



دانشگاه اصفهان

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# آزمایشگاه میکروبیولوژی پایه

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اصول اولیه کاربرد آزمایشگاه میکروبیولوژی


تهیه کننده : سهیلا عباسی



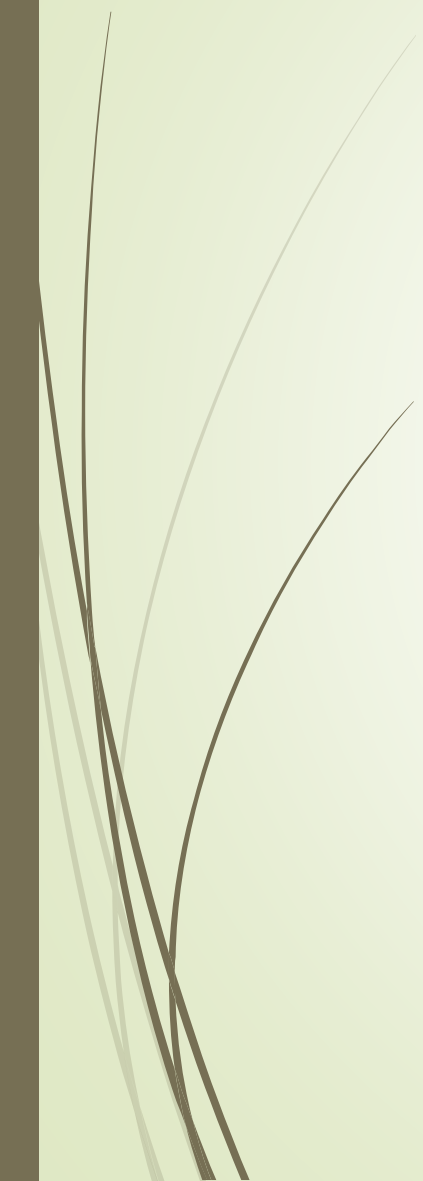
همانند هر محیط دیگری با ورود به آزمایشگاه میکروبیولوژی و آغاز کار در این محیط لازم است یک سری اصول اولیه مورد توجه قرار گیرند. بخشی از این اصول و قواعد مربوط به ایمنی فرد آزمایش کننده بوده و برخی نیز به ایمنی محیط و ابزار آزمایشگاه مربوط می باشند.

برخی از این موارد در آزمایشگاه های دیگر به ویژه آزمایشگاه های شیمی نیز مورد توجه بوده و برخی مختص کارهای میکروبی می باشند.

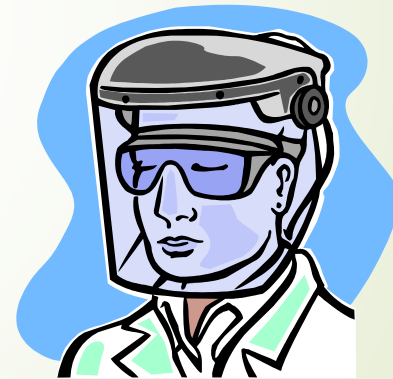
در ادامه مهمترین این اصول آورده شده اند:



1- هنگام ورود کیف، کتاب و کلیه لوازم غیر ضروری در محل تعیین شده قرار داده شوند و هرگز آن ها را روی میز آزمایشگاه (bench) قرار داد.



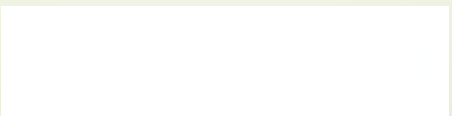
# Safety and Protection in Microbiology Laboratory





# **Safety & Hygiene/ Sanitation**

**What is**  
**The similarity**  
**and**  
**The difference ?**



# Safety & Hygiene/ Sanitation



Safety



Hygiene/ Sanitation



# Safety & Hygiene/ Sanitation



Safety



Hygiene

# Safety & Hygiene/ Sanitation



Safety



Hygiene/ Sanitation



# Safety & Hygiene/ Sanitation



Safety

Hygiene /Sanitation



**Similarity:**

Protection against

**HAZARDS**





**Difference** Protection against **in Health/Sanitation:**

**HAZARDS** which happen

- ➔ **sometimes**
- ➔ **gradually**
- ➔ **less serious damage**



**Difference, in Safety:**

**Protection against**

**HAZARDS** which happens

- more often
- suddenly
- more serious damage



# Protect whom?

- **Protect yourself**
- **Protect your colleagues in the lab**
- **Protect the environment**





