



Fire Safety in the Laboratory



Dangers of Fire

- Flame
 - Heat
 - Smoke
 - Suffocation
 - Toxic vapours
 - Explosions
-

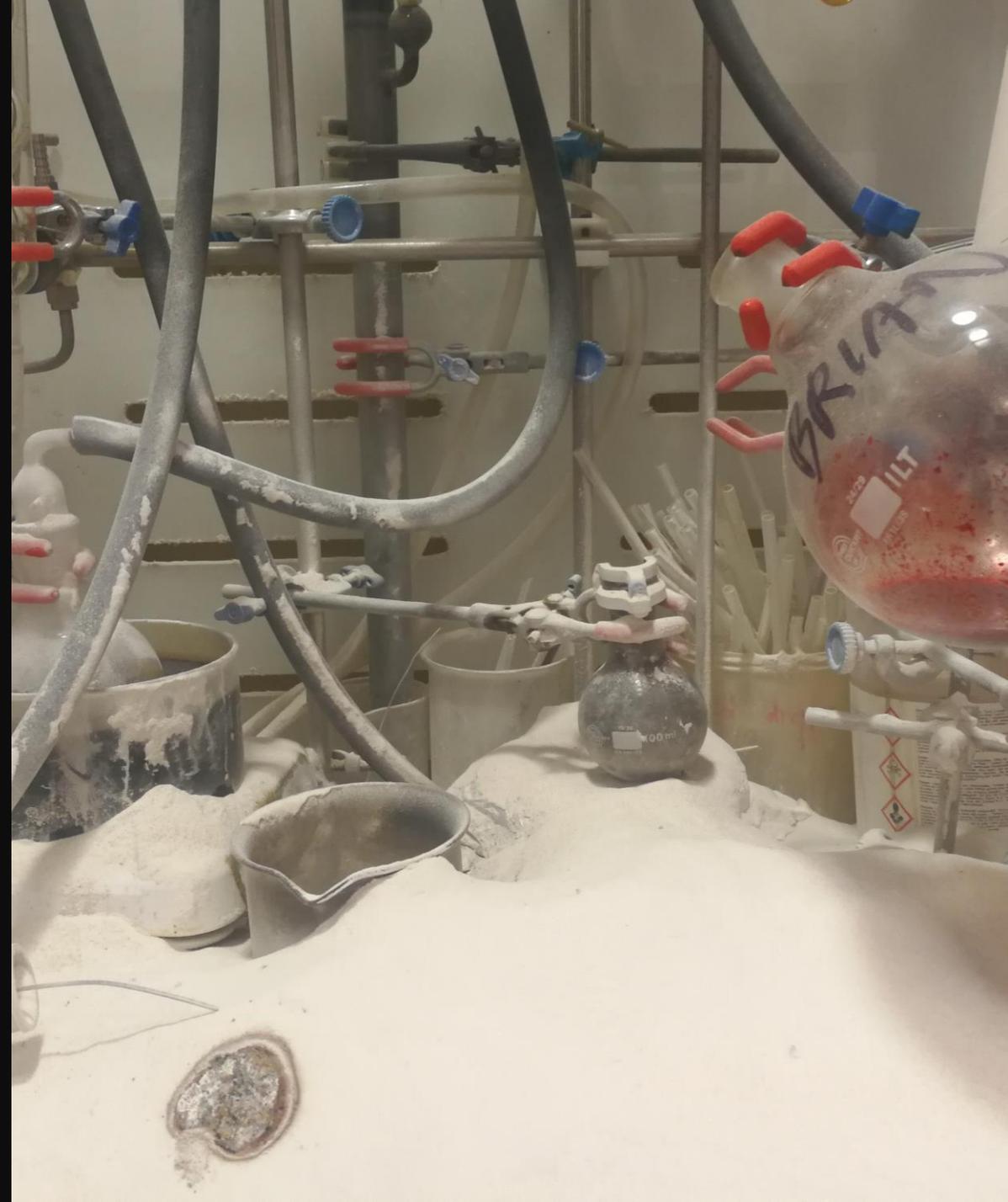




HKUST Fire Incidents

Case Study

- Fire Incident related to lithium aluminum hydride (LiAlH_4) with tetrahydrofuran in the fume hood
 - Condition after using dry powder extinguisher
 - Lost research samples, equipment, and time to clear the scene
-



