

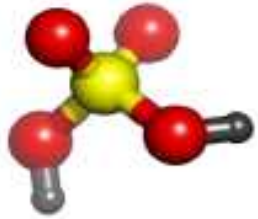


# WORKSHOP PRAKTIKUM KESEHATAN DAN KESELAMATAN KERJA (K3)

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# Normal operation



During normal operation, all **hazards** are contained and controlled, *but they are still present.*

All hazards which can give high risk effect are started from **unsafe behavior**

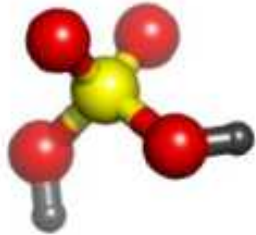
# Chemicals



CHEMICALS =  
SILENT KILLER????



Committee on Promoting Safe and Secure Chemical Management in  
Developing Countries, 2010



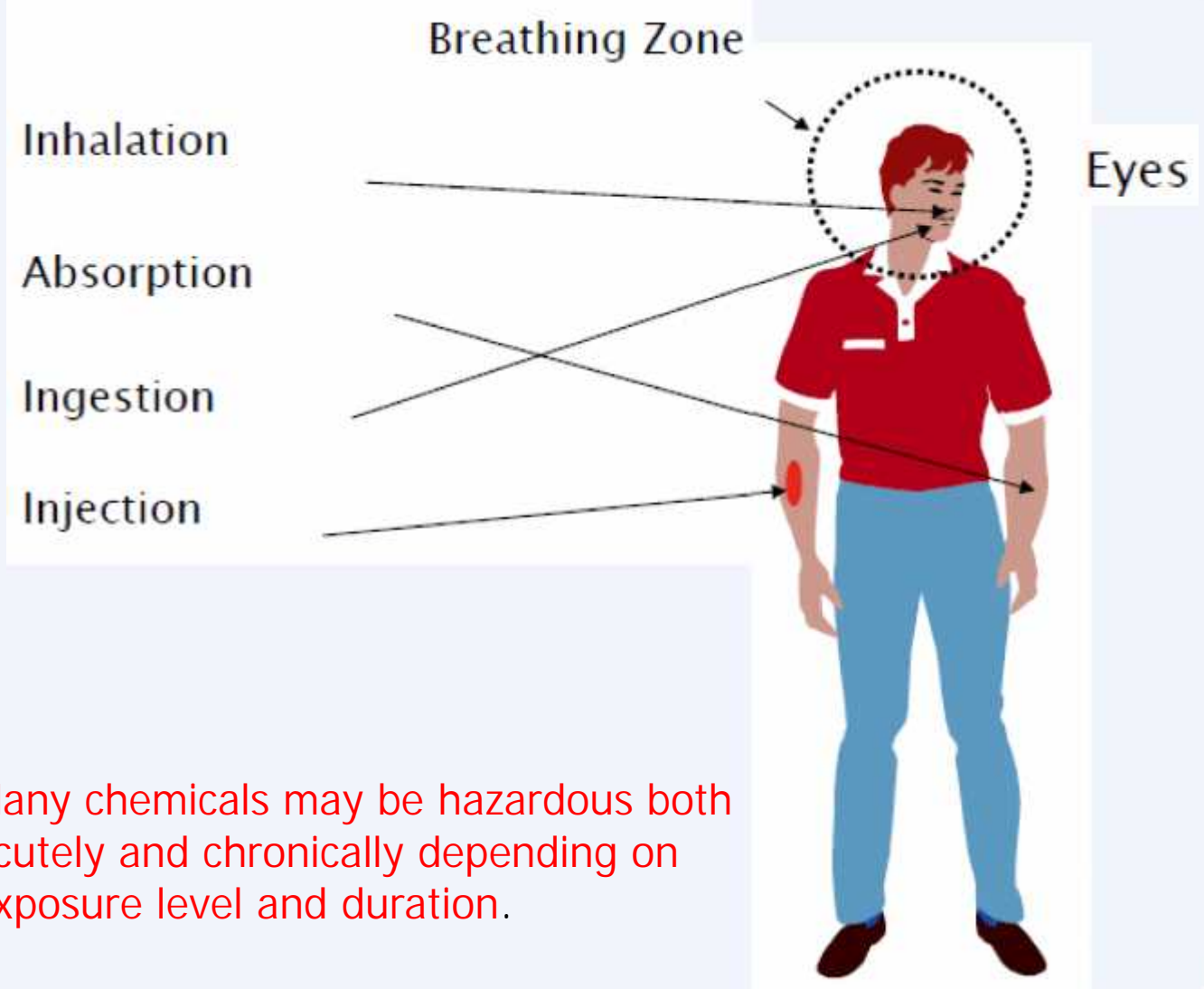
# Health Effects

Chemicals affect people differently:

- ▶ Age
- ▶ Gender
- ▶ Genetic makeup
- ▶ Disease or stress
- ▶ Nutrition
- ▶ Lifestyle
- ▶ Interactions between chemical toxicants



# Exposure



! Many chemicals may be hazardous both acutely and chronically depending on exposure level and duration.

