloves, and safety shoes;

8.1.4 All electrical wiring and construction must conform to standard safety practices;

8.1.5 Should avoid contacting circuits with wet hands or materials;

8.1.6 Push the RED button to disconnect the main supply if an incident occurs while working on the laboratory bench;

8.1.7 It is not recommended to use multi-strip outlets or extension power cords in place of permanently installed receptacles. An electrician should install additional outlets if necessary;

8.1.8 Keep one hand in a pocket or behind your back when checking an operating circuit to prevent making a closed circuit;

8.1.9 Access to electrical panels and disconnect switches should be clear and unobstructed;

8.1.10 Use only tools and equipment with non-conducting handles when working with electrical devices;

8.1.11 Maintain a workspace clear of extraneous materials such as books, papers, and clothes;

8.1.12 Never change the wiring with the circuit plugged into the power source;

8.1.13 Never plug leads into a power source unless they are connected to an established circuit;

8.1.14 Do not use or store highly flammable solvents/materials near electrical equipment;

8.1.15 Use suitable types of plugs for the socket outlets;



8.1.16 Avoid plugging or unplugging energized equipment with wet hands;

8.1.17 Plugs and sockets that are hot during normal use or have scorch marks shall be removed from service immediately;

8.1.18 Carefully place power cords so they don't come in contact with water or chemicals. Contact with water is a shock hazard. Corrosives and solvents can degrade the cord insulation;

8.1.19 Electrical accessories such as plugs, sockets, and portable socket outlets shall be replaced when it is damaged/broken, or when the manufacturer's recommended shelf life has been exceeded;

8.1.20 Routine inspection of the electrical equipment, components, wiring, or sockets should be conducted to identify any damaged or malfunctioning electrical equipment and frayed wires;

8.1.21 Anyone who is going to be using the electrical laboratory should be trained on how to use the equipment properly and how to handle any emergencies.

8.2 SOLAR SAFETY

Working in a solar laboratory can pose potential hazards, such as exposure to hazardous chemicals, electrical shock, and physical injuries.

8.2.1 Follow all posted safety signs, warnings, and instructions;

8.2.2 Always wear the appropriate PPE, including lab coats, gloves, safety glasses, and closed-toe shoes. Additional PPE such as respirators, face shields, and hearing protection may also be required for specific tasks;

8.2.3 Become familiar with the layout of the laboratory, the locations of emergency equipment such as fire extinguishers, the location of first aid kits, and know the procedures of the laboratory;

8.2.4 Keep the laboratory and your work area clean, tidy, and free from clutter. Ensure that all equipment is properly maintained and stored;

8.2.5 Use chemicals only in designated areas and with appropriate PPE. Never mix chemicals without knowing the potential hazards and always follow proper disposal procedures;

8.2.6 Label all chemicals and equipment clearly, and store them in appropriate storage facilities (chemical cabinet/fridge/dry cabinet);

8.2.7 Keep all chemicals in their original containers;

8.2.8 Put chemicals away when not in use;

8.2.9 Knows where material safety datasheet and equipment manuals are kept;

8.2.10 Follow proper electrical safety procedures when working with electrical equipment or high-voltage systems. Always turn off the power before making electrical connections or performing maintenance on equipment;

8.2.11 Ask the lab technician or lab coordinator how to use the electrical equipment (e.g., EQE, IQE, solar I-V tester, 3-phase connector, etc.,);

8.2.12 Use proper techniques when handling glassware and equipment, and report any damage immediately;

8.2.13 Stay up-to-date with the latest safety procedures and guidelines, and attend safety training sessions when available;

8.2.14 Be aware of the risk associated with UV radiation and use appropriate shielding;

8.2.15 Knows how to store and handle chemical wastes or lab wastes. The chemical wastes should not go to the drain. Refer to Section 10.0: Waste Management;

8.2.16 Knows how to use the spill kit, emergency shower, and eyewash available inside the lab;

8.2.17 Clean up spills immediately.

8.3 HYDROGEN SAFETY

8.3.1 Hydrogen must be handled with care, as it is highly flammable and can form explosive mixtures with air;

8.3.2 All work involving hydrogen should be carried out in a well-ventilated area, and sources of ignition, such as flames or sparks, must be kept away from the work area and hydrogen storage. This includes smoking, welding, and any other activity that may create sparks or heat;