Case Study

- A student took out an immersion heater from the water without turning it off and put it aside on the wooden rack and the plastic case of the heater melted and the wooden rack caught fire.
-



Case Study

- A student was not aware the hot plate was turned on.
 - The hot surface of a hot plate melted the Parafilm film, releasing smoke and smell
-



Case Study

- A student was not aware the hot plate was turned on.
- The hot surface of a hot plate melted the carboy, releasing smoke and smell



Case Study

- Hood fire involving unattended reflux process in an oil bath on a hot plate.
- Usually caused by inaccurate temperature control. The temperature was higher than necessary.
- Solvent over-heated and spilled on the hot plate surface which was at high temperature.
- The solvent caught fire when it contacted with hot surface.



Case Study

- A PG student left his experimental setup unattended and did not put up any warning sign.
 - Someone else in the laboratory interfered with his setup by mistake and caused the incident.
-



Case Study

- A PG was attempting to purify a synthetic membrane in n-hexane at around 60°C by a hotplate.
- n-hexane somehow came out from the bath and contacted the hotplate surface and was ignited, the fire then spread to nearby combustibles, causing a sustained fire that was eventually put out by the activated sprinklers.



Case Study

- After spraying ethanol to disinfect his gloves, a student proceeded to employ his gloved hand to sterilize a pipette container with a touch-O-mat burner, resulting in his glove catching fire.



Case Study

- Improper disposal of “treated” waste containing unreacted sodium and causing a fire in a spent metal waste container
-



Case Study

- A student heated a glass spreader with the Bunsen Burner and then dipped the hot spreader into a beaker containing 25-50 ml ethanol and the beaker of ethanol caught fire.



Case Study

- Inappropriate use of non-waterproof electric appliances such as DC power supply equipment in an outdoor environment caused a fire on the rooftop of the university.