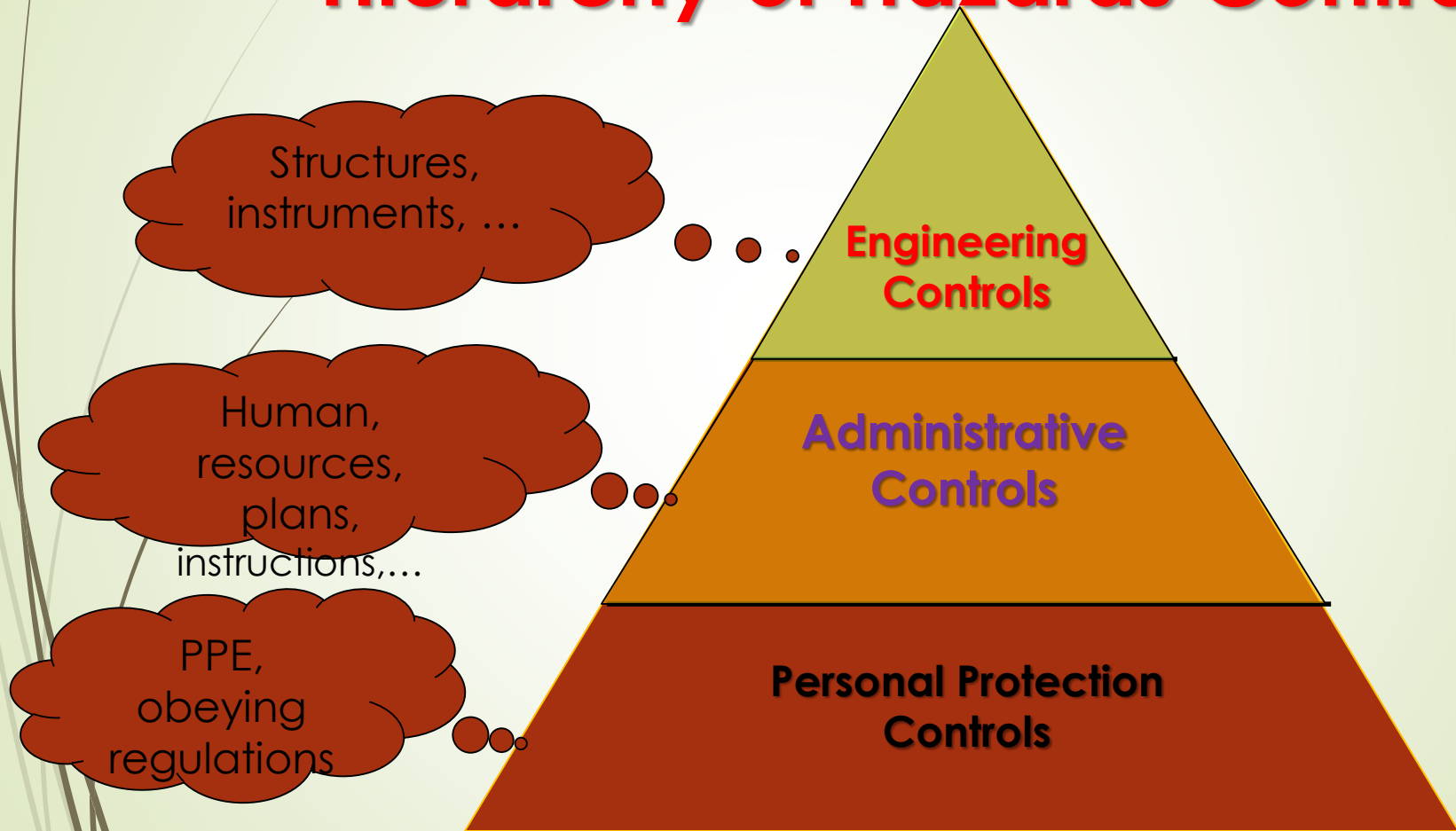
**BIOHAZARD**

**Always are in a microbiology lab**

**but**

**They can be controlled  
and reduced**

# Hierarchy of Hazards Control



# Personal Protections



**all patients are infectious to HIV !**



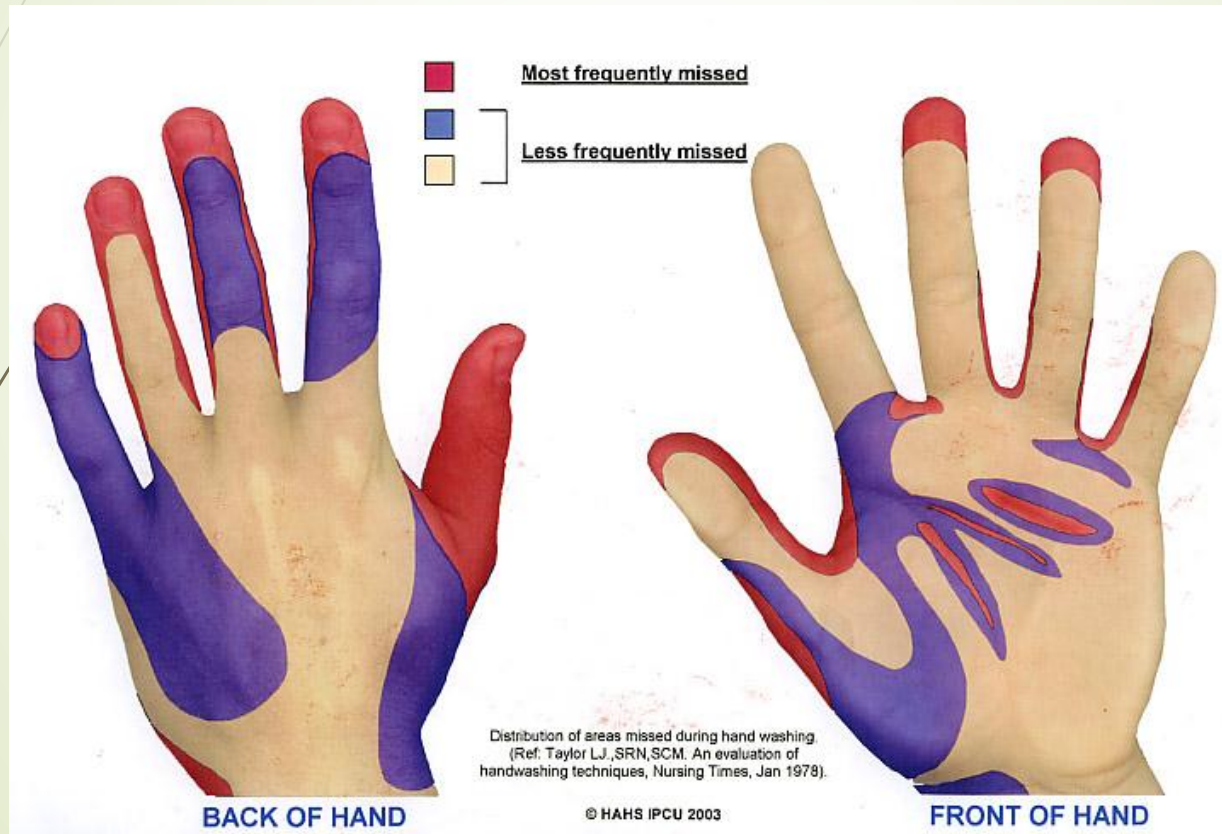
# Personal Protections

- ▶ No eating or drinking, apply cosmetics  
(No insertion or remove contact lenses)