8.3.3 All personnel working with hydrogen must receive appropriate training on the properties of the gas, proper handling techniques, and emergency procedures;

8.3.4 Only qualified personnel should be permitted to handle hydrogen, and a qualified supervisor should supervise work involving this gas;

8.3.5 Appropriate PPE should be worn; a laboratory coat made of fire-resistant materials. Working with gaseous hydrogen requires wearing safety glasses or goggles. When working with liquid hydrogen, insulated gloves, and protective shoes should be worn in addition to eye protection;

8.3.6 Hydrogen should be handled with care to avoid leaks or spills. If a leak or spill occurs, the area should be evacuated immediately and proper procedures should be followed for cleaning up the spill;

8.3.7 Hydrogen should be stored in approved containers that are designed for safe storage. These containers should be made of materials that are compatible with hydrogen, and they should be properly labeled;

8.3.8 Hydrogen should be monitored for leaks using appropriate gas detection equipment. This equipment should be regularly calibrated to ensure accuracy;

8.3.9 guarding rail for rotating moving parts/rotating cutting blade needs to be used to protect from accidental cuts;

8.3.10 Saw dust should be placed in appropriate containers.

8.4. CHEMICAL SAFETY

8.4.1 Before handling any chemical, it is essential to understand its properties, hazards, and proper handling procedures. Review the Safety Data Sheet (SDS) for each chemical to determine its hazards and how to handle it safely;

8.4.2 Wear appropriate protective equipment, such as gloves, eye protection, respiratory protection, and a laboratory coat when working with chemicals. Ensure that the equipment fits properly and is suitable for the chemicals being used;

8.4.3 Store chemicals in a designated area that is clearly labeled and away from incompatible substances. Use appropriate storage containers; never store chemicals in food or beverage containers;

8.4.4 Follow proper disposal procedures for chemicals and their containers. Never pour chemicals down the drain, and follow local regulations for disposal;

8.4.5 Handle chemicals with care to prevent spills and leaks. Use appropriate handling procedures, such as using a fume hood when working with volatile chemicals;

8.4.6 Avoid skin contact with the chemicals or acids, use gloves when handling or pouring the chemicals;

8.4.7 Avoid the inhalation of chemicals, handling the volatile and aerosolized chemicals inside the fume hood to minimize the smell of chemicals;

8.4.8 Avoid ingestion of chemicals, do not taste the chemicals and alcohol solvent;

8.4.9 Avoid injections of chemicals by using the same needles or syringe; dispose of needles or syringes after using them immediately;

8.4.10 Be careful handle sharp tools and equipment; please use the gloves when handling them;

8.4.11 Be careful handling the high-pressure system, never use your hand to check for pressure leaks;

8.4.12 Be careful handling high-temperature equipment such as oven and furnace, use thick gloves to handle the chemicals and powders;

8.4.13 Be careful to handle the nanoparticles powder in the laboratory area; wear a face mask to avoid any inhalation of powders;

8.4.14 Be prepared for chemical spills, leaks, and other emergencies. Know the location of emergency equipment, such as fire extinguishers, eyewash stations, and safety showers, and how to use them;

8.4.15 Wash your hand thoroughly with soap and water after removing the gloves and leaving the laboratory area;

8.4.16 Do not eat and drink inside the laboratory area; don’t consume any food inside the laboratory;

8.4.17 Do not leave your chemicals, acids, and volatile liquids in open space in the laboratory area; clean up your working space area after experimenting;

8.4.18 Do not leave your tools and equipment in an open space in the laboratory area; clean up your working space area after experimenting;

8.4.19 Do not place the materials, powders, acids, and volatile chemicals nearby the electrical equipment and machines;

8.4.20 Wash your hand and skin immediately as if your skin feels irritated after handling the acids and volatile chemicals;

8.4.21 Shower your body immediately as if your skins feel irritated and itchy after handling the acids and volatile chemicals;

8.4.22 Report the accidents in the laboratory area immediately to the person in charge, supervisor, or officer;

8.4.23 Ensure that workers are properly trained on chemical safety procedures and hazards. Communicate any changes or updates to safety protocols and provide regular safety training to workers.