Case Study – Fatal Accident at UCLA

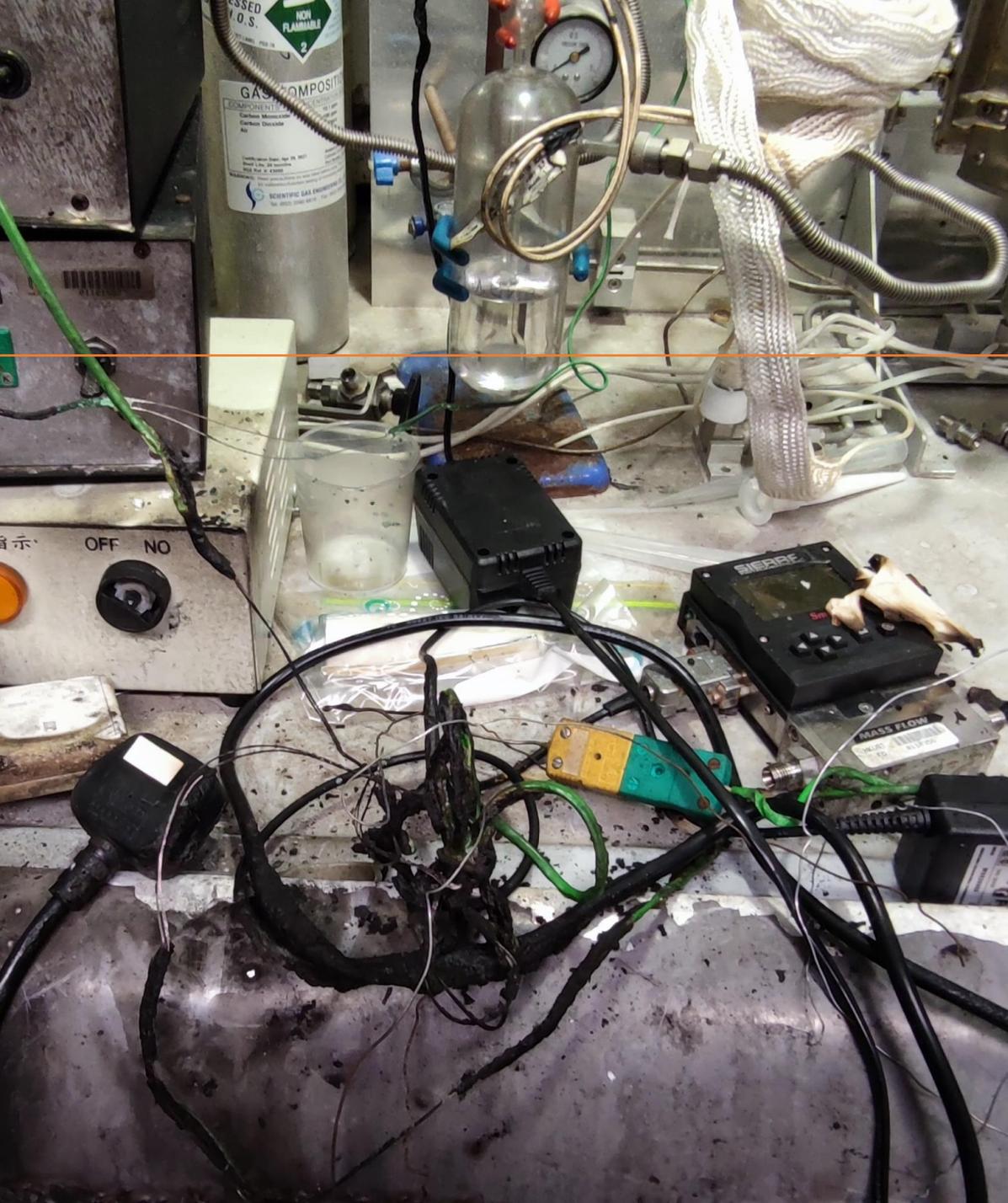
- A RA was trying to transfer up to 2 ounces (~50ml) of t-butyl lithium (pyrophoric chemical), which was dissolved in pentane from one sealed container to another by a 50 ml syringe.
 - The barrel of the syringe was either ejected or pulled out of the syringe, causing liquid to be released. A flash fire set her clothing ablaze and spread second- and third-degree burns over 43% of her body.
 - She died from her injuries 18 day later.
-





Fire Incident:

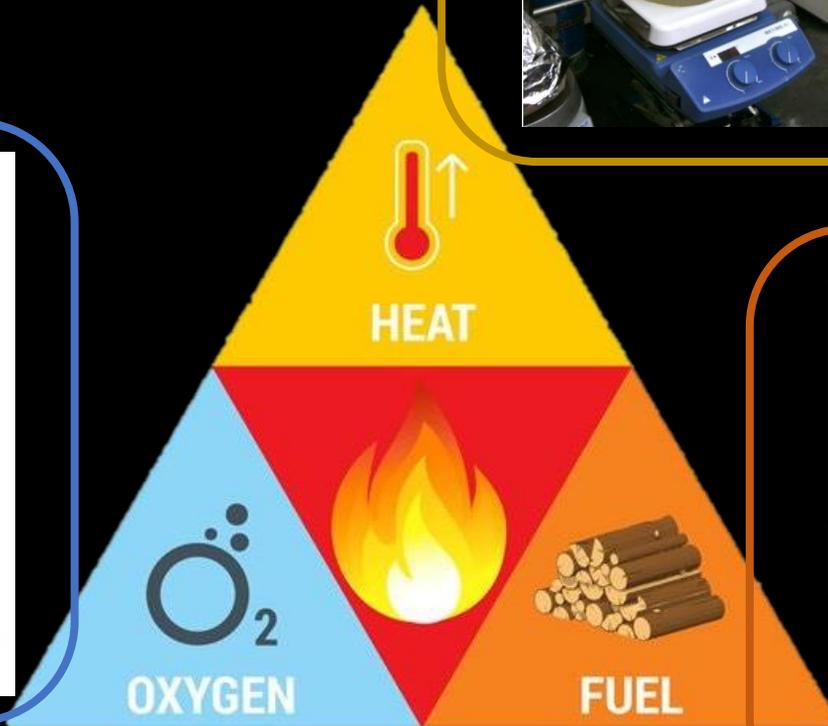
- can occur in various types of lab
- consequence: property damage, work suspension, personnel injury even fatal
- important to take precautions, follow safety rules, and respond quickly to fires to minimize their devastating effects.