A composite image showing various types of bacteria under a microscope. The top left shows green, rod-shaped bacteria. The top right shows blue, rod-shaped bacteria. The bottom left shows purple, spherical bacteria. The bottom right shows pink, rod-shaped bacteria. A white rectangular box with the word "BIOHAZARD" in red capital letters is centered over the image.

# BIOHAZARD



Working with microbes



POTENTIAL to  
and SPREAD DISEASE



LOGO

# Microbial Classification





# BIO SAFETY LEVEL 1

BSL 1 agents **are not associated with disease** in healthy adult humans

- E. coli nonpathogenic laboratory strains
- Saccharomyces cerevisiae
- Agrobacterium tumefaciens

when using these agents for transfection, foreign genes can be delivered even though disease is not caused

# BIO SAFETY LEVEL 1

## Protection

- No eating, drinking, applying makeup, etc.
- **Wash your hands**
- No mouth pipetting
- **Safety glasses worn**
- Lab coats stay in lab
- **Safe handling of sharps**
- Laboratory access limited when work is in progress

# BIO SAFETY LEVEL 1

## Safety Equipment

- Standard PPE
  - Lab coat to prevent contamination of clothes.
  - Gloves
  - Goggles
- **Special containment devices or equipment** such as a biological safety cabinet **are generally not required.**

# BIOSAFETY LEVEL 1

## Laboratory Facilities (Secondary Barriers)

- doors for access control
- sink for hand washing
- can be easily cleaned
  - No need for carpets and rugs
- bench tops
  - impervious to water
  - resistant to moderate heat and the organic solvents, acids, alkalis, and chemicals used to decontaminate the work surface and equipment.
- sufficient laboratory furniture
- sufficient spaces

# BIO SAFETY LEVEL 2

BSL 2 agents are **associated with human disease** which is **rarely serious** and for which preventative or therapeutic interventions are often available.

- E. coli, pathogenic strains
- Herpes simplex virus
- Chicken pox

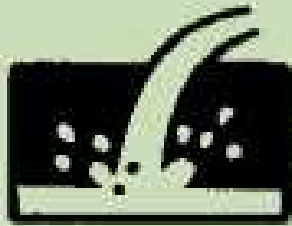
## Special Practices:

- **Access limited, warning signs**
- Immunizations/tests for personnel
- **Biosafety manual**
- Training of lab and support personnel
- **Leakproof containers for all potentially infectious waste**
- Decontamination of equipments and work surfaces



# BIOSAFETY LEVEL 2

- Use of personal protective equipment as a barrier to exposure: lab coat, gloves, eye and face protection
- Minimize aerosols
  - **Infectious aerosols or splashes from:**  
centrifugation, opening containers, grinding, inoculation, blending, shaking, etc
- Biosafety cabinet for aerosol control
- laboratory personnel have specific training in handling pathogenic agents and are directed by competent scientists



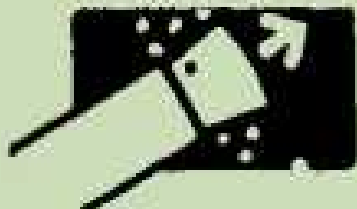
**Pouring fluids**



**Falling droplets**



**Emptying a pipette by blowing**



**Opening of wet caps**



**Centrifugation by means of  
open tubes**



**Inoculation needles that are too hot**

# BIO SAFETY LEVEL 3

BSL 3 agents are associated with serious or lethal human diseases for which preventative or therapeutic interventions may be available (high individual risk but low community risk)

- Yellow Fever Virus
- Mycobacterium tuberculosis
- Coxiella burnetti

Aerosol is a common route of transmission, and increases the risk potential for these agents



# BIO SAFETY LEVEL 3

Laboratory personnel have specific training in handling pathogenic and potentially lethal agents, and are supervised by competent scientists who are experienced in working with these agents.

## Safety Equipment-Primary Barriers:

- Biological Safety Cabinet for manipulation of infected materials
- PPE-mask, gloves, respirator, face shield.
- Protective clothing not allowed out of the lab.  
Changing rooms.



# BIOSAFETY LEVEL 4

BSL 4 agents **are likely to cause serious or lethal human disease** for which preventive or therapeutic interventions are not usually available (**high individual risk and high community risk**)

- Ebola virus
- Herpes B virus (Cercopithecine)
- Lassa fever virus

- Specialized training for all workers.
- All activities confined to class III BSC
- Lab is physically separated from access corridors
- On entering, personnel must put on a complete change of clothing; before leaving, they should shower before putting on their street clothing.