8.5 GLASSWARE SAFETY

8.5.1 Always wear appropriate personal protective equipment, such as safety glasses, gloves, and lab coats when working with glassware;

8.5.2 Check glassware for cracks, chips, or other damage before use. Do not use damaged glassware, as it may shatter or break during use;

8.5.3 Handle glassware carefully to avoid dropping or banging it against other objects, as this can cause it to break;

8.5.4 Use a suitable stand or support to hold the glassware in place during use, especially when heating or stirring;

8.5.5 Use caution when heating glassware, as rapid changes in temperature can cause it to break. Do not heat glassware that is not designed for heating, such as thin-walled or borosilicate glass;

8.5.6 Use appropriate clamps or holders when attaching glassware to a stand or support, and make sure it is securely fastened before use;

8.5.7 Use caution when pouring liquids into glassware, and avoid overfilling or spilling;

8.5.8 Use appropriate cleaning methods for glassware, and avoid using abrasive materials or harsh chemicals that can damage or weaken the glass;

8.5.9 Store glassware properly when not in use, and avoid stacking it or placing heavy objects on top of it.

9.0 HOUSEKEEPING

Housekeeping is an important aspect of laboratory safety. A clean and well-organized workplace not only promotes productivity but also reduces the risk of accidents and injuries.

9.1 Keep all work areas clean and free of clutter, debris, and obstructions. This includes floors, walkways, and workstations;

9.2 Keep all equipment and machinery clean and well-maintained. Regularly inspect and repair any faulty or damaged equipment;

9.3 Properly store all materials, tools, and equipment when not in use. Keep them in designated storage areas and properly labeled;

9.4 Use caution when using electrical cords, and keep them organized and free of kinks or knots;

9.5 Clean up spills immediately and post signs to warn others of any wet or slippery floors;

9.6 Dispose of waste properly in designated containers. Never leave waste lying around or in the wrong area;

9.7 Maintain good ventilation in the workplace to prevent the buildup of hazardous fumes, dust, or other airborne contaminants;

9.8 Keep exits and emergency evacuation routes free of obstructions.

10.0 WASTE MANAGEMENT

10.1 Laboratory Waste Management

UMPEDAC laboratory waste management is a crucial aspect of ensuring that laboratory operations are conducted in an environmentally responsible and safe manner. It involves the proper collection, handling, transportation, storage as well as waste recycling or disposal of all types of laboratory waste including chemicals, electronics, glassware, plastics, metals, and sharps. This is important to ensure the safety of laboratory personnel, protect the environment, and comply with local and federal regulations.

Laboratory waste refers to any materials, chemicals, or equipment that are no longer needed or have become contaminated during laboratory procedures. This waste can be hazardous to humans, animals, and the environment if not disposed of properly.

10.2 Waste Hierarchy

The waste hierarchy is a framework that outlines the preferred options for managing waste in order of priority, to reduce its environmental impact. The hierarchy is often depicted as a pyramid, with the most preferred options at the top and the least preferred at the bottom. In line with the needs and interests of humans and the environment, UMPEDAC has implemented a waste hierarchy in dealings with laboratory waste.

The six levels of the waste hierarchy in order of priority, are:

i. Prevention

The most effective way to manage waste is to prevent it from being generated in the first place. This can be achieved by reducing consumption, reusing items, and designing products that are more durable and repairable.

ii. Minimization

If waste cannot be prevented, the next best option is to minimize the amount generated. This can be done by improving production processes, using more efficient equipment, and reducing packaging.

iii. Reuse

Items that are no longer needed by their original owners can be reused by others. This includes donating items to charity, selling them second-hand, or repurposing them for different uses.

iv. Recycling

Materials that cannot be reused can often be recycled. This involves processing the waste into new raw materials, which can then be used to manufacture new products.

v. Energy Recovery

This involves extracting energy or material from waste that cannot be recycled. For example, waste-to-energy facilities burn waste to generate electricity.