# Laboratory Hazard Control

## HAND WASHING



# HAND WASHING





# Personal Protective equipment (PPE)

- Lab coat, Gown, Apron
- Goggles
- Gloves
- Mask
- Shoes



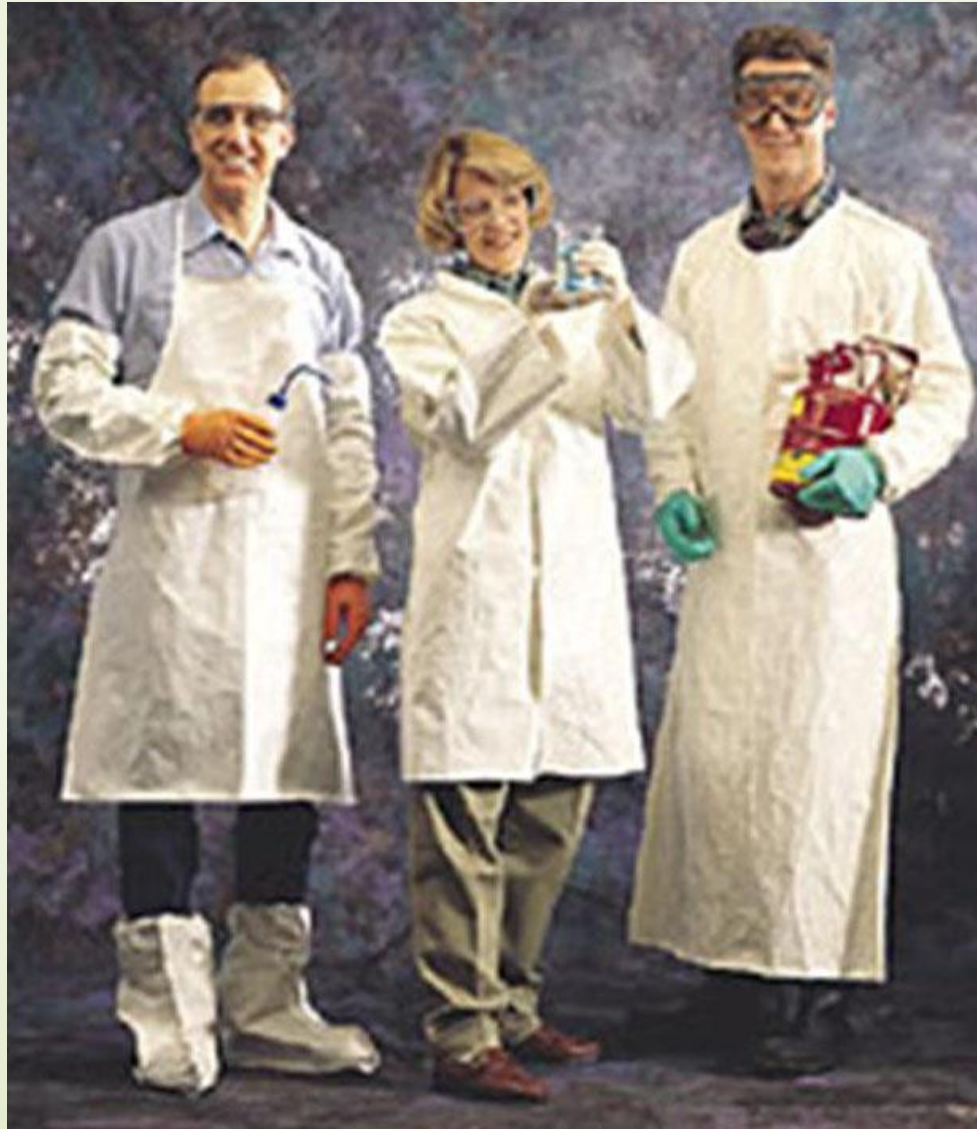
# Lab coats



# Gowns



# Apron/ lab coat/ Gown



# Wear Personal Protective equipment (PPE)





# Wear Personal Protective equipment (PPE)





# Wear Personal Protective equipment (PPE)



A



B

# Housekeeping



# Housekeeping: Correct

Storage



Oxidizers next to Flammables



↑Base next to Acid or in Alphabetical Order





# Gas cylinders must be secured



Do not mouth



do not mouth pipet









# Needle Shields





# Biohazard Wastes



**Figure 4-9** Sharps containers.  
(Courtesy Lab Safety Supply Inc.,  
Janesville, Wis.)



# Infectious wastes



# Infectious wastes are autoclaved



# Chemotherapeutic/ Carcinogenic Wastes



**Radioactive waste  
(yellow bins) are buried.**



**Carcinogenic waste (white  
bins) are burned.**

# Glassware waste





# Paper waste





**These are highly important !**

**Use**

**proper equipment  
& follow procedures**

**Know**

**the properties of agents you use  
before use or transport**



# Accidents in Microbiology lab

## **Types of accidents:**

- Chemical Spill on ground or body
- Infectious material spill on ground
- Infectious material on cloths, skin or in eyes, nose, mouth
- Injury by needle stick





Be familiar to procedures to chemical spill and learn how to clean up minor spill

PT



Immediately care for the site of exposure



Immediately care for the site of exposure



# Immediately care for the site of exposure



Perfect for Treating Chemical Splashes



# Hazard Control Equipment





# Hazard Control Equipment

- ▶ Immediately care for the site of exposure



# Hazard Control Equipment

- **Built in lab equipment**
  - Safety shower
  - Eye wash



# Hazard Control Equipment





STICK SAFE

embedding safety in medical practice



# If needle stick injury happens:

- **Report/** Notify supervisor immediately
- Ask for medical consultation
  - To verify whether an exposure incident has occurred
  - To receive HB vaccine, if indicated
  - Disinfect, antibiotic prophylaxis, ...



