



**UTM**  
UNIVERSITI TEKNOLOGI MALAYSIA

**PUSAT PENGURUSAN MAKMAL  
UNIVERSITI (PPMU)**

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**UNIT PENGURUSAN BAHAN KIMIA (CMU)**

**GUIDELINES OF CHEMICAL HANDLING**

## 1.0 INTRODUCTION

The procurement of hazardous chemicals is the first entry of a hazard into the workplace. The use of hazardous materials creates a variety of risks, thus the person ordering chemicals must be aware of the potential hazards of the substances being ordered. Certain hazardous chemicals are regulated and have specific requirements for possession and use.

## 2.0 PURPOSE

To guide the chemical handling for research, teaching and learning purposes on campus. It is also to ensure that compliance issues promulgated by applicable regulatory agencies are considered and addressed before a chemical material is procured. These agencies include Department of Occupational Safety and Health (DOSH), Department of Environmental (DOE) and Ministry of Health Malaysia.

## 3.0 RESPONSIBILITY AND ACCOUNTABILITY

All parties involved in chemical handling, including staff, students and other external parties, are responsible for ensuring the safety compliance from the Department of Occupational Safety and Health (DOSH), Department of Environmental (DOE) and Ministry of Health Malaysia. Refer to the Safety Data Sheet (SDS) of the chemicals prior to handling.

## 4.0 CHEMICAL USAGE IN THE LABORATORY

The basic safety regulations for chemical substances are the most common rules that all users must be aware of and adhere to Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000 (USECHH Regulations) when handling the chemical substances.

### 4.1 Chemical Inventory (CI) and Chemical Register (CR)

It is compulsory for each laboratory to have their own CI and CR. CI is the list of all chemicals used in the laboratories, whereas CR is the list of all chemicals hazardous to health used in the laboratories. USECHH Regulation defines chemicals as:

“Chemicals” means chemical elements, or compounds or mixtures thereof, whether natural or synthetic, but does not include micro-organisms.

“Chemical hazardous to health” means any chemical or preparation which –

(a) is listed in Schedule I or II;



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(b) possess any of the properties categorised in Part B of Schedule I of the Occupational Safety and Health (Classification, Packaging and Labeling of Hazardous Chemicals) Regulations 1997 [P.U. (A) 143/97];

(c) comes within the definition of “pesticide” under the Pesticides Act 1974 [Act 149];  
or

(d) is listed in the First Schedule of the Environmental Quality (Schedule Wastes) Regulations 1989 [P.U. (A) 139/89];

#### **4.2 Chemical Health Risk Assessment (CHRA)**

An employer shall not carry out any work which may expose or is likely to expose any employee to any chemical hazardous to health unless he has made a written assessment of the risks created by the chemical to the health of the employee. Thus, the chemical health risk assessment (CHRA) must be conducted at the workplace by hiring a DOSH certified assessor.

In order to assess all possible chemical hazards, it is compulsory for the assessor to visit the workplace and review documents related to the workplace. It is our responsibility as the employer/ employee to provide the documents needed by the assessor.

#### **4.3 Labelling and Relabelling**

All chemical users including staff, students and other external parties, are responsible for ensuring the labeling and relabelling comply with CLASS Regulation.

##### **4.3.1 Labelling**

The purpose of labelling is to ensure that the contents of a container can be readily identified by the product’s name, and to draw attention of a person who is handling or using a hazardous chemical to the significant hazards involved. Regulation 20 (1) stipulates that an employer shall ensure that all chemicals hazardous to health supplied or purchased by him and used in the place of work are labelled and the labels are not removed, defaced modified or altered.

##### **4.3.2 Relabelling**

When the labels are removed, defaced, modified or altered while the chemical hazardous to health is being used at the place of work, the employer shall relabel the chemical container. Where a chemical is transferred to another container, other than the originally supplied container, the type of relabelling required shall depend on whether the substance is used immediately or over a longer period of time.



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(a) If the contents of the container are used within a normal shift the employer shall ensure that the container is relabelled with the chemical name, or the trade name as written on the original label. This also applies to chemicals used in the testing chemical laboratory whether contents are used within a normal work shift. The container need not be relabelled if the chemical is used immediately.

(b) Containers containing pesticide shall be relabelled in accordance with the requirements of the Pesticide Act 1974; and in the case of schedule waste shall be relabelled in accordance with the requirements of the Environmental Quality (Schedule Wastes) Regulations 1989.

#### **4.4 Engineering Control**

Engineering controls are plant, processes or equipment that minimize the generation of hazardous substances, suppress or contain hazardous substances, or which limit the area of contamination in the event of spills or leaks. Types of engineering control include enclosure or partial enclosure, ventilation, automation of process, water spray, etc. Some examples of engineering controls are:

- ventilated booths for spray painting or fibreglassing;
- robot welding
- local extraction systems attached to grinding machines;
- automation of the removal of objects from degreasing baths; and
- closed reaction vessels.

