



LABORATORY SAFETY HANDBOOK

**DEPARTMENT OF BIOLOGICAL AND
AGRICULTURAL ENGINEERING
FACULTY OF ENGINEERING**



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LAB RULES AND REGULATIONS

A. GENERAL RULES

Personal Health and Hygiene

Exposure to hazardous chemicals may occur by four main routes: inhalation, ingestion, injection and absorption through eye or skin contact. The goal of personal hygiene in the lab is to prevent unnecessary exposure by minimizing "routine" contact with chemicals in the lab. Some ways to do this include:

- Avoid direct contact with any hazardous chemical. Know the chemical you are working with and wear the appropriate personal protective equipment.
- Avoid inhalation of chemicals. Transfer solvents in the fume hood, vent apparatus that may discharge chemical vapours into local exhaust devices and avoid "sniffing" chemicals.
- Always assume that a mixture of chemicals is more hazardous than its most hazardous component and treat it accordingly. Unknown substances should always be treated as hazardous.
- Wash hands thoroughly with soap and water after working with any lab chemicals, even if gloves were worn.
- Do not pipette by mouth.

Care must also be taken to prevent unintentional chemical exposure of others and the spread of chemical contamination, both in and out of the lab:

- Lab coats and aprons should not be worn outside the lab, except when necessary (getting chemicals from storerooms, walking from one lab to another, etc). They should never be worn in eating areas, restrooms, or offices.
- Remove gloves before leaving the lab or handling objects such as telephones, computer keyboards, and pens to prevent the spread of chemical contaminants. If it is necessary to wear gloves outside the lab (for example, when transporting chemicals), then another person should accompany to open doors, press elevator buttons, and similar operations.

Housekeeping

Clutter in the laboratory is both detrimental to efficient work and a serious safety hazard. Always keep areas clean and tidy, and free of unnecessary chemicals and apparatus. Make clean up a part of your normal work routine. Some ways to keep the lab tidy and orderly include:

- Store equipment not in active use in a designated area, away from the work area.
- Clean equipment and glassware as soon as possible.
- Return chemicals to storage after use.
- Clean work surfaces regularly to prevent accumulation of dust and spilled chemicals.
- Keep all exits, aisles, and walkways in the lab clean and unobstructed to allow safe movement throughout the lab.

- Do not allow electrical cords or tubing for gas or water flow to trail across aisles or out of fume hoods. Also, do not hang cords and gas tubing from the ceiling.
- Clean up all spills immediately.
- Do not block access to emergency equipment and utility controls.
- Do not store boxes, excess equipment, and personal belongings in the lab.

Proper Laboratory Apparel

Proper choice of clothing and apparel helps minimize chemical exposure.

- Wear a lab coat when working with chemicals.
- Wear shoes that fully cover the feet to protect against spills. Do not wear open toed shoes or sandals.
- Confine long hair and loose clothing.
- Wear clothing which does not leave large areas of skin exposed (shorts, skirts, short sleeved shirts).
- Soft contact lenses should not be worn in a laboratory where hazardous chemicals are in use.
- Do not wear loose jewellery, as it may become ensnared on equipment. Rings that can damage protective gloves or make wearing / removing gloves difficult should also be removed prior to working in the lab.

Food, Drink, and Smoking in the Laboratory

Eating, drinking, and smoking in areas potentially contaminated by harmful substances is prohibited. In addition, activities such as applying cosmetics, inserting, or removing contact lenses, or any other manipulations that could transfer hazardous chemicals into the body via the mouth or eyes, are prohibited in laboratories and chemical storage areas. University policy prohibits smoking in buildings or parts of buildings under the control of the University.

Do not use laboratory equipment (e.g., refrigerators, microwave ovens, glassware) to store, prepare or consume food. Laboratory water sources and deionized water should not be used as drinking water sources.

Experimental Planning and Hazard Management

Before starting new work, thoroughly plan and assess each step of the process to identify and eliminate or control associated hazards. The degree of documentation and formality of the planning process will depend on the level of potential hazard and the skill of the personnel involved. Since the types of lab experiments are diverse and are conducted by a wide range of practitioners whose skills and backgrounds vary, the lab supervisor should establish the level of experiment planning and documentation appropriate for each situation.