# Hierarchy of Hazards Control



# Administrative Controls

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- ▶ Training employees
- ▶ Using safe structures and equipment
- ▶ Access to safety information, procedures and regulations.
- ▶ Medical Consultation/  
Examinations/vaccination
- ▶ Risk assessment & Hazard Identification
- ▶ Putting aside some budget for research on safety.

# Administrative Controls

## Recognition and Evaluation of Hazards:

- ▶ A **full scale survey** of each clinical lab are completed on a regular basis (usually **each three years**).
- ▶ In addition, clinical labs are walked through **twice a year**.





# Recognition and Evaluation of Hazards

## ➤ **Controlled Substances**

- License Required
- Individuals working around controlled substances are required to have a criminal background check performed and cleared.
- Inventory and use log
- Locked storage



# Laboratory Access

- No children under 12 allowed
- **Follow Visitor's Policy and accompany visitors**
- Lock lab doors when unoccupied
- **Lab staff that are or might be pregnant should consult their personal physician**
- Administrative, clerical and other non-lab personnel may not maintain workstations in a lab

# Recognition and Evaluation of Hazards



# Recognition and Evaluation of Hazards









**Figure 5-1** Specimen bag with biohazard label, separate pouch for paperwork, and self-seal. (Courtesy Allegiance Healthcare Corp., McGaw Park, Ill.)

# Hierarchy of Hazards Control





# Engineering Controls



## Engineering Controls

1. Lab Structure design and control.
2. Equipment (Biosafety cabinets, lab equipment, ....) control.



# Engineering Controls

## The main rooms of technical departments:

- ▶ Floors, walls and ceiling resistant to chemicals and disinfectants.
- ▶ Working surfaces resistant to acids, basis, solvents, different temperatures and pressures.

# Engineering Controls



# Engineering Controls





# Engineering Controls

**EMERGENCY  
EXIT  
ONLY**







# Eyewash and Safety Showers

## Eyewash:

- Must meet standard requirements
- Operate eyewash weekly



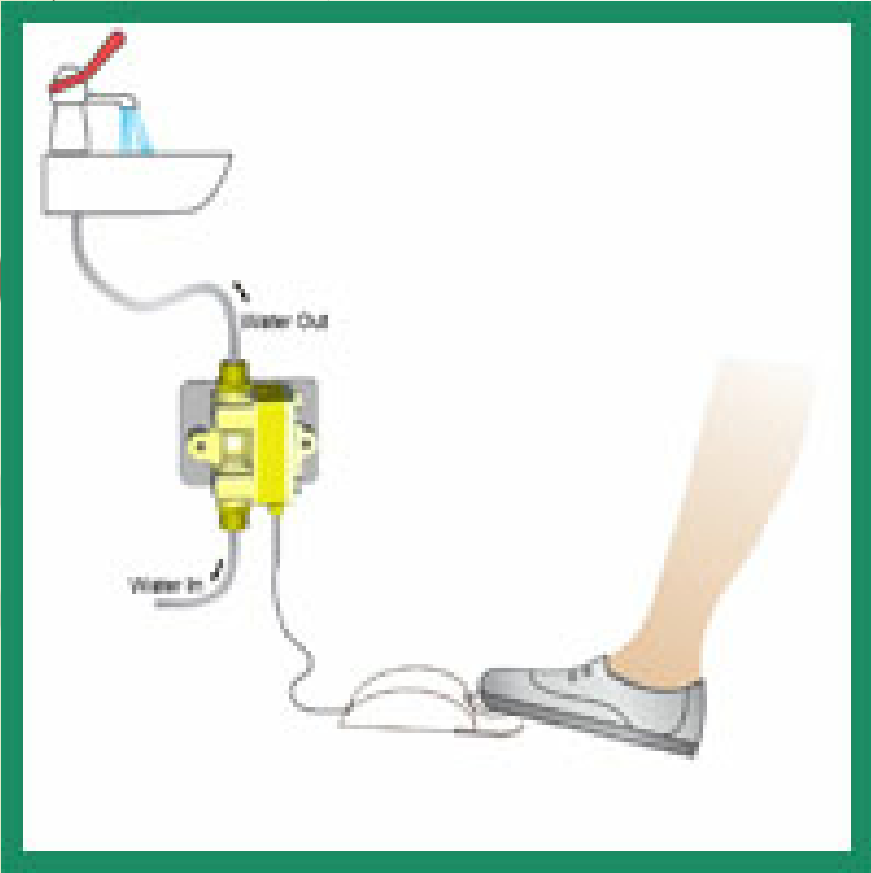
# Engineering Controls



**Splash Gourd**







# General ventilation in lab



# Microbiology Lab



# First aid box and kit







# Engineering Controls

- The **washing sinks** should be installed in all main rooms and preferably near exit.
- It is better that **taps** can be opened by pushing feet or upper parts of hands.
- Emergency power supply
- Cables have a **connection to the earth**

