



Occupational Safety and Health knowledge and education training

Management of Laboratory Safety and Health
A1 Campus Safety and Health Foundation

According to the Occupational Safety and Health Law, the new hire staff should take **3** hours of general safety and health training to familiarize the workplace environment.

- Please read the following lecture notes and complete the quiz.



Potential hazards of general environment

- Physical hazards: noise, abnormal, electricity, mechanical hazards
- Laboratory hazards: fire, chemical explosion
- Animal hazards: wild and stray animals
- Human-factor hazards: accumulated musculoskeletal disorder
- Psychological hazard: pressure related to work sheet, burnout, etc.



Occupational Safety and Health Act

- This Act is enacted to protect workers' safety and health and to prevent occupational accidents; if otherwise provided by other applicable act, the provisions of that other act shall prevail.
- This Act applies to all employees.



國立政治大學山下校區地圖 NCCU Downhill-Campus Map

國際關係研究中心

Institute of International Relations, IIR

指南校區

ZhiNan Campus

指南學生宿舍預定地

傳播學院及其他學院
預定地

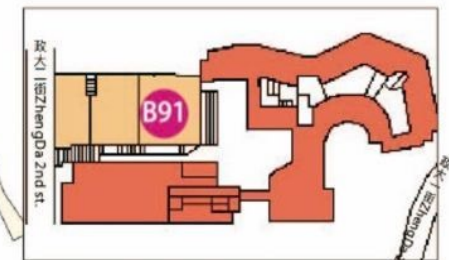
生活服務中心
預定地

Infirmary

往山上校區

往山上校區

- 校園公車車站 | Bus stop
- 汽車停車場 | Car Parking Area
- 機車停車場 | Motorcycle Parking Area
- 汽機車停車場 | Car & Motorcycle Parking Area
- 餐廳 | Cafeteria
- 微笑單車租賃站 | YouBike Station





國立政治大學山上校區地圖

NCCU Uphill-Campus Map

0 40 80 160 200(M)



-  校園公車車站 | Bus stop
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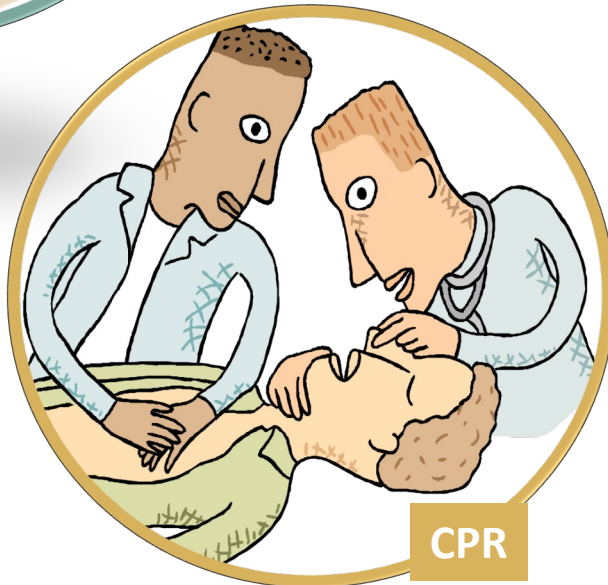
Basic First-Aid



Burns



Bleeding control



CPR



choking

Burns



Compression cloth





Bleeding control

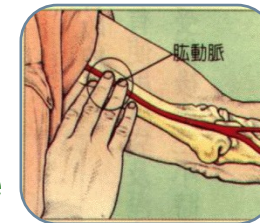
Vein or capillary

- Direct pressure
- Raise injury limb above heart level
- Apply cold/ice

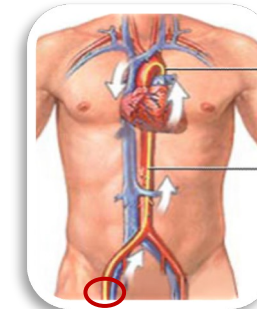


Artery

- Pressure Points
- Raise the injured above the level of the heart



Brachial artery



Femoral artery

nosebleeds

- Pinch victim's nose with thumb and index finger, and hold it for about 10 minutes





Aid for Burn or Chemical Exposures

Step 1



Remove from the fire area.