Learning Objectives

- Understand the Fire Triangle
- Identify Common Fire Hazards
- Strategies of Fire Safety Management
- Proper Use of Fire Fighting Equipment

Fire Triangle



Fire Hazards – Chemical Labels

Flammable Gas



Flammable Liquid



Flammable Solid



Oxidizer



Common Fire Hazards in Laboratories

- Flammable Chemicals
 - Improper storage, handling, or disposal of flammable chemicals can lead to fires
 - Cluttered and poorly organized storage areas can increase the risk of fires
-



Common Fire Hazards in Laboratories

- Electrical Equipment
 - Malfunctioning or overloaded electrical equipment, damaged wiring, or improper use of electrical devices can cause electrical fires
-



Common Fire Hazards in Laboratories

- Heat Sources
 - Hot plates, ovens, heating mantles, and other heat-producing equipment can pose fire hazards if left unattended, operated at high temperatures, or placed near flammable materials
-



Common Fire Hazards in Laboratories

- Open Flames
 - Bunsen burners, gas torches, and other open flame sources are inherent fire hazards if not used and controlled properly
-





Strategies of
Fire Safety
Management

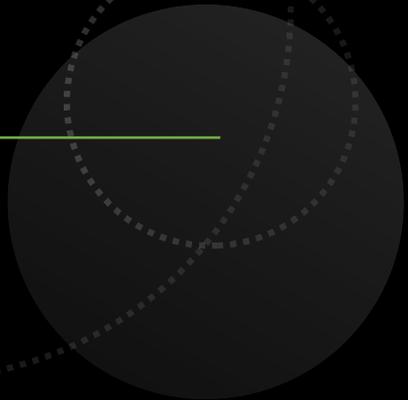
PREVENTION

ESCAPE

ALERT

CONTAINMENT

EXTINGUISHING





Prevention of Fire

- No overloading for electrical wiring, plugs and sockets and repairs are carried out by a qualified electrical worker
- Make sure that electrical wiring, plugs and sockets are correctly fused
- Turn off electrical appliances when not in use



Prevention of Fire

- Open flames should only be used after carefully considering any adjacent apparatus and experiments
- Flammable liquids should only be kept in appropriate quantities and stored in special cabinets equipped with drip trays



Prevention of Fire

- Inspect town / LPG gas tubing regularly and reject any that expired or shows hardening and cracking
- Make sure rubbish, wastepaper or other combustible materials that could catch fire do not accumulate in the laboratories