# Engineering Controls

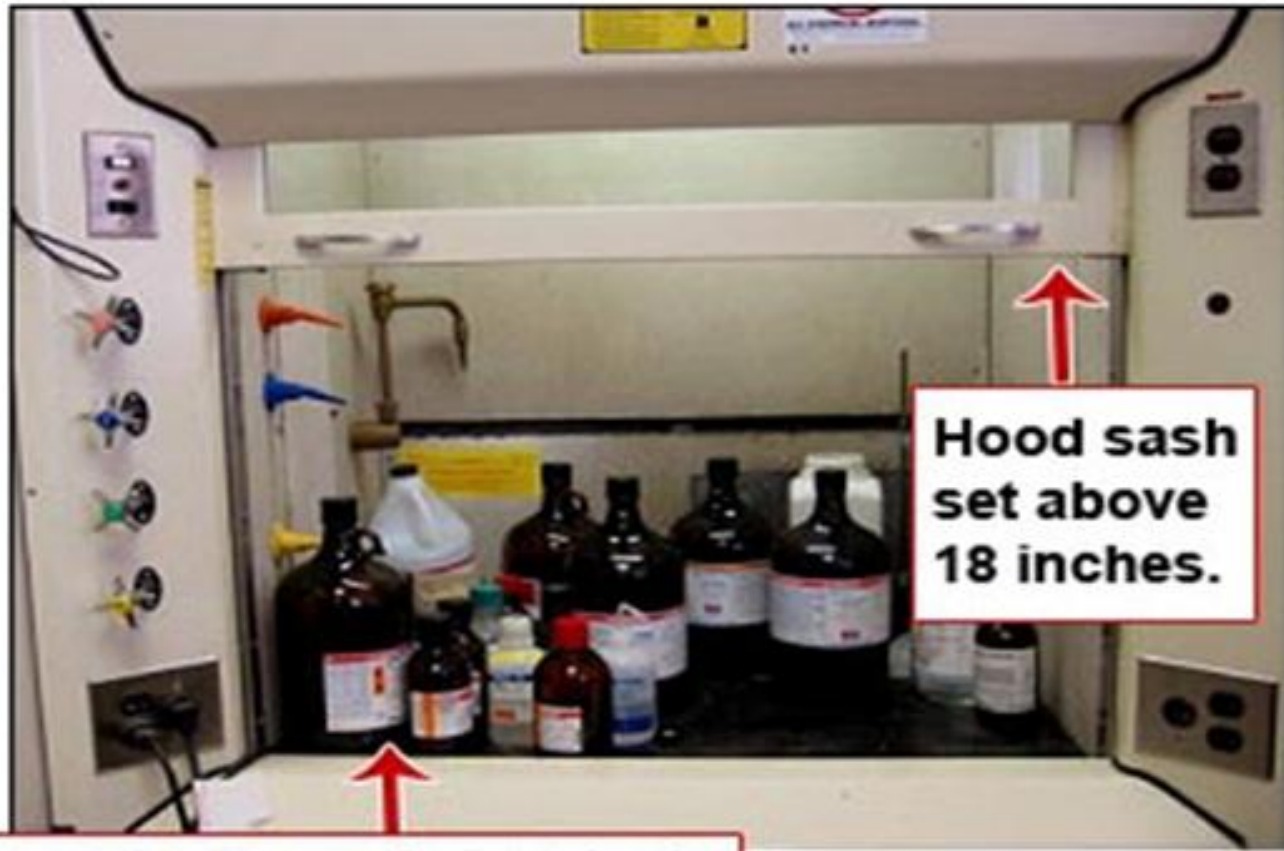
- ▶ Having spare water supply or water storage.
- ▶ General ventilation for each room.
- ▶ Normal temp (25 c)
- ▶ Enough light and brightness
- ▶ Safety devices such as smoke alarms
- ▶ First aid boxes available in each main room.

# Fume hood Vs Biological Safety



Fume hood: for removing **chemical vapors** not **particulates**.