Step 2



Rinse the burned area of your skin under cool water until you no longer feel pain.(at least 30 minutes)

Step 3



Remove any jewelry and clothing from the burned area.

Step 4



Bandaging Your burn and to the hospital.

Chocking



Give 5 back blows



Give 5 abdominal thrusts





How to use AED

- These AED steps should be used when caring for a non-breathing child aged 8 or older who weighs more than 55 pounds, or an adult.
- After checking the scene and ensuring that the person needs help, you should ask a bystander to call 119 for help.



AED steps

1

- Complete the CHECK and CALL steps

2

- As soon as an AED is available, turn it on and follow the voice prompts

3

- Remove clothing and attach pads correctly

- Remove all clothing covering the chest. If necessary, wipe the chest dry
- Place one pad on the upper right side of the chest
- Place the other pad on the lower left side of the chest, a few inches below the left armpit

Note: If the pads may touch, place one pad in the middle of the chest and the other pad on the back, between the shoulder blades



AED steps (cont.)

4

- Plug the pad connector cable into the AED, if necessary

5

- Prepare to let the AED analyze the heart's rhythm

- Make sure no one is touching the person.
- Say "CLEAR!" in a loud, commanding voice.



AED steps (cont.)

6

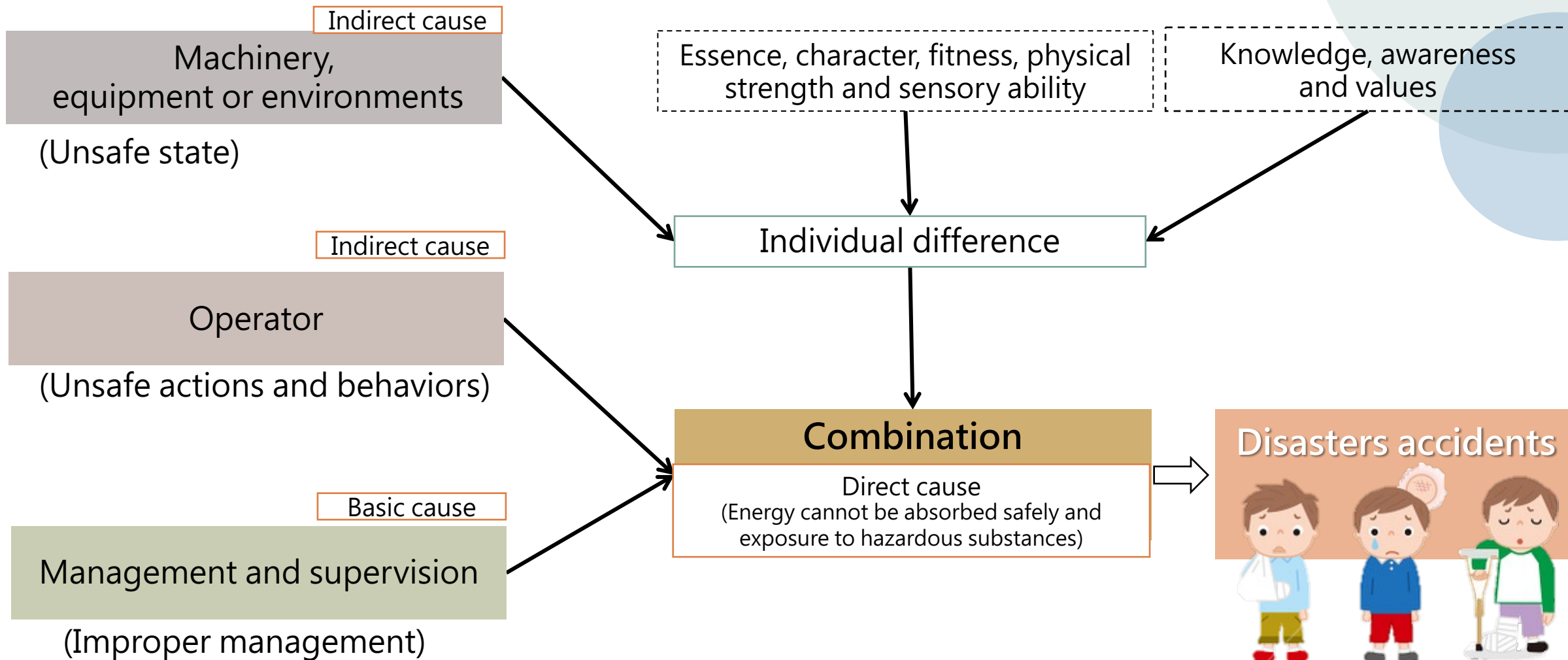
- Deliver a shock, if the AED determines one is needed