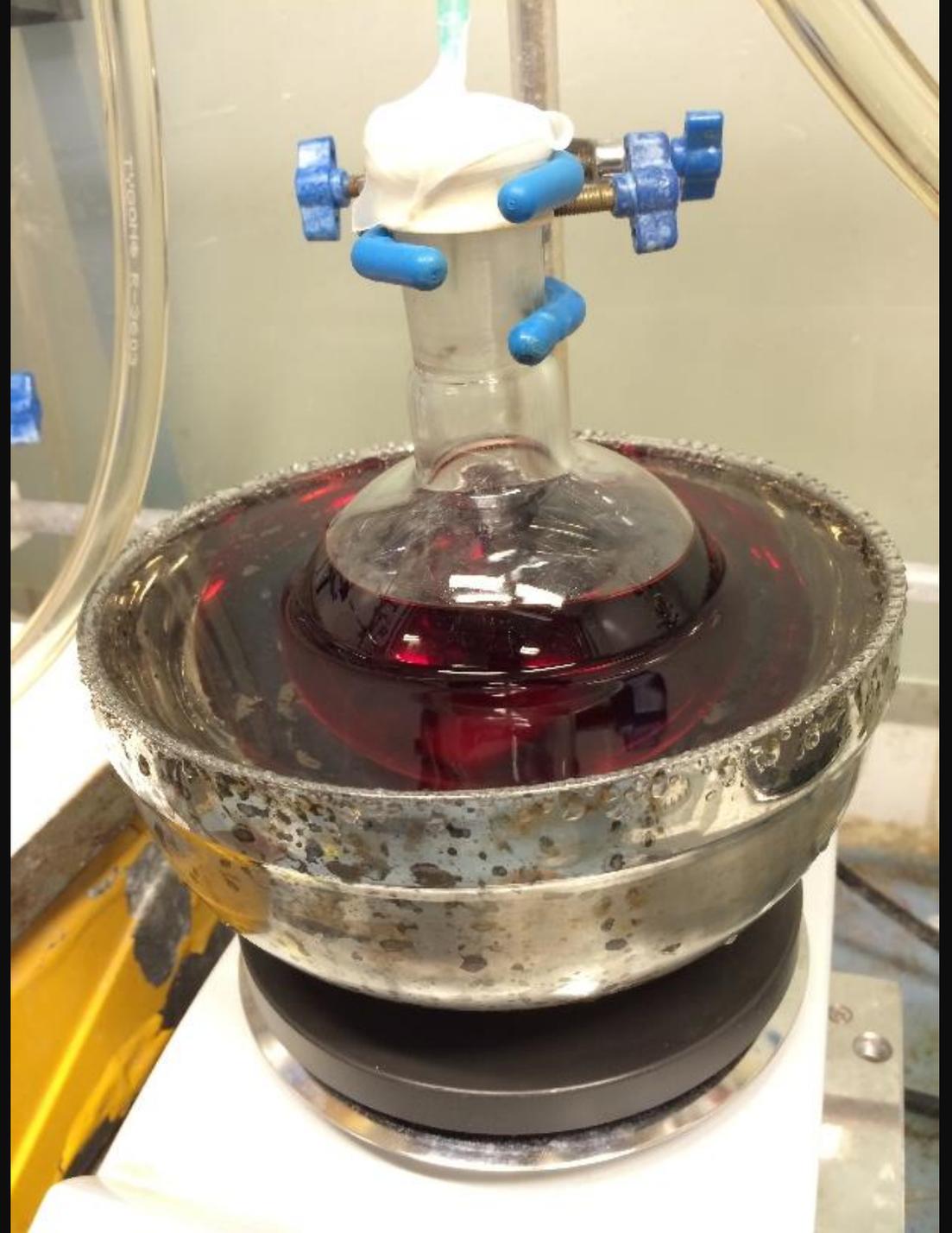


Prevention of Fire

- Ensure the means of escape are kept clear of obstruction
- Close smoke doors at all time

Reporting Fire Hazards

- Encourage participants to report fire hazards and safety concerns to DSO or Lab safety representatives
 - Highlight reporting channels and the importance of prompt reporting
-



Fire Evacuation

- In the event of a fire or a fire drill, all occupants must follow suitable evacuation instructions
 - A location plan clearly identifying the escape routes will be prepared
 - Fire instruction notices must be prepared
 - Both the location plan and fire instruction notices shall be posted at conspicuous positions of a location
-

GENERAL EMERGENCY PROCEDURES

FIRE

These fire emergency procedures are for the Academic Building. **For student dormitory residents, refer to Hall Resident Handbook for fire emergency procedures.**