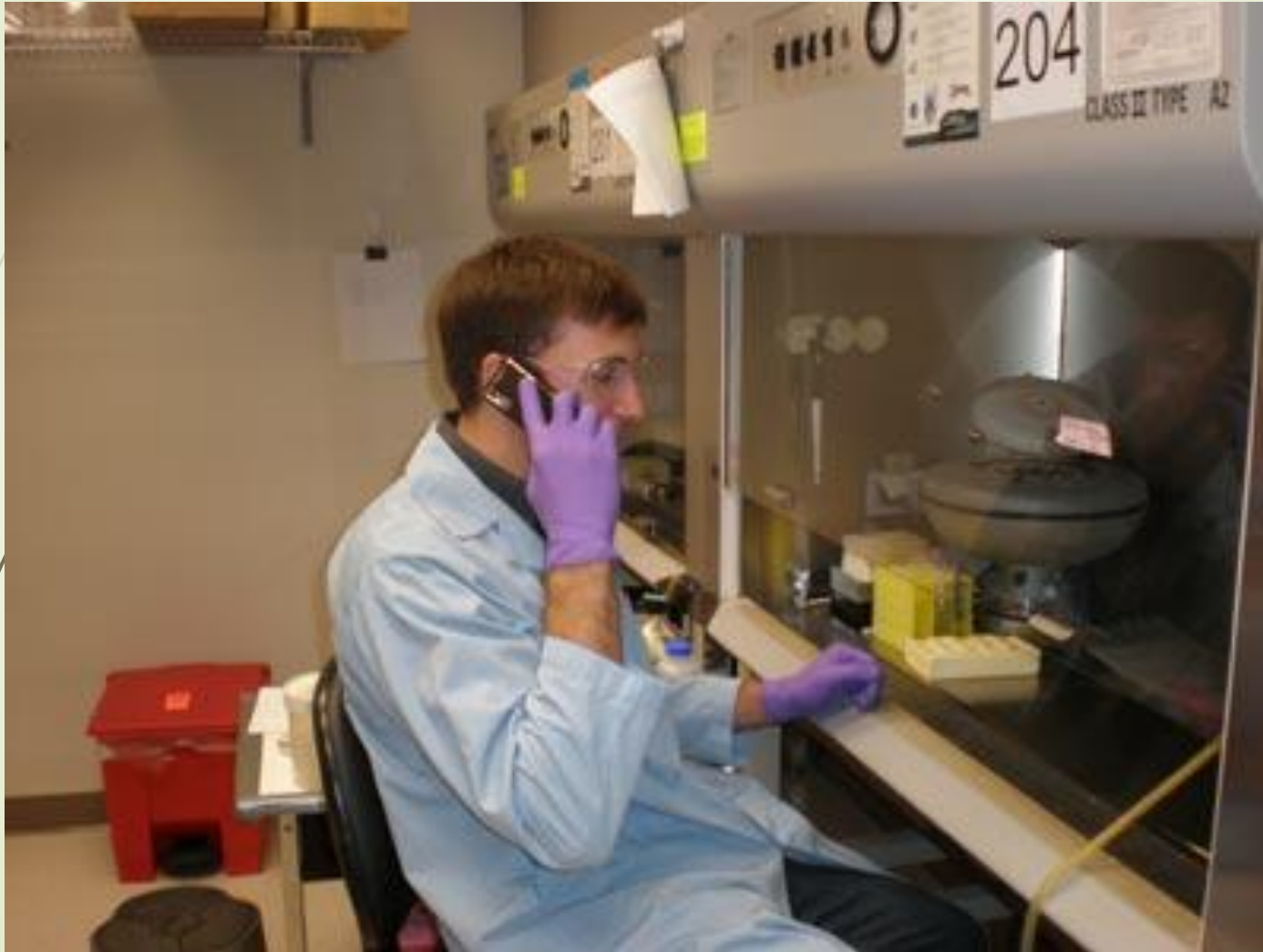
# Engineering Controls




- Excess storage of chemicals.
- Exhaust slots blocked.
- Containers stored within six inches of face of hood.



# Engineering Controls





# Biological hoods (Safety cabinets)

- ▶ Classified as Class I, II and III
- ▶ All have Hepa filters
- ▶ Hepa (High Efficiency Particular Air) filter
  - Absorbing 95% of particles  $\geq 0.3$  micron
  - Must be changed each six months in busy labs
  - In Class I: The air speed in the hood must be 0.7 – 1 meter/sec.
  - In class II: 20-30% of filtered air pass to the out of building.

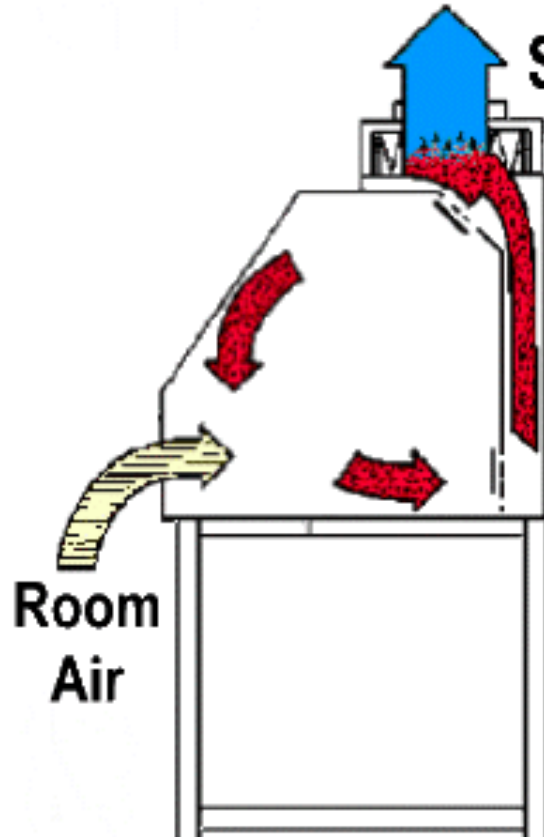
# Hood Testing

Hoods are tested with dry ice & face velocity is measured



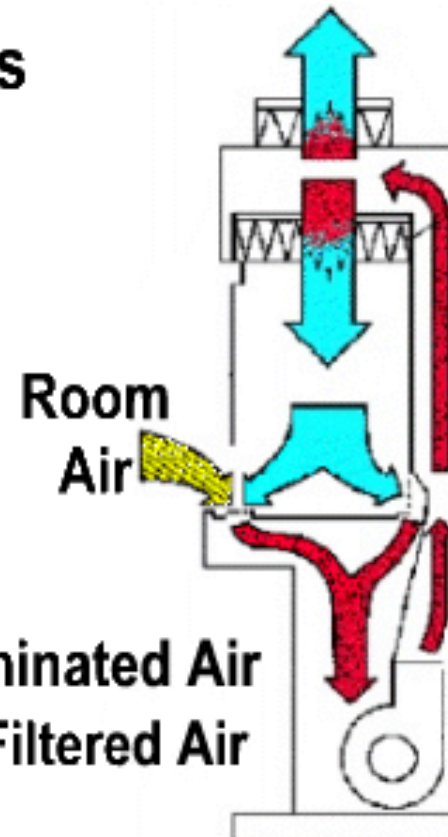
A sticker will be placed indicating maximum sash height  
A tell tale will be attached to the hood  
Hoods that do not pass will be posted out of service