- Make sure no one is touching the person
- Say, “CLEAR!” in a loud, commanding voice
- Push the “shock” button to deliver the shock.

7

- After the AED delivers the shock, or if no shock is advised, immediately start CPR, beginning with compressions

Three major causes of disasters accidents



**Accidents or incidents
occur frequently in the
workplace**

How to prevent it?





Physical hazards

- Definition:
Hazards to human body damage caused by **physical energy**, such as noise, abnormal temperature, vibration, lighting, and abnormal air pressure.





Noise hazards

- Definition:
Sounds make people feel unpleasant or high decibel may cause auditory hazards and other adverse physical or psychological reactions
- Source: mechanical operation...
- Health hazard:
 - hearing loss: temporary or permanent in nature
 - Physiological and psychological effect: increased blood pressure and increased heart rate, etc.



Abnormal temperature

- Sources:
 - Contact with utensils being heated
 - Use of **liquid nitrogen** (boiling point at -196°C , brief contact with skin or eyes could cause frostbite or blindness)
 - Use of freezer, etc.
- Health hazard: **Scald** and frostbite
- Preventive methods: In line with status of hazard, wear proper-grade heat-resistant gloves or cold-resistant gloves and protective goggles, as well as other protective gears.

Liquid nitrogen and warning sign





Electricity hazard

- Definition:
Injuries caused by contact of human body or equipment with **electric current** or electric current-induced **high temperature**.



Unsafe electric facility



Three-phase
electrical power
(220V)

distribution
board partition

single-phase
electric power
(110V)



outside of partition



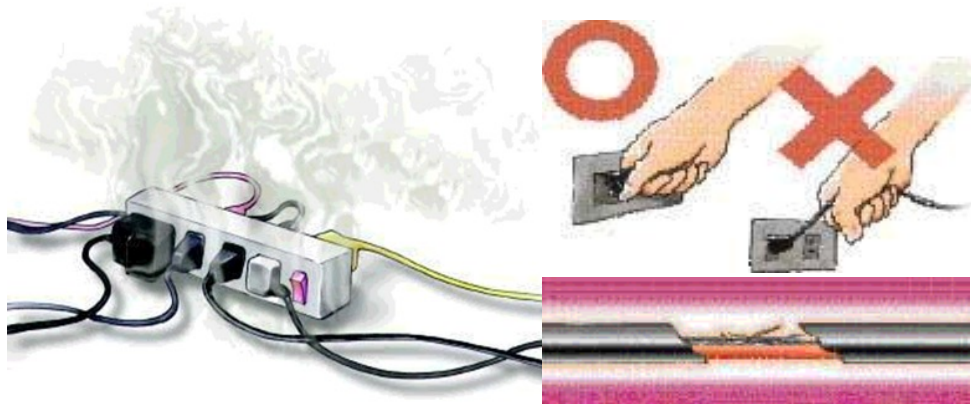
Inside the baffle
distribution board and partition



Electrical hazards (cont.)

