

# Toxic Chemicals

L. C. Lee  
Safety in the Laboratory  
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**It contains more than 4,000 chemicals and it has spread into every human body on Earth.**

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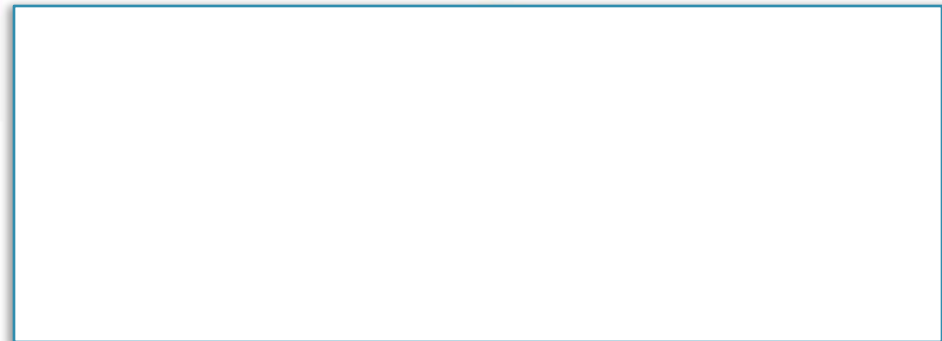
**Among its components are formaldehyde, acetone, ethanol, ketone bodies, dihydrogen monoxide, tryptophan, urea, Dehydroepiandrosterone, Hexosephosphate P, and at least 20 kinds of acids.**

**Nearly every chemical constituent will, in certain concentrations, kill children and adults.**

**Chemical compounds within it are also used in yoga mats, explosives, warfare, and industrial applications.**

**It is now so pervasive that every human baby is born with high concentrations already in his or her tiny body.**

**Healthcare workers, pharmaceutical companies, and governments spend billions each year to maintain or increase its presence in citizens.**



# Toxic Chemical Learning Targets

**Understand the hazards of working in a chemistry lab, and how to prevent injury to yourself and others.**

1. Practice basic lab safety rules and precautions
2. Interpret hazard symbols for chemicals
3. Describe 4 routes of chemical entry and how to prevent each
4. Describe types of injury from chemicals.
5. Explain why people are impacted differently by chemicals
6. Explain LD<sub>50</sub> and TLV
7. Be able to find target info on SDS

# What is a Toxic Chemical?

- Any chemical which, when ingested, inhaled, absorbed or injected into the body, in relatively small amounts, by its chemical action, may cause damage to structure or disturbance to function
- ~ From *Dorland's Medical Dictionary*

# Hazard Pictograms

## HCS (Hazard Communication System)



### **HEALTH HAZARD**

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity



### **FLAME**

- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides

# Hazard Pictograms

## HCS (Hazard Communication System)



### **EXCLAMATION MARK**

- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer



### **GAS CYLINDER**

- Gases under pressure

# Hazard Pictograms

## HCS (Hazard Communication System)



### **CORROSION**

- Corrosive to skin
- Eye damage
- Corrosive to metals



### **EXPLODING BOMB**

- Explosives
- Self-reactives
- Organic Perozides



# Hazard Pictograms

## HCS (Hazard Communication System)



**OXIDIZERS**



**ENVIRONMENT**

- Aquatic Toxicity

# Hazard Pictograms

## HCS (Hazard Communication System)



### **ACUTE TOXICITY**

- Fatal or toxic; poison

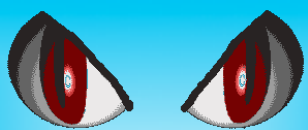


# 4 Routes of Chemical Entry

- Absorption - skin contact
- Inhalation - through the lungs
- Ingestion - via the mouth
- Injection - via a puncture wound (cut)

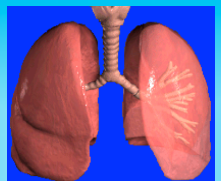
## Routes of Entry

*Absorption*



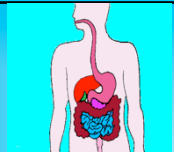
- Skin
- Eyes

*Inhalation*



- Lungs
- Respiratory System

*Ingestion*



- Gastrointestinal Tract
- Bloodstream

*Injection*



- Skin
- Muscle

# Prevention of Chemical Entry:

- Do not eat or put anything in your mouth while working in lab. NO gum, candy.
  - Do not chew your pen or fingernails.
- Wash hands before leaving
- Handle glassware carefully
- Waft chemicals to detect odor
- Work in well-ventilated area or fume hood

# Personal Protective Equipment

- PPE must suit the hazard
  - Chemical splash goggles
    - Whenever heat, chemicals, or glassware are in the area
  - Protective apron or lab coat
  - Shoes with closed toes
- Hoods, hats with brims, baggy sleeves, coats, scarves, ties are unsafe
  - Fire hazards
  - Other hazards



# Three types of damage caused by chemicals:

- Damage to biological structure
  - Example:
- Disturbance of biological function
  - Example:
- Damaging **both** structure and function
  - Example:

# Damage Can Be Local or Systemic

- **Local** - affects only the exposed part.
  - Contact through absorption, inhalation, ingestion, or injection
- **Systemic** - effect of a substance after absorption the bloodstream.
  - Absorption may take place through the skin, stomach, or lungs.

# Acute or Chronic damage?

- **Acute toxicity** - victim becomes ill or injured after “short exposure”
  - sometimes just a few moments
- **Chronic toxicity** - effects of a toxicant on a body over a long period, sometimes several years
  - Effects may not be noticed until the damage is too far advanced to correct.



# Measuring Toxicity: LD<sub>50</sub>

- Lethal Dose. 50% kill
- dose which, when administered to test animals, kills half of them.
- Usually refers to ingestion or injection
- Units are mg of toxicant per kg of body mass
- Correlating rat-doses to man-doses
  - LD<sub>50</sub> for a chemical ingested by rats is 8 mg/kg. How much would each person in a group of 150 lb people need to ingest to have a 50% fatality rate?

# Measuring Toxicity: TLV

- Threshold Limit Value
- Maximum concentration of a toxicant or corrosive in air that is known NOT to cause damage or illness.
- Units are ppm (parts per million)
- Used to describe toxicity by inhalation

# Variables Affecting Toxicity

- Not everyone suffers equally from toxicity. The effects may vary from person to person depending on:
  - Mode of entry
  - Physical Condition
  - Dose and/or Duration
  - Sensitivity; Stress
  - Combined effects
  - Gender, race, temperature, altitude, body chemistry

# ***Safety Data Sheet:***

Information :

- Chemical Name and Formula
- Hazards Identification
- Physical data: formula weight, solubility, appearance, odor, density (specific gravity)
- Toxicity info: LD<sub>50</sub>, TLV
- Exposure Control and PPE needed
- First Aid measures

# First Aid

- INFORM INSTRUCTOR OF ANY INJURY NO MATTER HOW SMALL!
- Minor burns: hold under cold running water
- Minor cuts: rinse under cold running water

# Summary:

- Following the Lab Safety Rules will help prevent injury



# 5 Categories of Hazardous Chemicals

- **Toxics** - poisons; usually cause systemic damage
- **Reactives** - react chemically with everyday substances
- **Corrosives** - corrode substances including flesh
- **Flammables** - combust (burn)
- **Compressed gases** - very high pressure (Scuba cylinder, Helium tank)
  - Gas may or may not also be toxic or flammable