Below are few general steps you should do to minimize the risk of hazards:

- Be aware of the safety equipment available, its location and method of use, i.e., fire extinguishers, fire blankets, safety shower, eyewash stands, telephone, first aid kit, spillage kit, etc.
- Observe and obey all safety sign and warnings.
- Familiarize yourself with the layout of the building and its fire escapes.

Prior approval from the lab supervisor is required when:

- Working with chemicals that are carcinogenic, reproductive toxins, or highly toxic.
- Starting a new, unfamiliar experiment or procedure, or making significant changes to existing procedures.
- Leaving experiments unattended for a lengthy period or overnight.
- Continuing experiments in which there has been an unexpected result or incident, for example personnel becoming ill, or unexpected hazardous conditions developing during the experiment.
- Working alone or after/off hours.

Laboratory Operating Hours

Laboratory working hours:

8.00 am - 1.00 pm and 2.00 pm - 5.00 pm (Monday–Thursday)

8.00 am – 12.15 pm and 2.45 pm – 5.00 pm (Friday)

Laboratory after working hours:

5.00 pm – 10.00 pm (Monday – Friday)

All works in laboratory must be stop not later than 10.00 pm. Plan your experiment so that you can finish your work not later than 10.00 pm.

All after hour work in the lab must get the approval from the respective supervisor and head laboratory. Please fill form **(UPM/FK/KBP/PERMIT)** to apply for approval.

Off-Hours Work Practices

Off-working hours:

5.00 pm – 7.30 am the next day (Monday – Friday)

Saturday and Sunday

Public Holidays

Working off hours in the laboratory poses additional risks not encountered during regular working hours since there are generally few, if any, other people around. It is necessary to be vigilant of potential health and safety problems at these times, since in the event of an emergency, assistance may not be readily available. Therefore:

- Keep the amount of laboratory work performed outside of regular work hours to a minimum.
- New or unfamiliar procedures should never be performed off hours.
- Only work of relatively low risk should be performed off hours.
- All off hour works in the lab must get the approval from the respective supervisor and head laboratory. Please fill form **(UPM/FK/KBP/PERMIT)** to apply for approval.
- Ensure appropriate personal protective and emergency response equipment such as first aid kit, emergency shower, eyewash and fire extinguisher are available.

B. LABORATORY PROCEDURE

General Rules

1. All students must inform the assistant engineer when they are about to commence work. No work can commence without permission from the laboratory assistant engineer.
2. After getting approval of using the laboratory, please register your matrix card to enable you to go in and out of the laboratory.
3. Do not allow/assist unauthorized person(s) to enter to the laboratory.
4. No materials/equipment/laboratory property may be removed from the laboratory without permission from the laboratory assistant engineer.
5. Approval for working space, casting and storage of test specimens should be obtained from the laboratory assistant engineer.
6. Replace tools in their original place after use.
7. Always ensure the laboratory is clean and tidy both during and after use.
8. Advice and assistance must be sought by student before operate machine which they are not familiar.
9. Please always ensure all electrical appliances are switch off before leaving the laboratory i.e., fan, etc.

What Should You Do with Laboratory's Tool & Glassware?

1. Any damage/broken to equipment, tools or glassware must be reported immediately to the laboratory assistant engineer.
2. No equipment, tools or glassware in the laboratory are to be used without permission from the laboratory assistant engineer.
3. Miscellaneous items i.e., thermometer, spatula, time-watch, etc. can be signed out on the day of use and to be returned on the same day.

Penalty of Lab Rules Violation

Students fail to abide to lab rules will be penalized according to the following procedures.

First offence: verbal warning from KM (*Ketua Makmal*)

Second offence: written warning from departmental Employer Representative of JKKP (*Jawatankuasa Keselamatan dan Kesihatan Pekerjaan, Fakulti Kejuruteraan*)

Third offence: Suspend from lab until further notice. Need to appeal by writing to HOD (Head of Department)

Working Outside Office Hours

1. No students are permitted to work outside office hours in the laboratory without the permission of the Supervisor and the respective Head Laboratory.
2. Please fill form (**UPM/FK/KBP/PERMIT**) if need to work during outside office hour and get **APPROVAL FIRST BEFORE START DOING WORK.**
3. Students are not allowed to hold lab keys.
4. You are responsible for your own safety and please take extra precautions in laboratory.
5. If permission is given, you must not work alone unless accompanied by a member of staff/postgraduate student from Faculty of Engineering. The safety is at your own risk.