#### **4.5 Emergency Equipment**

All laboratories that use hazardous materials (chemicals/ biological material) must have access to an:

- emergency eyewash
- emergency shower
- fire extinguisher
- first aid
- appropriate spill kit

Everyone working in the laboratory must know the location of that equipment and how to use it. With reference to UTM Chemical Safety Audit Checklist, emergency preparedness equipment must be well-function and being maintained regularly. Each maintenance shall be recorded in a proper document and can be accessed easily.

#### **4.6 Personal Protective Equipment (PPE)**

PPE is equipment worn to minimize exposure to hazards that could cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact



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with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. PPE may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits. Storage of PPE:

- 4.6.1 Follow instructions from the manufacturer.
- 4.6.2 Most PPE must be protected from chemicals, sunlight, extreme temperatures, excessive humidity, and moisture, or the specified shelf-life will be reduced.
- 4.6.3 Disposable, reusable, or limited-use PPE must be discarded if not stored properly.
- 4.6.4 Keep PPE in its sealed package until use, and never store PPE with pesticides or personal clothing.
- 4.6.5 With reference to UTM Chemical Safety Audit Checklist, records of PPE must contain issuance, maintenance, inspection, and training.

**4.7 Safe Operating Procedure(SOP), Information, Instruction and Training**

An employer who undertakes work which may expose or is likely to expose the employees to chemicals hazardous to health shall provide the employees with such information, instruction and training as may be necessary to enable them to know:

- (a) the risk to health created by such exposure; and
- (b) the precautions which should be taken.


In order to comply with the regulations, each chemical user should undergo chemical safety training at least once every two years. Other than that, chemical users must be familiar with any SOP related to chemical management.

**4.8 Safety Data Sheet (SDS)**

A chemical user who receives a supply of chemicals hazardous to health for which the chemicals are not labelled or the SDS have not been provided, shall obtain the relevant information from the supplier and shall not use the chemicals until such information is obtained.

SDS means a document which contains relevant information on a chemical and is furnished in pursuance of the Occupational Safety and Health (Classification, Packaging, and Labelling of Hazardous Chemicals) Regulations 1997;

- Suppliers are compulsory to supply chemicals together with the SDS.
- The validity of SDS from the date of revision should be within 5 years.
- Reference for the right format of SDS: CLASS Regulations.

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## 4.9 Warning Sign

### 4.9.1 General

Employers shall ensure that warning signs are posted at the area where a chemical hazardous to health may be or likely to be at risk to the health of any person who may be or is likely to be at risk of being exposed to hazardous chemicals. When posting warning signs employer shall ensure that the following conditions are adhered to:

- The warning signs shall be posted at a conspicuous place at every entrance of the area to warn person entering the area of the hazards.
- Other relevant information is given to persons who may be or are likely to be at risk of being affected by the chemicals hazardous to health.
- Warning signs shall be illuminated and cleaned as necessary so that the legend is readily visible.
- Warning signs shall have the following features:
- Example of warning signage at the entrance of the working area:
  - i. Give warning of the hazards
  - ii. Written in National and English language.
  - iii. Attract attention to afford a rapid interaction of dangers, and to facilitate their identification.
- Example of warning signage at the entrance of the working area:

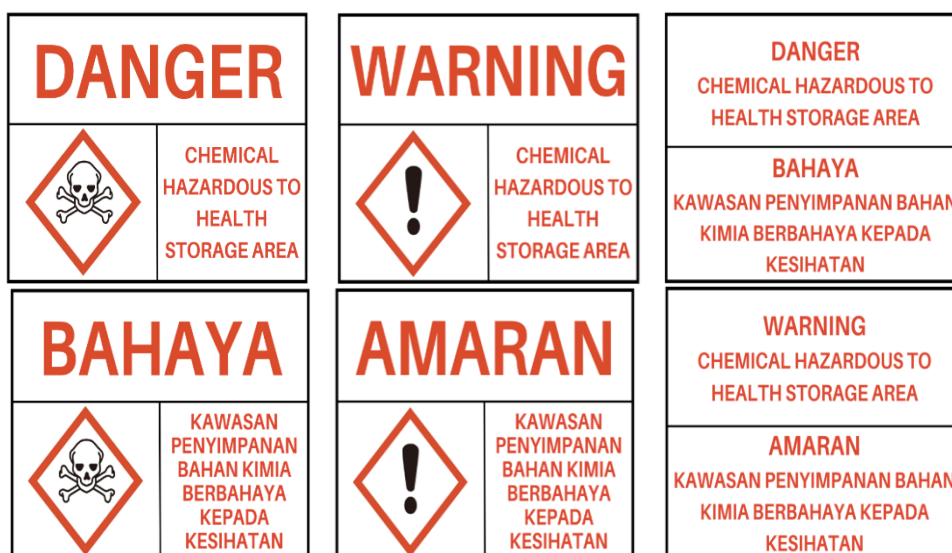


Figure 1: Warning sign



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#### 4.10 Chemical Storage

Chemical storage areas should be located away from densely populated areas, from drinking water sources, from areas liable to flooding and from flooding and external sources of hazards. Location should provide easy access for transport and emergency services on the ground stable enough to support robust and safe buildings and roadways. Adequate services should be provided including electricity with emergency supply if needed, portable water and fire-fighting water, drainage preventing ground run-off to either public/ storm sewer or a waste treatment plant as a part of a site containment plan.

Chemicals need to be stored properly to ensure their safe use in the future. Neglecting safe storage practices for hazardous chemicals can lead to serious consequences, such as fires and explosions, as well as long-term exposure that may result in diseases such as cancer, respiratory problems, and severe allergies.

##### 4.10.1 Basic Regulations on Chemical Storage

The basic regulations for chemical storage are as follows:

- Store chemicals according to their hazard types. Only chemicals in the same hazard category should be stored alphabetically. If a chemical exhibits more than one hazard, separate it based on its primary hazard classification.
- Do not store chemicals near heat sources, such as ovens and direct sunlight.
- Record the date when chemicals are received and opened. These records can help users identify chemicals that need to be used first and assist in reducing the quantity of chemicals to be disposed of. If a chemical has an expiration date, users should also note the expiration date on the chemical's container. Note that the expiration date provided by the supplier is only for user guidance, and the chemical may not necessarily be safe for use on that date.
- Do not use the laboratory bench as a permanent storage location for chemicals. Each chemical must have a designated, secure storage location.
- Regularly inspect all chemicals to identify signs of contamination and check the integrity of chemical labels.
- Do not store any chemicals in glass containers on the floor.
- Use secondary containment (Figure 2) as a control measure to prevent the spread of chemicals in case of spills.
- Do not use fume hood as a permanent storage location for chemicals, except for chemicals with strong odours that may require ventilation. Some chemical fume hoods have storage cabinets with proper ventilation

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systems to safely store chemicals.

- Chemicals that need cold temperatures should be tightly sealed and stored in a dedicated refrigerator in the laboratory. Safe refrigerators or freezers are necessary for storing flammable chemicals.
- It is not recommended to store chemicals at higher levels than eye levels.
- Do not store excessive quantities of chemicals in the laboratory.
- Ensure that CR and CI are reviewed and updated periodically.



**Figure 2: Two chemical bottles placed inside a secondary container**

#### **4.10.2 Hazard Classification**

In any situation, the precaution needed to achieve a reasonable standard of control will vary but must consider the properties of the chemicals to be stored. Different chemicals create very different risks because of their hazards. It is therefore important that the standards adopted at a particular site are based on an understanding of the physical and chemical properties of the chemicals concerned. Interactions between different chemicals, especially those which are incompatible, may create additional hazards.










There are 9 hazard categories (Figure 3) which comprise four hazard categories based on physicochemical properties (i.e.: explosive, oxidising, compressed gas and flammable and 5 hazard categories based on health effect (i.e.: environmental hazard, health hazard, toxic, corrosive, and harmful).





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<p><b>Explosion Bomb</b></p> <ul style="list-style-type: none"> <li>• Explosives</li> <li>• Self-reactive</li> <li>• Organic Peroxides</li> </ul>	<p><b>Corrosion</b></p> <ul style="list-style-type: none"> <li>• Skin corrosion/burns</li> <li>• Eye damage</li> <li>• Corrosive to metals</li> </ul>	<p><b>Flame over circle</b></p> <ul style="list-style-type: none"> <li>• Oxidizing gasses</li> <li>• Oxidizing liquids</li> <li>• Oxidizing solids</li> </ul>
		
<p><b>Gas Cylinder</b></p> <ul style="list-style-type: none"> <li>• Gasses under pressure</li> </ul>	<p><b>Environment</b></p> <ul style="list-style-type: none"> <li>• Aquatic toxicity</li> </ul>	<p><b>Skull &amp; Crossbones</b></p> <ul style="list-style-type: none"> <li>• Acute toxicity (fatal or toxic)</li> </ul>
		