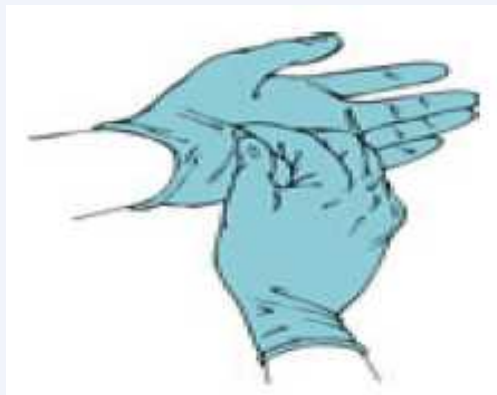
# Material Safety Data Sheet (MSDS)

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# PERSONAL PROTECTIVE EQUIPMENT (PPE)

LOGO

# PPE



(Sandia National Laboratories, 2013)

LOGO



(Sandia National Laboratories, 2013)

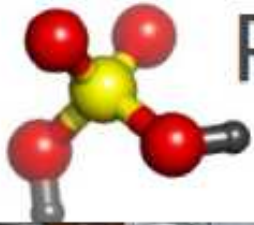
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# Filtering Facepieces: *Inappropriate use*



(Sandia National Laboratories, 2013)

LOGO



# Proper steps to remove Gloves



1



2



3



4



5



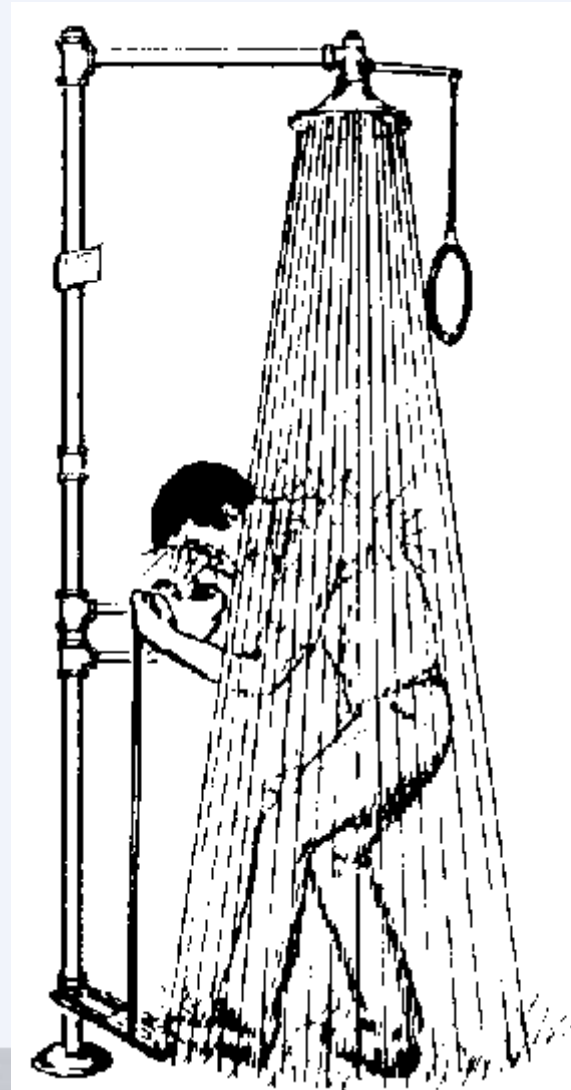
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# Laboratory Facilities






Shower and eye wash






(Sandia National Laboratories, 2013)



# Symbols

Pictogram	Hazard Classification
	Gases under Pressure
	Environmental Toxicity
	Acute Toxicity (severe)

Pictogram	Hazard Classification
	Corrosives
	Oxidizers
	Carcinogen Respiratory Sensitizer Reproductive Toxicity Target Organ Toxicity Mutagenicity Aspiration Toxicity

## Pictogram

## Hazard Classification



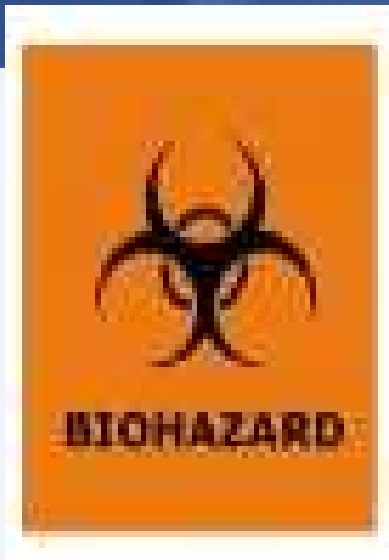
Explosives  
Self-reactives  
Organic Peroxides