Accidents

1. Report all accidents, no matter how trivial, on the day of occurrence to a supervisor and assistant engineer.
2. First Aid Kit is available in each laboratory. Seek advice from your assistant engineer for using any medicine/contents inside the kit.



a) Fire



1. Familiarize yourself with the location of fire extinguishers/fire hydrants.
2. Personal safety is most important. If a person's clothing catches on fire, he/she needs help. Prevent him/her from running. If he/she is close enough, put him/her under the safety shower because it is more effective than a blanket. If not, make him/her lie down and smother the flames by rolling, wrapping with lab coats, blankets, towels, etc. Never turn a carbon dioxide extinguisher on a person.
3. If a fire breaks out, turn off all burners and remove solvents if time allows. There are carbon dioxide extinguishers in the laboratory and the positions and operation of these should be known. Point the extinguisher at the base of the flames. Very small fires can be put out with a damp towel by smothering. Only after the safety of all is assured should the matter of extinguishing the fire be considered.
4. When the fire alarm sounds, leave the building immediately. Do not stop to collect personal belongings. Shut doors behind you. Go to the assembly point and do not return to the building until you are told that it is safe for you to do so.

b) Chemicals



1. If corrosive chemicals are spilled on the clothing, immediate showering (with clothing on) is the best remedy. Go to the nearest safety shower with your place. If chemicals are spilled on the skin, wash them off with large volumes of water.
2. If corrosive chemicals are spilled on the desk, dilute them with a large volume of water and then neutralize with sodium bicarbonate if an acid, or dilute acetic acid if a base.
3. For all chemicals, please refer to MSDS for specific safety procedure of the chemicals.

C. CONTACT PERSONS

If you require advice, assistance or have a complaint concerning safety matters, please contact one or more of the following people: -

- Your academic supervisor or research co-workers.
- The Head of the Laboratory and Assistant Engineer in charge of that area.
- Department's Employer and Employee Representative in *Jawatankuasa Keselamatan dan Kesihatan Pekerjaan, Fakulti Kejuruteraan*.

Please refer to the latest department's organization chart for head labs and assistant engineers for each labs. You can also refer to the respective lab's organization chart posted on each lab entrance door.

Department has 9 labs and there are:

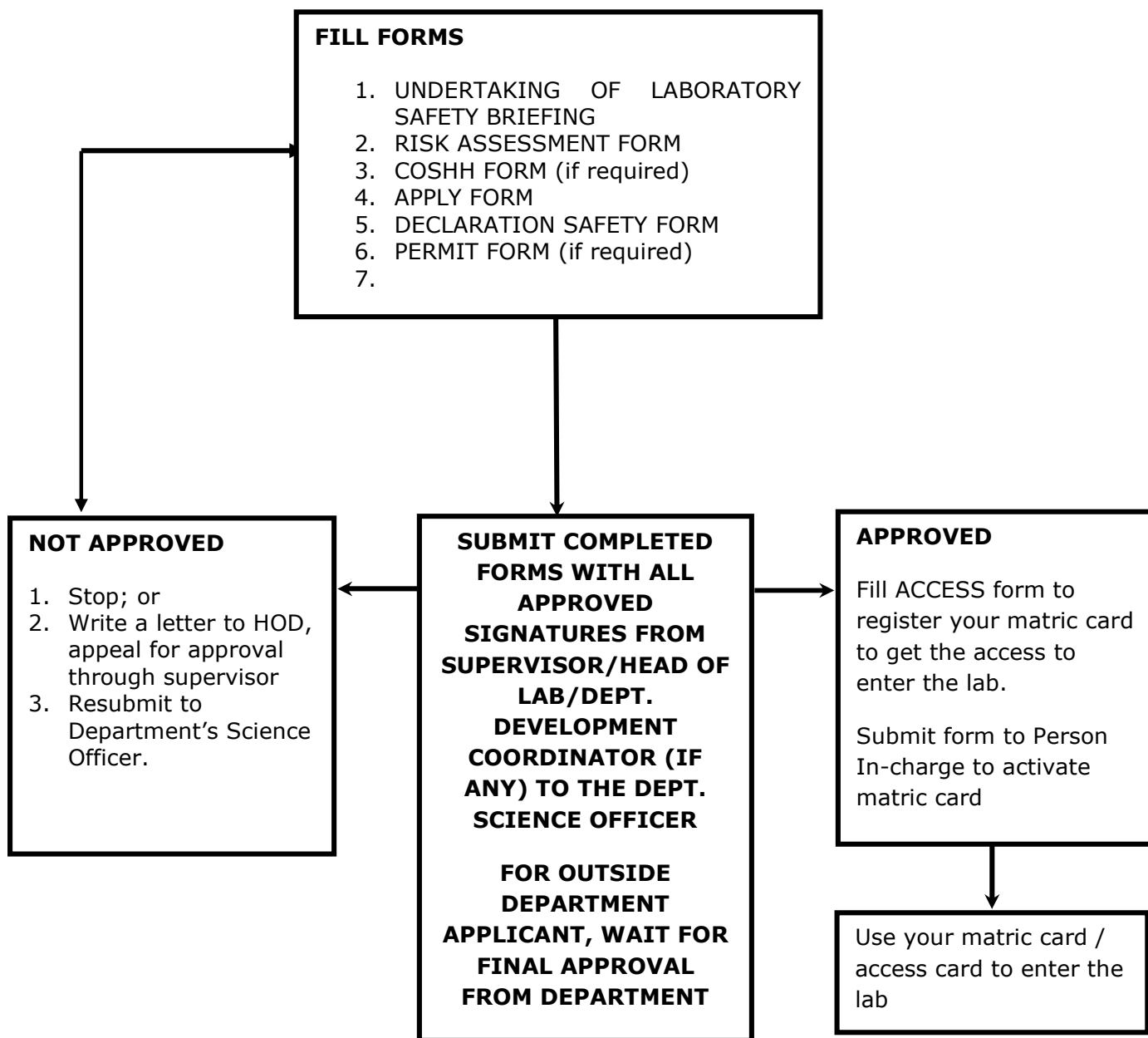
1. Machinery Design Laboratory (*Makmal Rekabentuk Jentera*)
2. Agricultural Machinery Laboratory (*Makmal Jentera Pertanian*)
3. Control and Robotics Engineering Laboratory (*Makmal Kejuruteraan Kawalan dan Robotik*)
4. Technology Worksop Laboratory (*Makmal Bengkel Teknologi*)
5. Power and Energy System Laboratory (*Makmal Kuasa dan Sistem Tenaga*)
6. Biosystem Environment Laboratory (*Makmal Kesekitaran Biosistem*)
7. Biomaterial Processing laboratory (*Makmal Pemprosesan Bahan Bio*)
8. Agricultural Irrigation, Drainage, and Infrastructure Engineering Laboratory (*Makmal Kejuruteraan Pengairan, Penyaliran dan Infrastruktur Pertanian*)
9. Land and Water Conservation Laboratory (*Makmal Pemuliharaan Tanah dan Air*)
10. Spatial Information System Laboratory (*Makmal Sistem Maklumat Spatial*)

Emergency Contact Number:

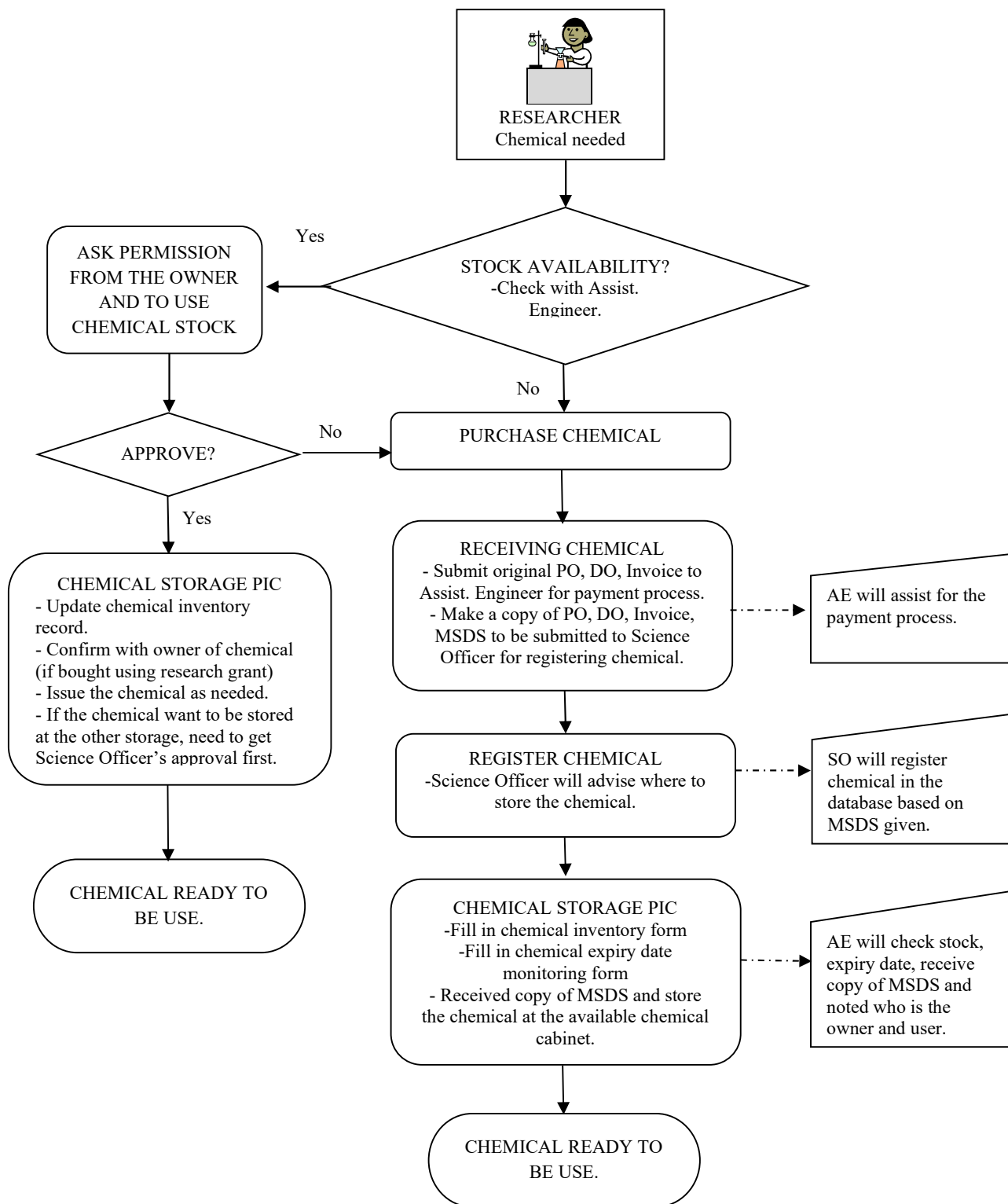


UPM Security Control Centre (Pusat Kawalan Bahagian Keselamatan UPM)	03-97697990 03-97691999 / 7470
Emergency Unit Universiti Health Centre (Unit Kecemasan Pusat Kesihatan Universiti)	03-97697332 / 7334
Serdang Hospital (Hospital Serdang)	03-89475200
Serdang Police Station (Balai Polis Serdang)	999 / 03-89482222
Seri Kembangan Fire Service (BOMBA Seri Kembangan)	999 03-89416281 / 7635

PROCEDURES BEFORE STARTING WORKING IN THE LABORATORY



FLOWCHART FOR CHEMICAL HANDLING AND PURCHASING



Documentation

Guideline on Filling Safety Forms

To all KPM's laboratory users, need to fill up all these forms before commencing your lab works. Make a photocopy, keep the photocopy's form and the original forms need to be submitted to Department's Science Officer:

1. Fill form Undertaking of Laboratory Safety Briefing after attended the Department's Laboratory Safety Briefing session.
2. Fill forms Risk Assessment (UPM/FK/KBP/RISK) (compulsory for all lab works) and COSHH Assessment (UPM/FK/KBP/COSHH) (if the lab works using any type of chemical).
3. Fill form Declaration Safety Form (UPM/FK/KBP/DECLARE).
4. Fill application form to use equipment (UPM/FK/KBP/APPLY), if needed.
5. Fill application form for laboratory access using swipe card system (UPM/FK/KBP/ACCESS).
6. Fill application form to use laboratory outside office hour (UPM/FK/KBP/PERMIT), if needed.