When you hear the fire alarm,

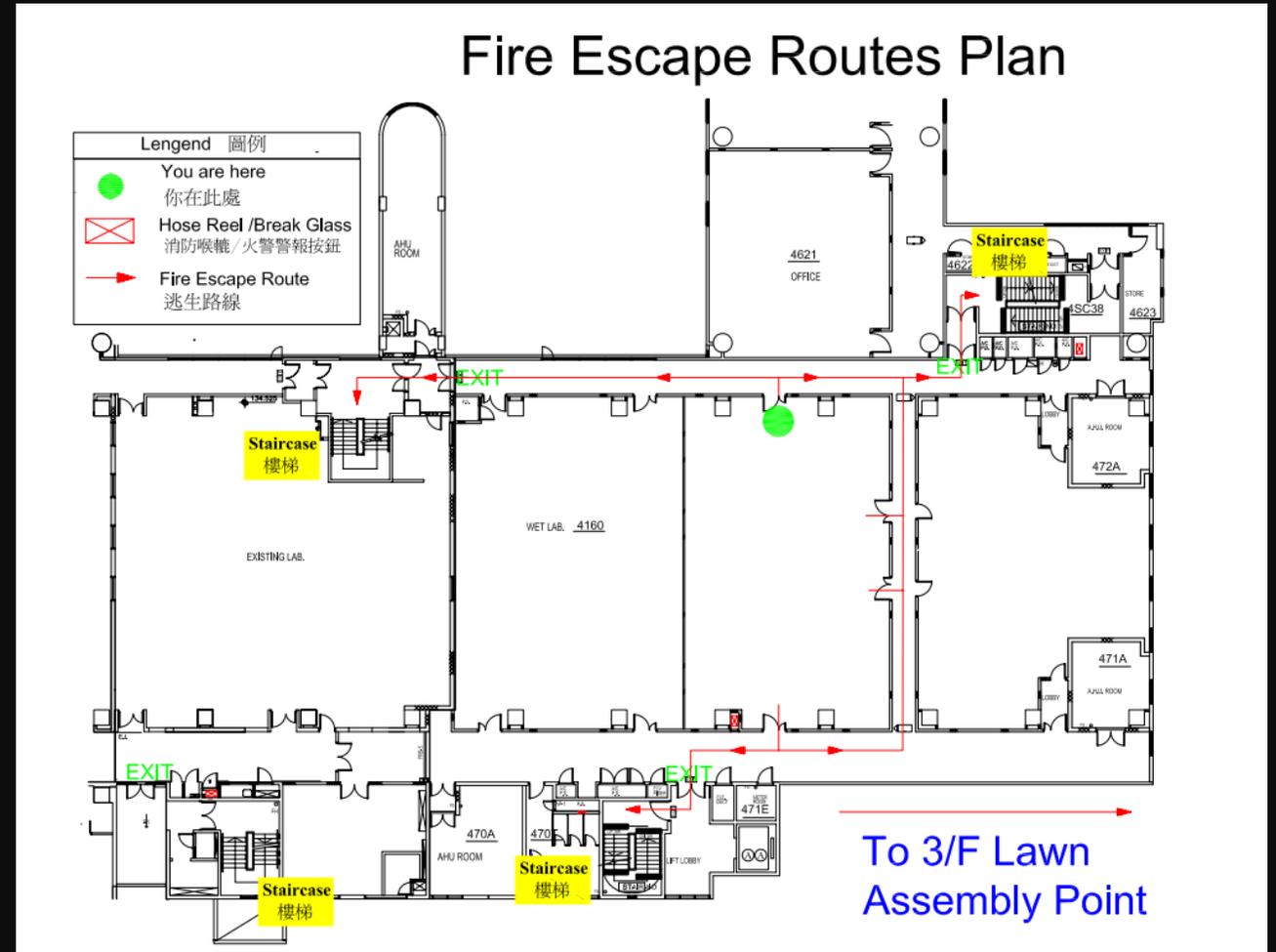
- **Remain calm and check** if there is any sign of fire in the vicinity.
- **If you see fire or smoke**, or hear the announcement asking you to **evacuate**, follow the evacuation procedures.
- **If there is no sign of a fire, stay alert** and pay attention to announcement until the fire alarm is silenced.
- **Evacuate if the alarm has sounded for more than two minutes.**
- **If you hear the buzzer sound** which indicates the fire alarm is activated in an adjacent fire zone, **stay alert** and pay attention to announcement.
- **If you hear both** the buzzer and the fire alarm, then you are near the boundary of a fire zone, and must **treat it as if you hear the fire alarm.**