Irritant  
Dermal Sensitizer  
Acute Toxicity (harmful)  
Narcotic Effects  
Respiratory Tract Irritation



Flammables  
Self-reactives  
Pyrophorics  
Self-heating  
Emits Flammable Gas  
Organic Peroxides



Electromagnetic Field

Electrical hazard [LOGO](#)



High voltage



Hot surface



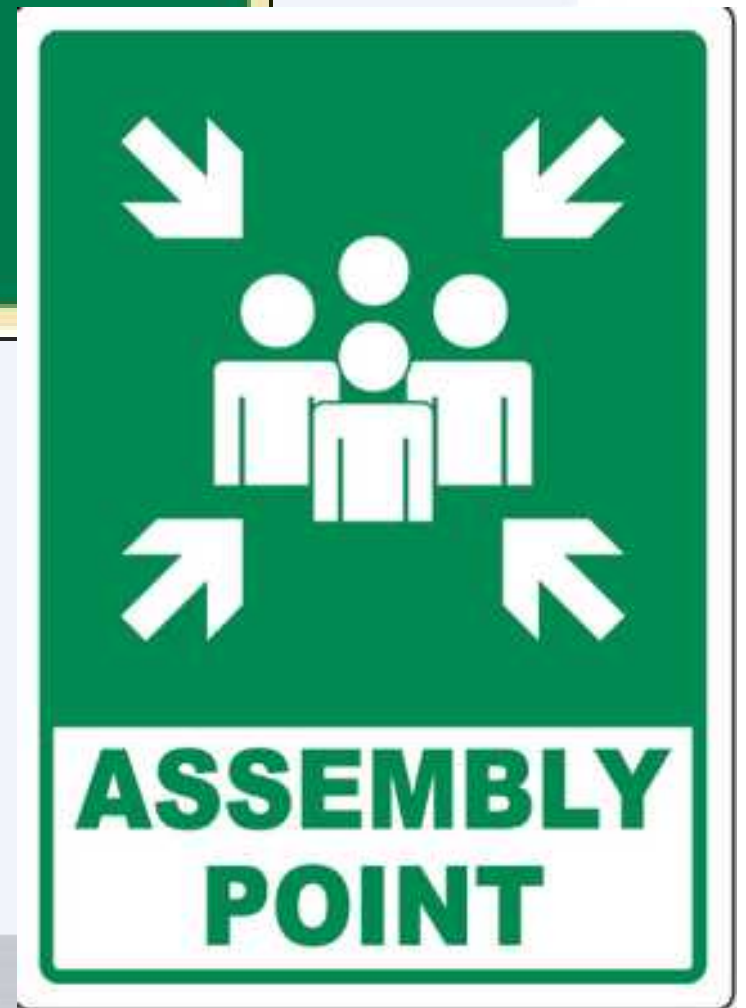
Radiation



Optic Radiation







## Evacuation procedure:

- ❖ Stop what you are doing and walk, not run, to the nearest stairwell. Close all doors behind you.
- ❖ Always Use the stairs, do not use elevators.
- ❖ People who walk slowly or need assistance should walk to the right side of stairwells to prevent impeding other people from exiting a building
- ❖ Once evacuated, proceed to your designated gathering area at least 50 feet away, so Emergency Personnel have clear access to the building. Do not panic.
- ❖ In assembly area report to your instructor/supervisor
- ❖ Do not re-enter the building until the "all clear" announcement is given by the emergency coordinator.

## FIRE

Do not attempt to fight fires in the lab (except clothing fires - use emergency shower/eyewash); evacuate the lab quickly (see Building Evacuation); close all doors and call for assistance. Fire extinguishers are placed in the labs for use on small fires by trained personnel working in pairs.

## EARTHQUAKE

Move away from overhead lights, heavy unsecured objects & hazardous materials. Choose a sheltered position to wait (under a strong table or bench, in a door frame, or against a bearing wall). Once the tremor stops, shut down gas lines & heat sources. Exit the building quickly (see Building Evacuation).

# Hazards Identification



(Kresnowati, 2013)

# References

Committee on Promoting Safe and Secure Chemical Management in Developing Countries, 2010, Chemical Laboratory Safety and Security. A Guide to Prudent Chemical Management, The National Academies Press Washington, DC

Kresnowati, P.M.T.A., 2013, Introduction to Biohazard in Laboratory and Bioprocess Microbiology and Bioprocess Technology Laboratory. Dept. Chemical Engineering. Bandung Institute of Technology, Presented at Workshop Chemical Risk Management for Chemical Engineers, Bandung 1-5 July 2013

Laboratory biosafety manual, World Health Organization, Geneva, 2004

Sandia National Laboratories, 2013, Workshop Chemical Risk Management for Chemical Engineers, Bandung 1-5 July 2013

THANK YOU

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