- Electrical hazards in life:

Overload current on the extension cord



Incorrect usage cause damage on the wire and poor connection

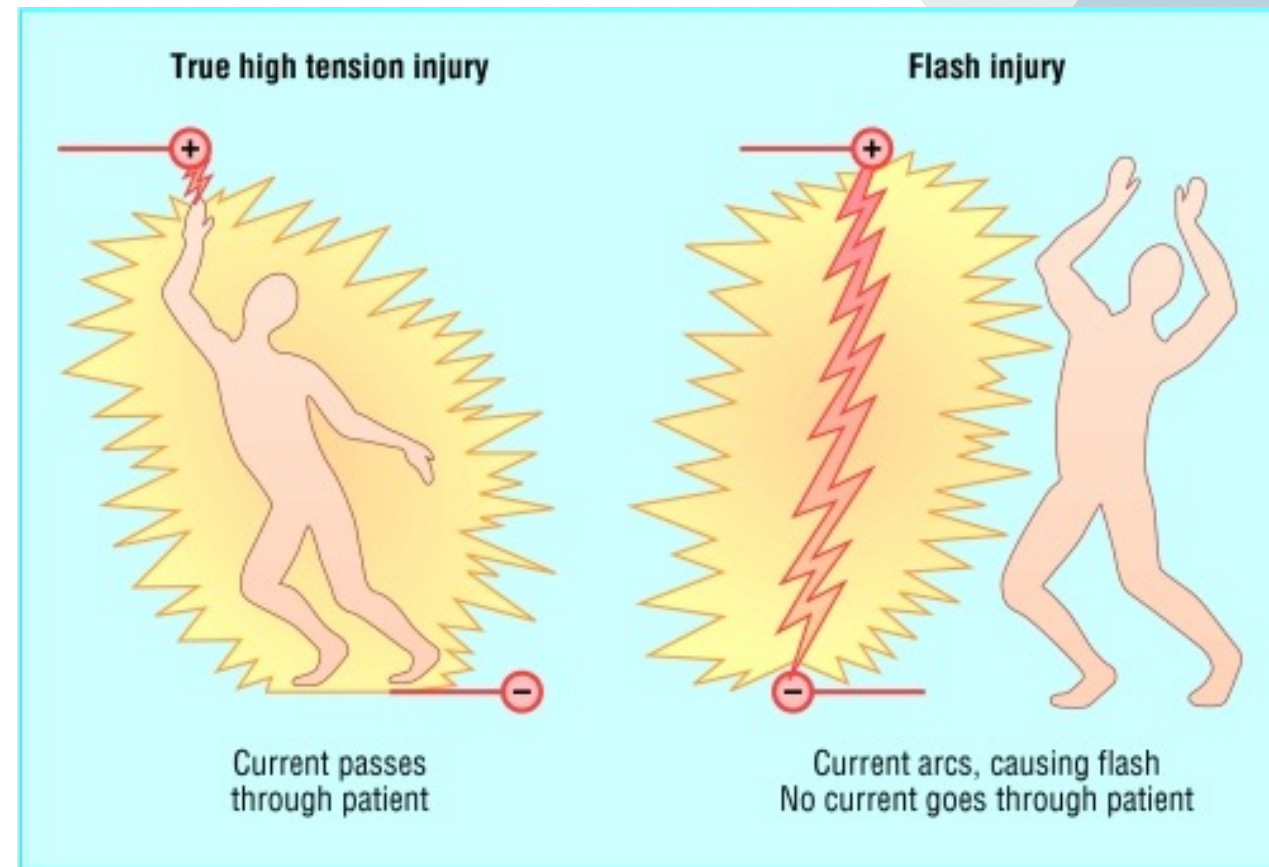
Avoid high-power electric appliances sharing the same set of sockets



<http://www.klfd.gov.tw>

Electrical hazards (cont.)

- Electrical hazards in experimental sites:
 - **Inductive disaster**
The hazard caused by a part of the human body touching a power source to form an electrical circuit
 - **Burn caused by electric arc**
Short, grounding and flashover of circuit or electrical equipment all might cause the electric arc to burn a human body





Environmental characteristics of the laboratory

- Stored and placed kinds of hazardous, harmful or toxic chemical substances
- Operating machinery requires proper protection and safe operating procedures
- High turnover rate of staff or personnel
- Operate various experiments in laboratory
- Engaged in new research and development with unknown high risk
- Numerous machinery and equipment



The importance of safety and hygiene in laboratory

The top five factors of accidents related to experimental sites **in colleges and universities:**

- Hazardous substances (20.1%)
- Electrical equipment (12.3%)
- Chemical equipment (11.7%)
- Material (6.5%)
- Others (24.0%)



The importance of safety and hygiene in laboratory (cont.)