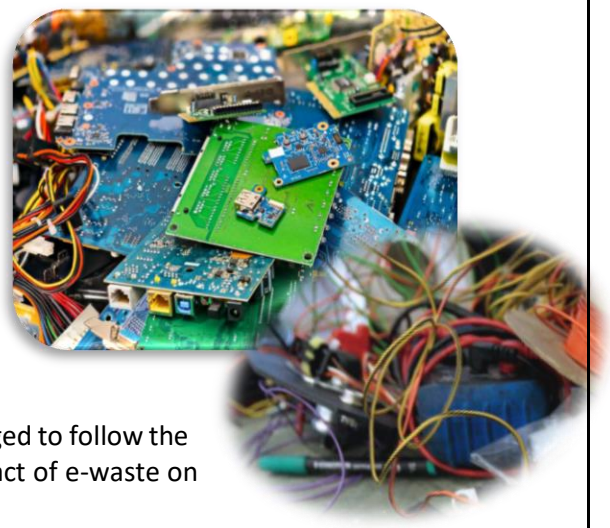
vi. Disposal

The final option is disposal, which should only be used for waste that cannot be prevented, minimized, reused, or recycled. The disposal can take many forms, including landfill, incineration, and composting. The goal is to minimize the environmental impact of disposal by using methods that are safe and environmentally responsible.

10.3 Electrical Waste (e-waste)

Laboratory electrical waste refers to any electronic equipment or devices that are no longer usable or needed in a laboratory setting. This can include items such as old computers, batteries, power supplies, wires, heating apparatus, PCB board, photovoltaic panels, charges, ventilation equipment, monitoring and control instruments, and other electronic devices.

Many electronic devices contain hazardous materials such as lead, mercury, cadmium, hexavalent chromium, and plastics including PVC, BFRs, and barium which can seep into the soil and water if the devices are not disposed of correctly. Therefore, proper disposal of laboratory electrical waste is important to prevent environmental pollution and potential harm to human health. Additionally, e-waste can also contribute to climate change when incinerated, releasing harmful greenhouse gases into the atmosphere.



At UMPEDAC, all researchers and laboratory staff are encouraged to follow the steps below in managing e-waste to reduce the negative impact of e-waste on the environment and ensure a sustainable future.

i. Reduce

The best way to manage e-waste is to reduce it in the first place. This can be achieved by buying products that are designed to last longer, repairing or upgrading electronic devices instead of replacing them, and avoiding unnecessary purchases.

ii. Reuse

Electronic devices that are still functional can be reused by donating them to charity, selling them, or giving them away.

iii. Recycle

Recycling e-waste involves the collection of electronic devices and appliances that are no longer in use and the separation of their components for reuse. Recycling helps to conserve natural resources and reduce pollution.

iv. Disposal

E-waste that cannot be reused or recycled should be disposed of properly. This can be done by taking it to a designated e-waste disposal facility, where it can be safely and responsibly disposed of.

v. Awareness

Raising awareness about the importance of proper electrical waste management is crucial. This can be done through educational campaigns, workshops, and other public events.

10.4 Solar Waste

The solar waste generated from solar energy experiments or research may include various chemicals and materials used in the process. Some of these materials may be hazardous to human health and the environment. Proper disposal of laboratory solar waste is crucial to avoid potential harm to the environment and human health. Examples of waste generated in solar energy research might include:

a. Chemical waste

Some solar energy research may involve the use of chemicals, such as solvents or acids, which can generate waste. Proper disposal of these chemicals is important to ensure the safety of laboratory workers and the environment.

b. Electronic waste

Solar energy research may also involve the use of electronic equipment, such as photovoltaic panels or testing equipment, which can generate electronic waste at the end of their useful life. Researchers and laboratory personnel need to follow proper waste disposal procedures to minimize the environmental impact of their research.

Steps that need to be followed when disposing of solar waste from the UMPEDAC laboratory are:

i. Identify the type of solar waste

There are different types of solar waste that laboratories can generate, including solar panels, batteries, and other electronic components. It is essential to identify the type of waste to determine the appropriate disposal method.

ii. Segregate the waste

Once the type of solar waste is identified, segregate it from other waste streams. This segregation helps ensure that the waste is not mixed with other hazardous materials, which could increase the potential for harm.

iii. Consider recycling

Recycling is often a preferred method of disposing of solar waste because it reduces the amount of waste sent to landfills and conserves valuable resources. Find information about local recycling facilities that accept solar waste and follow their guidelines for proper disposal.

iv. Dispose of hazardous components properly

Some components of solar panels, such as cadmium telluride and lead, are hazardous and require special handling. Ensure that these materials are properly disposed of by local regulations.

v. Document the disposal

Keep a record of the disposal process, including the type of waste, the method of disposal, and any relevant documentation, such as receipts or certificates of disposal.