If you discover a fire,

- **Activate the fire alarm** by pressing the breakglass fire alarm button.
- **Report to Security Control Centre** by dialling 8999.
- **Alert other people.**
- **If SAFE to do so, try to put out the fire** using fire fighting equipment.
- **DO NOT take any personal risk. If the fire gets beyond your control, evacuate immediately** by following the evacuation procedures.
- **Close the door** of the room on fire.

Escape

- This is to ensure that the occupants of the building and the surrounding areas are able to move to places of safety before they are threatened by the heat and fire.



Annual Fire Drill with Fire Alarms

- Carry out once a year
 - Provide an opportunity for occupants to become familiar with escape routes and assembly points
 - Observers are appointed and report to HSEO if any failings in the drill
-



Fire Alert System

- In the case of breakage of break glass or activation of smoke detectors or heat detectors will trigger a fire alarm system that includes flashing lights, fire indicator lamps and fire alarm
- These components work together to provide both visual and audio warnings in the event of a fire



Emergency Ventilation Button

- Use for activating the emergency ventilation system in the event of the release of highly toxic gas or volatile chemicals in a laboratory
- **DO NOT** press the EV button in case of fire to prevent the fire from receiving a fresh air supply





Containment

- The principal of containment is to contain the fire to the smallest possible area for reduction in property or life loss, and minimized the spread of flame and smoke to other parts of the building



Fire Protection System

Class of Fire – Use of Fire Extinguishers

Types of Fire Extinguisher	Class of Fire				
	Class A Flammable Materials	Class B Flammable Liquids	Class C Flammable Gases	Class D Flammable Metals	Class E Electrical Equipment
Carbon Dioxide	X	√	√	X	√
Water	√	X	X	X	X
Foam	√	√	X	X	X
Dry Powder	√	√	X	√	√

How to Use Fire Extinguishers - PASS Procedures

1.



Pull the Pin to unlock the lever.

3.



Squeeze the Lever to discharge.

2.



Aim Low to point the nozzle at the base of the fire.

4.



Sweep from Side to Side

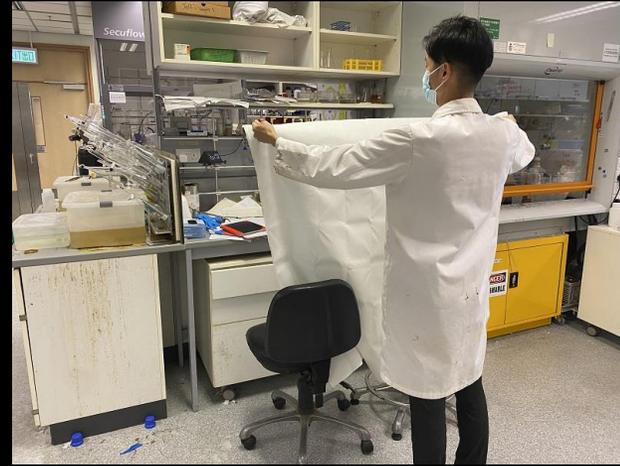
How to Use Fire Blanket



Remove the fire blanket from its rack by pulling the tape(s)



Grab the tapes that face towards you, leaving 1-2 inches loose



Approach slowly to the fire



Cover the fire gently

Final Remarks

- Prevention
- Don't try to extinguish fire if you are not confident
- Escape to safe area
- Report Fire (x8999 or 999)