The top factors of accidents related to experimental sites **in senior high school**:

- General power machinery(18.7%)
- Manpower tools / hand tools (14.2%)
- Other machinery (11.2%)
- Appliance (8.2%)
- Material (7.5%)
- Others (9.0%)



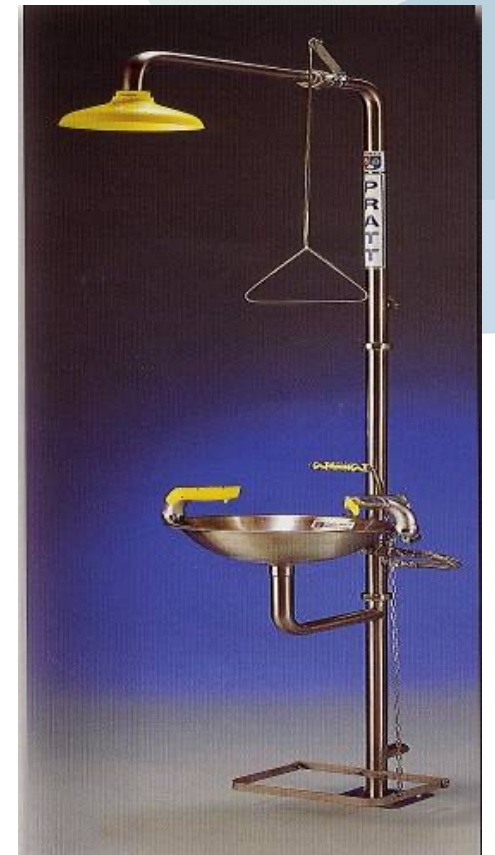
Electrical hazards (cont.)

- Electrical hazards in experimental sites:
 - **Electricity-induced fire**
The hazard caused by high temperature and heat from overloaded, short-circuited, poor connection circuit or electrical equipment
- **Check arrangement of circuits in laboratories regularly.**



Emergency eyewash and shower device

- Need to be familiar with its **location** and **usage**
- **The main switch cannot be closed**
- No debris around
- **Regular testing** is required to confirm that the function can be used normally
- **Sewage collection facilities** should be provided
- Avoid **power sockets** nearby, otherwise a **protective cover** should be installed

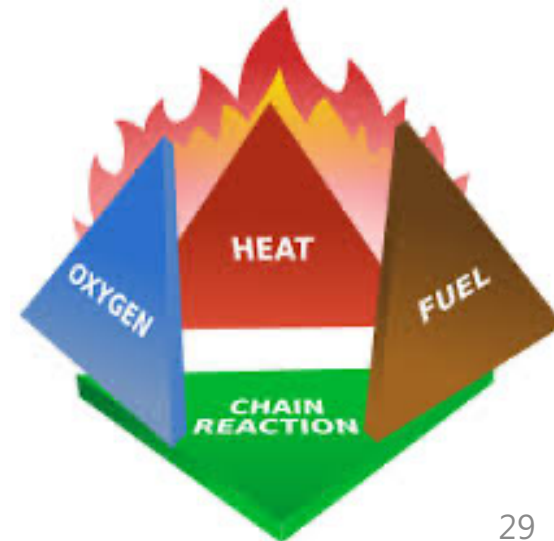


Occupational safety and health facilities regulations &
Specific chemical substance hazard prevention regulations