10.5 Chemical Waste

Laboratory chemical waste refers to any chemical substance, mixture, or by-product that is generated during laboratory research or experimentation and is no longer needed or useful. Chemical waste can be hazardous to human health and the environment if not properly disposed of.

There are different types of laboratory chemical waste, such as:

i. **Hazardous waste**: this includes chemicals that are toxic, corrosive, flammable, or reactive.

ii. **Non-hazardous waste**: this includes chemicals that are not classified as hazardous, but still need to be disposed of properly.

Some examples of laboratory chemical waste include:

i. Acids and bases
ii. Solvents
iii. Heavy metals
iv. Organic compounds
v. Radioactive materials
vi. Biological waste

Best practices for managing UMPEDAC laboratory chemical waste:

i. **Identify the types of chemicals:** Before using any chemicals, identify their hazardous properties, such as flammability, reactivity, toxicity, and corrosiveness.

ii. **Segregate the waste:** Segregate the waste based on its hazardous properties, such as flammable, corrosive, toxic, or reactive. Separate incompatible wastes and store them separately.

iii. **Label the waste:** Label all waste containers with the name of the chemical, the date, and its hazardous properties. This will help in proper disposal.

iv. **Store waste properly:** Store waste in appropriate containers, such as chemical-resistant containers, with tight-fitting lids to prevent spills and leaks. Store the waste in a designated area with proper ventilation and fire protection.

v. **Dispose of waste properly:** Dispose of hazardous waste through a licensed waste disposal service or follow the institution's guidelines for waste disposal. Do not pour chemicals down the drain or dispose of them in the trash.

vi. **Train personnel:** Train laboratory personnel in proper waste management practices, including how to handle, store, and dispose of waste safely.

vii. **Keep records:** Keep accurate records of all waste generated, stored, and disposed of. This will help in tracking the waste and in compliance with regulatory requirements.

10.6 Hydrogen Waste

Hydrogen waste refers to any waste or byproduct generated during the production or use of hydrogen in a laboratory. Hydrogen is often used as a fuel source or reactant in various laboratory experiments and processes, and the waste generated can include gas emissions, liquid waste, or solid waste.

i. Gas form

If the hydrogen is in gas form, the waste should be collected in a gas-tight container designed for the purpose. The container should be marked with a label indicating the contents and the date of collection. The container should be kept in a well-ventilated area, away from heat sources, ignition sources, and reactive chemicals.

ii. Liquid form

If the hydrogen is in liquid form, the waste should be collected in a suitable container that is compatible with the chemical properties of hydrogen. Again, the container should be marked with a label indicating the contents and the date of collection. The container should be kept in a well-ventilated area, away from heat sources, ignition sources, and reactive chemicals.

iii. Solid form

If the hydrogen is in solid form, the waste should be collected in a suitable container that is compatible with the chemical properties of hydrogen. Again, the container should be marked with a label indicating the contents and the date of collection. The container should be kept in a well-ventilated area, away from heat sources, ignition sources, and reactive chemicals.

10.7 Glassware Waste

Laboratory glassware waste refers to broken or damaged glassware, as well as glassware that has been contaminated with chemicals or biological materials.

Proper disposal of laboratory glassware waste is important to prevent injury or harm to individuals who handle the waste, as well as to prevent contamination of the environment.

i. Segregation

Segregate glassware waste from other waste streams. This will make it easier to identify and handle glassware waste.

ii. Handling

Handle glassware waste carefully to avoid breakage. Use a broom and dustpan to clean up broken glass. Broken or damaged glassware should be placed in a designated glass disposal container. This container should be labelled and kept separate from other waste containers.

iii. Reuse

Consider reusing glassware whenever possible. This will reduce the amount of waste generated and save money on purchasing new glassware.

iv. Recycling

Glassware can be recycled, but it is important to ensure that the glass is not contaminated with hazardous materials. This can be done by rinsing the glassware with water or other appropriate solvents, depending on the type of contamination. If the glassware cannot be decontaminated, it should be placed in a designated hazardous waste container for proper disposal.

v. Disposal

If glassware cannot be reused or recycled, it must be disposed of properly. Glassware waste should be placed in a designated glass waste container and disposed of according to local regulations. Large or bulky glassware should be wrapped in paper or plastic before disposal to prevent injury to those handling the waste.