<p><b>Exclamation Mark</b></p> <ul style="list-style-type: none"> <li>• Irritant (eye &amp; skin)</li> <li>• Skin sensitizer</li> <li>• Acute toxicity</li> <li>• Narcotic effects</li> <li>• Respiratory tract irritant</li> <li>• Hazardous to ozone layer (non-mandatory)</li> </ul>	<p><b>Health hazard</b></p> <ul style="list-style-type: none"> <li>• Carcinogen</li> <li>• Mutagenicity</li> <li>• Reproductive toxicity</li> <li>• Respiratory sensitizer</li> <li>• Target organ toxicity</li> <li>• Aspiration toxicity</li> </ul>	<p><b>Flame</b></p> <ul style="list-style-type: none"> <li>• Flammables</li> <li>• Pyrophorics</li> <li>• Self-heating</li> <li>• Emits flammable gas</li> <li>• Self-reactive</li> <li>• Organic peroxides</li> </ul>

**Figure 3: Hazard classification**

**4.10.3 Chemical Compatibility**

In brief, incompatible chemicals are combinations of substances that are typically in a concentrated form, react with each other to produce highly



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exothermic reactions that are uncontrollable and explosive, and/or release toxic substances, usually in the form of gasses. The following are hazards resulting from the reaction of two or more incompatible chemicals.

- The production of heat.
- The generation of flames that can lead to fires.
- Explosions occurring.
- The release of toxic gases or steam.
- The formation of end products is more toxic than the original materials.
- The formation of compounds sensitive to shock or friction.
- Increased pressure within a closed container.
- The dissolution of toxic substances.
- The dispersion of toxic dust and fumes.
- Uncontrolled polymerization.

Users should refer to the SDS to assess the hazards of the stored chemicals. Most chemicals have multiple hazards. Therefore, decisions for segregation for storage purposes should be prioritized according to the following hazard hierarchy:

**4.10.3.1 Flammable**

The primary hazard to consider is flammability. If the chemical is classified as flammable, it is advisable to store the chemical in a dedicated cabinet designed for flammable substances.

**4.10.3.2 Reactivity**

If a chemical substance has the potential to cause combustion (for example, oxidizing materials), it must be separated from flammable substances. If a chemical readily reacts with water, it should be stored in a dry cabinet and away from water sources, including safety shower areas.

**4.10.3.3 Corrosiveness**

Chemicals that are corrosive can cause damage and destruction to solid structures. A chemical is categorized as corrosive if it produces irreversible damage or destruction when in contact with human skin for a certain duration. Users should review the corrosiveness hazard of a chemical and then store it according to the recommended procedures.

**4.10.3.4 Toxic**

Separate toxic chemicals from being stored together with other chemicals. If there are toxic chemicals that are also flammable, they should be stored in a specialized cabinet for flammable chemicals.

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Chemicals should only be stored together if they are chemically compatible. Physiochemical compatibility refers to similar hazards, allowing all chemicals to be placed together, or different hazards with no chemical reactions occurring. Table 1 provides information on chemical compatibility chart that can be referred to before storage is performed.

Safe chemical storage locations typically refer to the use of shelves, cabinets, refrigerators, freezers, and the like. Unsafe storage locations include on tables, in drawers, in laminar flow cabinets, on the floor, in drawers, under sinks, and places higher than eye level.

Chemical Compatibility Chart\*


	Acids, inorganic	Acids, oxidizing	Acids, organic	Alkalis (bases)	Oxidizers	Poisons, inorganic	Poisons, organic	Water - reactives	Organic solvents
Acids, inorganic			X	X		X	X	X	X
Acids, oxidizing			X	X		X	X	X	X
Acids, organic	X	X		X	X	X	X	X	
Alkalis (bases)	X	X	X				X	X	X
Oxidizers			X				X	X	X
Poisons, inorganic	X	X	X				X	X	X
Poisons, organic	X	X	X	X	X	X			
Water-reactives	X	X	X	X	X	X			
Organic solvents	X	X		X	X	X			

\* LBNL ES&H Manual, Chapter 45, "Chemical Hygiene Safety Plan", Work Process K, Table K-1

X = incompatible materials (must segregate)  
 = compatible materials

**Table 1: Chemical Compatibility Chart**
**5.0 REFERENCES**

- 5.1 Occupational Safety and Health (Use and Standard of Exposure Chemical Hazardous to Health) Regulations 2000 (USECHH Regulations).
- 5.2 Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013 (CLASS Regulations).
- 5.3 Panduan Keselamatan Penggunaan Bahan Kimia dan Gas. 2023. Penerbit UTM Press.

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5.4 Chemical Safety. URL: <https://ppmu.utm.my/cmu/chemical-safety/>

## 6.0 GENERAL/ AMENDMENT

Issue No.	Review No.	Amendment Details	Effective Date
1	0/2023	New guidelines for chemical handling	01/12/2023