Four essential elements of fire

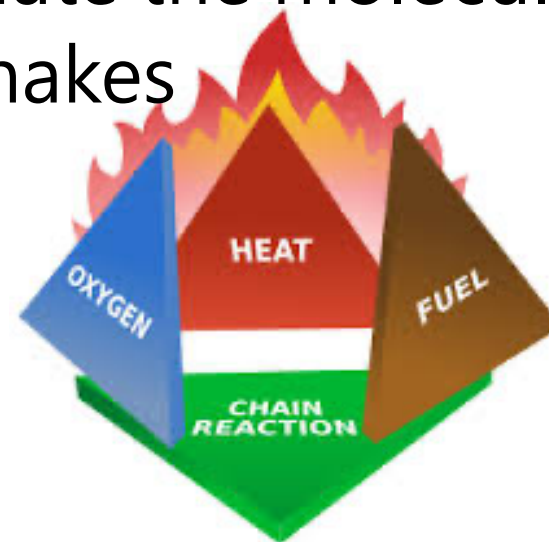
- Fuel: Flammable substances such as wood, coal, gasoline, gas or dust reach the lower explosive limit (LEL)
- Oxygen: Air is the main **source of oxygen**. Oxygen in oxidizing substances may also become a **source of oxygen** during high temperature combustion.