Always wear gloves and other personal protective equipment when handling glassware waste to prevent injuries and exposure to hazardous materials.

10.8 Metal Waste

Laboratory metal waste can include a variety of materials, such as metal scraps, metal containers, metal equipment, and metal parts that are no longer needed or useful in a laboratory. These may include metals like aluminum, copper, iron, lead, nickel, silver, stainless steel, and zinc.

The metal waste from laboratories may contain hazardous substances or chemicals that need to be properly disposed of to prevent harm to human health and the environment. Some metals can be toxic or corrosive, while others may be reactive or flammable.

There are various ways to dispose of laboratory metal waste, depending on the type and quantity of waste generated. Some options may include recycling, incineration, or landfill disposal.

The steps to follow in the disposal or recycling of UMPEDAC laboratory metal waste include:

i. Segregation

The first step in managing laboratory metal waste is to segregate the waste according to the type of metal. This makes it easier to determine the appropriate disposal method for each type of metal.

ii. Identification

All metal waste should be clearly labeled with the type of metal, its form (e.g. powder, solid, liquid), and any hazardous properties.

iii. Storage

Metal waste should be stored in a secure and labeled container that is appropriate for the type of metal and the amount of waste generated. It is important to ensure that the containers are kept in a safe location, away from potential hazards such as heat or moisture.

iv. Disposal

The disposal of metal waste will depend on the type of metal and any hazardous properties it may have. Some metals can be recycled, while others may need to be disposed of as hazardous waste.

v. Recycling

Many metals used in laboratories can be recycled, which can help to reduce the amount of waste that is sent to landfills. Some common metals that can be recycled include aluminum, copper, and steel.

vi. Hazardous waste disposal

If the metal waste is hazardous, it must be disposed of according to local regulations. This may involve transporting the waste to a licensed hazardous waste facility or arranging for a hazardous waste disposal service.

11. EMERGENCY EQUIPMENT SAFETY RULES

11.1 Eyewash

11.1.1 Always wear personal protective equipment (PPE) when handling hazardous materials or chemicals;

11.1.2 Know the location of the eyewash station and ensure it is easily accessible;

11.1.3 Regularly inspect eyewash stations to ensure they are clean, functional, and have a sufficient supply of clean water;

11.1.4 Train employees on the proper use of eyewash stations and ensure they understand the importance of immediately rinsing eyes if exposed to hazardous materials;

11.1.5 In case of eye exposure, hold eyelids open and flush eyes with water for a minimum of 15 minutes;

11.1.6 Seek medical attention after flushing eyes with water;

11.1.7 Do not rub or touch the eyes during the flushing process as this may cause further damage;

11.1.8 Report all incidents involving eye exposure to management and complete an incident report;

11.1.9 Regularly review and update emergency response procedures to ensure employee safety.

11.2 Shower

11.2.1 Know the location of the emergency shower and familiarize yourself with its operation before beginning any work with hazardous materials;

11.2.2 Keep the path to the emergency shower clear at all times;

11.2.3 Wear appropriate protective equipment when handling hazardous materials;

11.2.4 Do not block or obstruct the emergency shower;

11.2.5 Activate the emergency shower immediately if you come into contact with hazardous materials. Do not delay or wait for symptoms to appear;

11.2.6 Use the emergency shower for at least 15 minutes, even if you feel fine;

11.2.7 Notify a supervisor or call for medical assistance after using the emergency shower;

11.2.8 After using the emergency shower, report the incident to your supervisor and complete an incident report;

11.2.9 Regularly inspect and maintain the emergency shower to ensure it is in good working condition;

11.2.10 Train all employees on the location and proper use of emergency showers.

11.3 Fire Extinguisher

11.3.1 Know the type of fire extinguisher you have and its proper use;

11.3.2 Keep fire extinguishers in easily accessible locations, such as near exits;

11.3.3 Check the pressure gauge on the extinguisher regularly to ensure it is properly charged;

11.3.4 Have all employees trained on how to use a fire extinguisher;

11.3.5 Stand at a safe distance from the fire and use the PASS method (Pull the pin, Aim at the base of the fire, Squeeze the handle, Sweep from side to side) to discharge the extinguisher;