Guideline on Purchasing New Chemicals





1. Fill form 'Borang Permohonan Pembelian R.O. (SOK/KEW/BR002/BUY)'.
2. Request quotation from supplier (3 quotations from 3 different companies). Make sure the quotation included the latest MSDS as well (this is compulsory).
3. Submit RO and all documents to 'Wakil Jabatan' for purchasing process.
4. When chemical arrived, please make sure the chemicals delivered is the same as written in the Purchasing Order (PO). Invoice, Delivery Order (DO) and PO need to be submitted to 'Wakil Jabatan' for the payment process.
5. Submit the copy of Invoice, DO, PO and MSDS to department's Science Officer to register the new chemical in the department's database "Daftar Bahan Kimia Berbahaya Kepada Kesihatan (SOK/LAB/BR01/DBK)".
6. After that, bring the new chemicals, go to chemical storage as instructed. Meet the Assistant Engineer of that laboratory for storing the chemicals and they will be completing the other forms needed.

Guideline on Using the Stock-Ready Chemicals

1. Check the availability of the chemical with Assistant Engineer and ask permission from the chemical's owner.
2. When approved, Assistant Engineer need to update the form of 'Borang Inventori Bahan Kimia (SOK/LAB/BR02/IBK)' and 'Borang Pemantauan Stok Bahan Kimia Luput (SOK/LAB/BR03/SBKL)' before issuing the chemical needed. Carry the chemical to your lab.
3. If you want to store the chemical at the other chemical storage that nearby with your lab, submit the MSDS for each chemical to department's Science Officer to register the chemical into "Daftar Bahan Kimia Berbahaya Kepada Kesihatan (SOK/LAB/BR01/DBK)". After that, go to chemical storage as instructed.
4. Record the movement of the chemical from/into the cabinet using 'Borang Inventori Bahan Kimia (SOK/LAB/BR02/IBK)', everytime chemical being used along the way your lab works.

New labels for chemical products – do you know what they mean?

Category	CLP	Hazard	Advice
Physical Hazards		May explode if exposed to fire, heat, shock, friction.	Avoid ignition sources (sparks, flames, heat) Keep your distance
		Flammable if exposed to ignition sources, sparks, heat. Some substances with this symbol may give off flammable gases in contact with water.	Wear protective clothing
		Can burn even without air, or can intensify fire in combustible materials.	
		Contains gas under pressure. Gas released may be very cold. Gas container may explode if heated.	Do not heat containers. Avoid contact with skin and eyes.
		May corrode metals.	Keep away from metals.
Health Hazards		Corrosive material which may cause skin burns and permanent eye damage.	Avoid contact with skin and eyes. Do not breathe vapours or sprays. Wear protective clothing.

		Toxic material which may cause life threatening effects even in small amounts and with short exposure.	Do not swallow the material, allow it to come into contact with skin or breathe it.
		May cause serious and prolonged health effects on short or long term exposure.	Do not swallow the material, allow it to come into contact with skin or breathe it.
		May cause irritation (redness, rash) or less serious toxicity.	Keep away from skin and eyes.
		May damage the ozone layer.	Avoid release to the environment
Environmental Hazards		Toxic to aquatic organisms and may cause long lasting effects in the environment.	

Tips for using chemicals safely:

1. Always read the label before choosing and using a chemical product and follow any safety advice given by the supplier (MSDS), including wearing personal protective equipment (PPE) suggested.
2. Store chemicals safely in their original containers out of reach of unauthorized person, preferably in a locked cupboard.
3. If you accidentally swallow or come into contact with a chemical in a way that harms you, you must seek medical attention. You need to immediately inform assistant engineer of your lab or go to Bahagian Kecemasan, Pusat Kesihatan UPM. Make sure you take information about the chemicals with you (name of the product, supplier's name, and any hazard symbols and safety information on the label).
4. Always keep in your mind the nearest location of a safety shower and eye wash station from your working area, in case if the chemicals spill on your skin or into your eye. The first 10 to 15 seconds after exposure to a hazardous substance, especially a corrosive substance, are critical. Delaying treatment, even for a few seconds, may cause serious injury. Emergency showers and eyewash stations provide on-the-spot decontamination. They allow you to flush away hazardous substances that can cause injury.
5. Advice on disposing of old and unwanted chemicals can be obtained from your lecturer, *wakil majikan* or *wakil pekerja* in *Jawatankuasa Keselamatan dan Kesihatan Pekerjaan, Fakulti Kejuruteraan*. Never dispose of chemicals down the sink, drain, or toilet.