# Engineering Controls



Class I Type Biological Safety Cabinet HEPA Filter System

## Side Views



Class II Type Biological Safety Cabinet HEPA Filter System

■ Contaminated Air  
■ HEPA Filtered Air

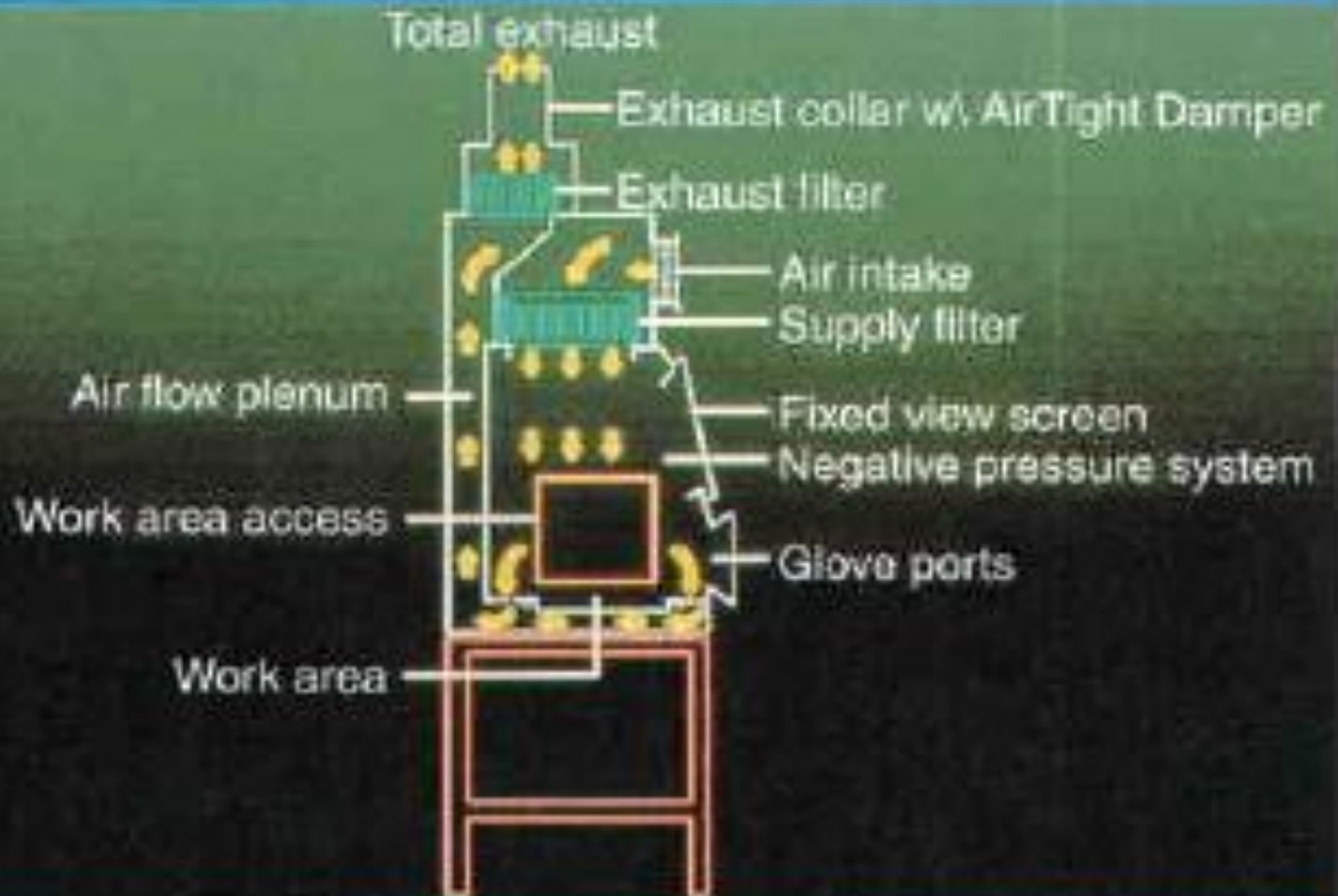




# Engineering Controls



## Class III biological safety cabinet





# Microorganisms' Risk groups

- ▶ Ranking of Microorganisms based on their ability to cause disease
  - Severity of the disease
  - Mode of transmission
  - Risk degree
  - Reversibility of the disease (prevention & treatment)



# Microorganisms' Risk groups

## ► Risk Group 1

- Unlikely to cause disease

## ► Risk group 2

- Cause disease but unlikely to be a serious hazard (Effective treatment): Hepatitis A-E, Influenza, Measles, Mumps, T. palidum, V. cholerae