11.3.6 Do not use water on an electrical or grease fire, as it can make the situation worse;

11.3.7 If the fire does not go out or grows larger, evacuate immediately and let the fire department handle it.

11.4 First Aid Kit

11.4.1 Keep the kit in a secure and easily accessible location, out of the reach of children and pets;

11.4.2 Regularly check the kit for expired items and replace them as needed;

11.4.3 Store the kit in a cool, dry place, away from direct sunlight or heat sources;

11.4.4 Keep the kit clean and free from dust or debris;

11.4.5 Avoid using any items in the kit unless you are trained and qualified to do so;

11.4.6 Follow the instructions and guidelines provided with each item in the kit;

11.4.7 Always wear gloves when administering first aid to prevent the spread of infection;

11.4.8 Dispose of used materials properly and safely;

11.4.9 Keep a first aid manual or guidebook in the kit, and familiarize yourself with its contents;

11.4.10 If the kit is used in an emergency, replace any used or depleted items as soon as possible.

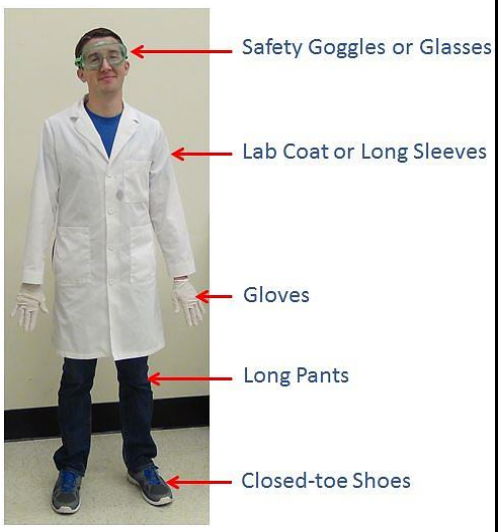
12.0 PERSONAL PROTECTION EQUIPMENT (PPE)

PPE stands for Personal Protective Equipment. It includes items that workers wear to reduce their exposure to hazards in the workplace, such as gloves, safety glasses, respirators, hard hats, and safety shoes. PPE is important because it can protect workers from serious injuries and illnesses, including cuts, burns, respiratory problems, and head injuries. Employers are responsible for providing PPE to their workers and ensuring that it is properly used and maintained.

12.1 Wear the right PPE for the job;

12.2 Inspect PPE before each use and replace any damaged equipment;

12.3 Use PPE properly and follow the manufacturer's instructions;



12.4 Clean and disinfect PPE after each use;

12.5 Store PPE in a clean and dry place;

12.6 Remove PPE after leaving the work area;

12.7 Report any damaged or missing PPE to a supervisor;

12.8 Do not share PPE with other workers;

12.9 Train employees on the proper use and care of PPE;

12.10 Review and update PPE policies and procedures regularly.

13.0 EMERGENCY CONTACT NUMBER

EMERGENCY NUMBER IN UM	
University Malaya Security Office	03-7967 7070 / 3582
University Malaya Medical Centre	03-7949 2898 / 2190
Student Health Clinic	03-7949 2837 / 3737
Occupational Safety & Health, Risk and Environment Centre (OSHREC)	03-7967 7925
EMERGENCY NUMBER OUTSIDE UM	
National Emergency No.	999 (Mobile phone, dial 112)
Pantai Fire Station (BOMBA)	03-2282 4444
Pantai Police Station	03-2282 4222 / 03-2282 2207
UMPEDAC NUMBER	
UMPEDAC's Office	03-2246 3246
Ts. Dr. Vengadaesvaran Balakrishnan (OSH Chairman)	03-2246 3406
Mr. Anuar Hamzah (OSH Committee)	03-2246 3360

These guidelines are prepared by the Occupational Safety and Health (OSH) Committee of UMPEDAC with the advice of Professor Ir. Dr. Nasrudin Abd Rahim, Executive Director of UMPEDAC.

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