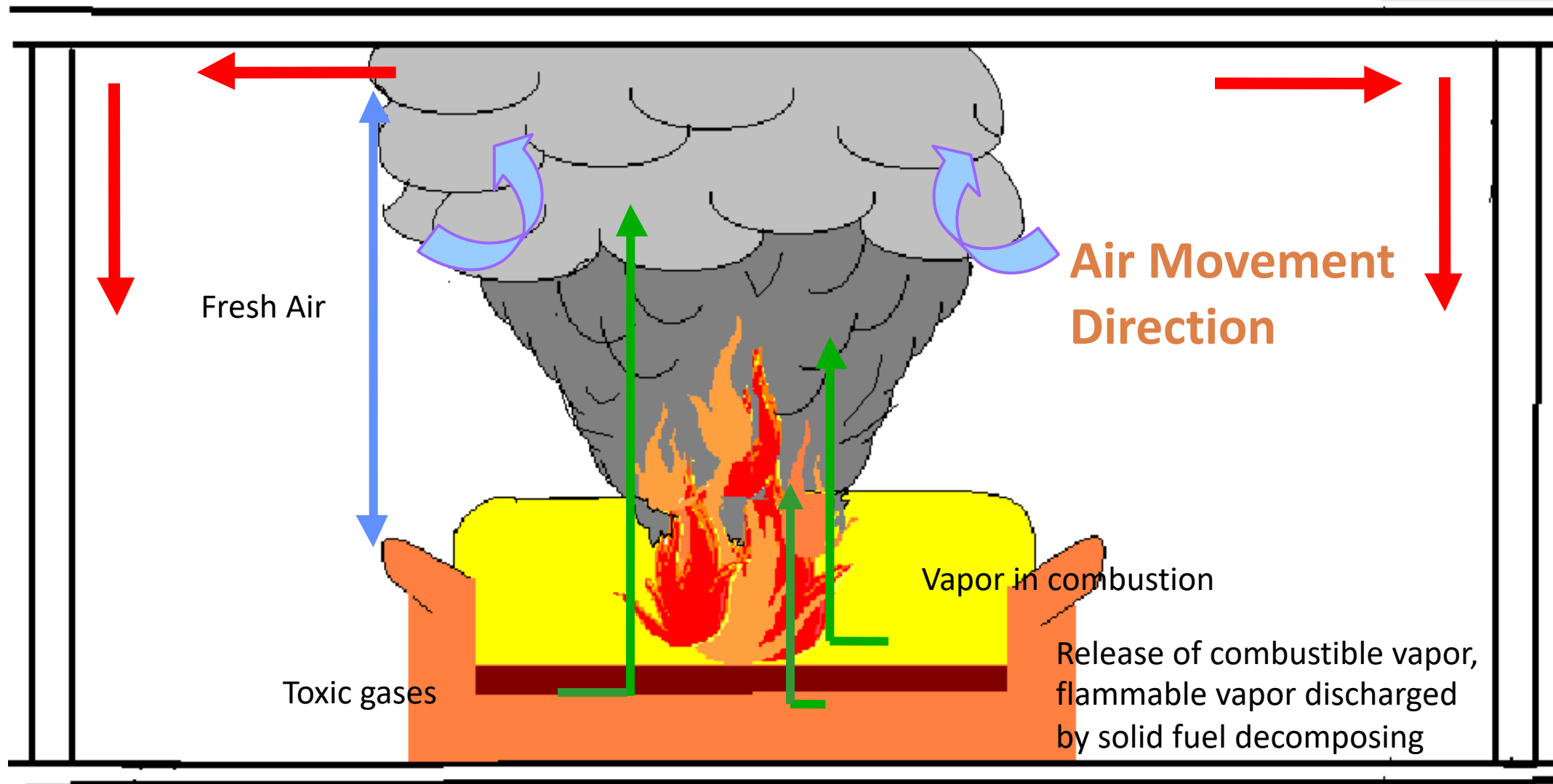
Four essential elements of fire

- Heat: Fuel must have a certain amount of heat to burn. The sources of heat may be open flames, electrical **sparks**, impact, friction, overheated objects, high-temperature surfaces, **spontaneous combustion**.
- Chain reaction: Chain reaction dissociate the molecules to generate unstable free radicals and makes the flame keeping burning





How combustion occurs





Characteristics of Smoke

- Total blackness obstructs visibility
- Mixed with toxic gases and vapors
- Overstimulation of eyes, throat, and lungs
- High temperature
- Vertically raising speed :3~5m/sec(10~18km/hr)
- Horizontally moving speed :0.5~1.5m/sec



Characteristics of Heat

- High temperatures: in/around the fire can reach 800 to 2000 degrees C.
- Heat causes nearby material to spontaneously combust (esp. wood/paper).
- Psychological effect : panic, loss of judgement, miss chance for escape.
- Physiological effect :water in lungs boils, proteins coagulate, destroying lung' s ability to exchange oxygen.



Major causes of fatality of building fires

■ Fires have historically been a major killer. Three main reasons for this are:

■ Equipment/facilities

- . Only one exit, blocked by fire or smoke
- . Emergency exits obstructed by materials or safety door locked
- . Furnishings (furniture, wall hangings, etc.) use flammable materials, accelerating burning and increasing smoke
- . Use of space or furnishings makes fire prevention areas ineffective

■ Management: Fire safety equipment not well-maintained or sensors malfunctioning.

■ Contingency planning: Fire safety vigilance insufficient, not enough training or regular drills, leading to failure when emergency strikes

Emergency exits obstructed by materials



Center aisle obstructed
by materials



Emergency exit obstructed
by materials



Emergency door obstructed
by chemicals

Emergency equipments obstructed by materials



Escape sling obstructed
by desk, chair



Fire hydrant obstructed by
Furniture, Cardboxes



Fire extinguisher obstructed
by instruments



Human Factors/Ergonomics Engineering

- Understand environmental features, human capabilities, and restriction
- Improvement of environment and tools to increase work efficiency, safety, and comfort

Fit the machine to the person !



Human-factor hazards

- **Inadequate human-machine interface**: Inadequate machine interface design leads to higher error rate or human injuries
 - Computer usage
- **Muscle/bone injury (cumulative trauma disorder, CTD)**: musculoskeletal disorder injury, mostly in upper body, caused by **long-term repetitive and unnatural movements**
 - Low back pain, carpal tunnel syndrome, tennis elbow
- **Human error**: Erroneous movements or damage of foolproof device caused by such human factors as emotion, lack of attention, and fatigue





Emergency preparedness cabinets

- Appropriate protective equipment should be prepared in advance for the types of laboratory experiments, equipment and experimental materials (chemical substances, etc.):
 - Personal protective equipment
 - Chemical absorbent
 - First aid kit
- Emergency preparedness equipment cabinet **cannot be locked**
- Pay attention to the **shelf life** of various equipment and protective drugs

An ounce of prevention is worth a pound of cure.

**Good laboratory safety and health management greatly
reduced the proportion of **injuries** and **accidents****



Information source

- Compiled by Chung Yuan Christian University
- Edited by Yow-Jer Juang, Chang Jung Christian University
- References:
 1. Laboratory Safety and Hygiene Management - basic concepts
 - Yih-Yang Sheu, Taiwan Occupational Hygiene Association
 2. Laboratory Safety and Hygiene Management - general education
 - Huan-Ping Chao, Department of Environmental Engineering, Chung Yuan Christian University