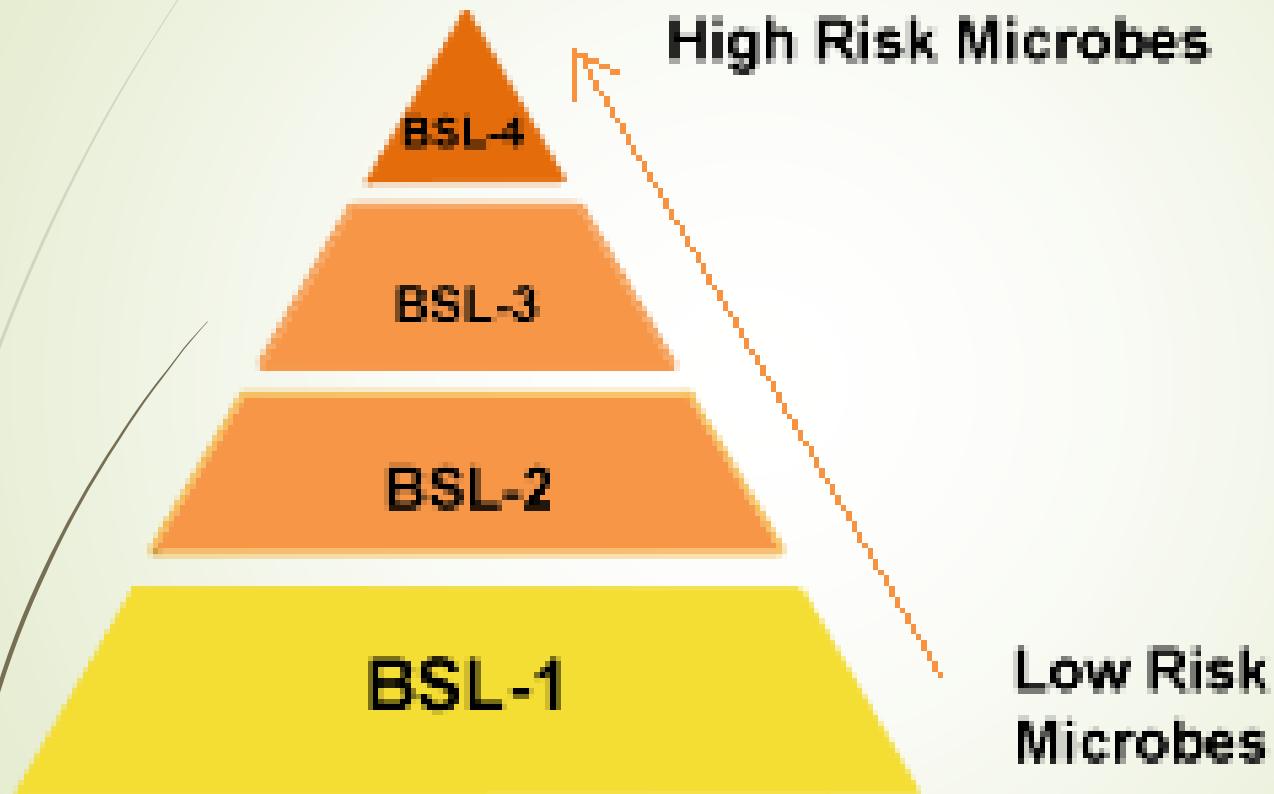
## ► Risk Group 3

- Cause serious disease and effective treatment or prevention available
- Does not ordinarily spread from infected individual indirectly: HIV, Rabies, Yersinia pestis, Brucella, Francisella

## ► Risk Group 4

- Cause serious disease but effective treatment or prevention not available
- Transmittable directly or indirectly: Ebola, Congo fever, Lassa fever

# Biological Safety Levels (BSL)



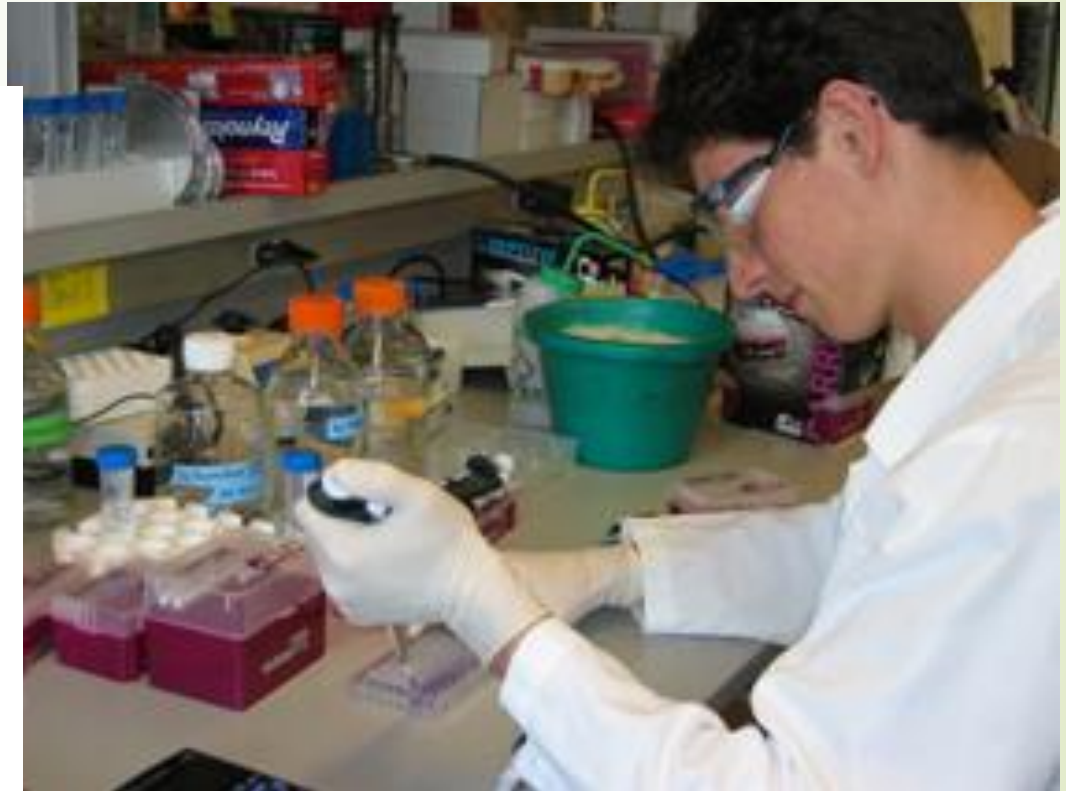
# Biological Safety Level 1 (BSL 1)



# Biological Safety Level 1 (BSL1)



**Lab coats must be  
worn in this area**





# Biological Safety Level 2

**BIOHAZARD**



**Biosafety Level 2**

**AUTHORIZED PERSONNEL ONLY**



# Biological Safety Level 2 (BSL2)





# Biological Safety Level 3 (BSL 3)



# Biological Safety Level 3 (BSL-3)





# Biological Safety Level 4



# Biological Safety Level 4 (BSL 4)



# Biological Safety Level 4 (BSL 4)





# Biological Safety Level 4 (BSL 4)





# Biological Safety Level 4 (BSL4)



# Biological Safety Level 4 (BSL4)



# Biological Safety Level 4 (BSL4)

