

# Graduate Lab Safety Training

California State University Fresno  
College of Agricultural Sciences and  
Technology

# Safety Mindset

- Think safety-
  - Being safe in the lab requires conscious effort to think ahead and be aware of potential hazards.
- Act Safely
  - Being safe in the lab requires behaviors to minimize the likelihood and severity of accidents.

# Safety Mindset

- Ignorance vs. Knowledge
  - You are at greatest risk when starting a new procedure because you are ignorant of the potential hazards.
  - Training helps you acquire the knowledge to be safe.
- Complacency Vs. Vigilance
  - A lack of accidents creates a false sense of safety i.e. an accident won't happen to me.
  - Reviewing safety procedures helps maintain vigilance.

# Safety Mindset

- Murphy's law: If it can go wrong; it will go wrong.
- Don't count on your luck to avoid accidents. Be prepared!
- What you decide before an accident is what you will most likely do if an accident happens.

# Safety Planning

- Evaluate situations that could create a lab accident.
- Take steps to prevent the unsafe situation.
- Have a plan for what you will do when the accident happens.

# Safety Planning

- Know the safety concerns of all procedures and equipment you use.
- All lab procedures should be checked out with the lab technician.

# Safety Planning

- Read and understand the **Material Safety Data Sheets, MSDS**, for all chemicals before using.

# MSDS Location

- Material Safety Data Sheets (MSDS) are located in three binders in the hallway by the Analytic room door.

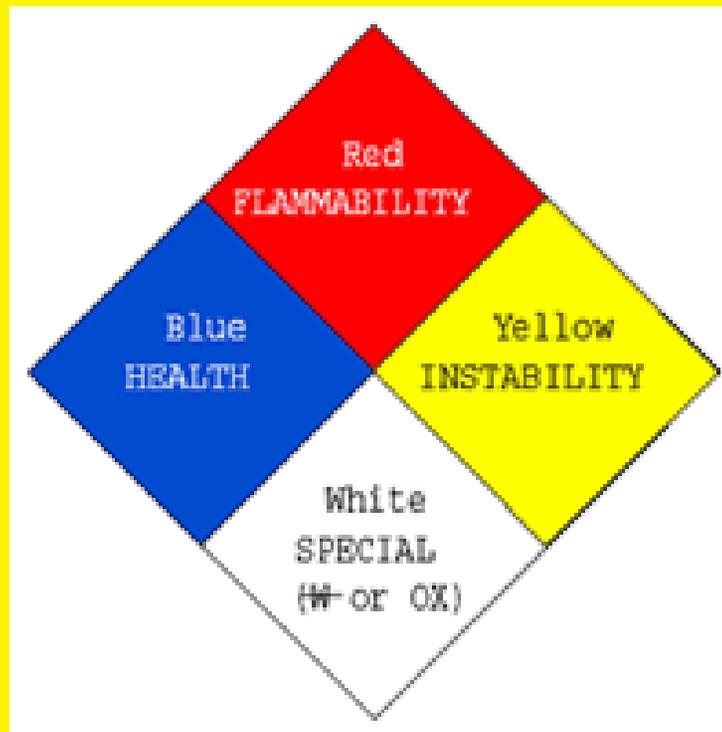


# MSDS

- MSDS provide information about the safe use of chemicals.
  - Safe handling
  - Potential risks
    - Health
    - Flammability
    - Instability / Reactivity
  - Protective measures

# MSDS NFPA Rating

- All MSDS contain National Fire Protection Association (NFPA) ratings of chemicals. The symbol below is an example.

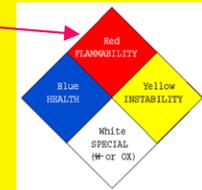


# NFPA **Health** Hazard Scale



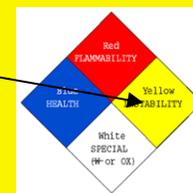
- **0 None** - No hazard
- **1 Slight** hazard: Can cause irritation but only minor residual injury.
- **2 Moderate** hazard : could cause temporary incapacitation or possible residual injury.
- **3 Severe** hazard: short exposure could cause serious temporary or residual injury.
- **4 Extreme** hazard: very short exposure could cause death or major residual injury.

# NFPA **Flammability** Hazard Scale



- **0 None:** Will not burn
- **1 Slight:** Must be pre-heated before ignition can occur.
- **2 moderate:** must be moderately heated or exposed to relatively high ambient temperature before ignition can
- **3 Severe:** Liquids and solids that can be ignited under almost all ambient temperature conditions.
- **4 Extreme:** Will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or that are readily dispersed in air and that will burn readily.

# NFPA **Instability** Hazard Scale



- **0 none:** normally stable, even under fire exposure conditions, and is not reactive with water.
- **1 Slight:** normally stable, but which can become unstable at elevated temperatures and pressures.
- **2 moderate** undergoes violent chemical change at elevated temperatures and pressures or which reacts violently with water or which may form explosive mixtures with water. Example: calcium metal
- **3 Severe:** capable of detonation or explosive decomposition or reaction but requires a strong initiating source or which must be heated under confinement before initiation or which reacts explosively with water.
- **4 Extreme:** in itself is readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.

# NFPA Special Precautions



- ~~W~~ Material shows unusual reactivity with water
- **OX** Material possesses oxidizing properties.
- **ACID** Material is an acid.
- **ALK** Material is a base (alkaline).
- **COR** Material is corrosive.
- Material is radioactive.

# MSDS Information LD50

- LD 50 – Lethal Dose that will kill 50% of a population.
- Usually tested on rats or mice
- Unit is milligram of chemical per kilogram of body weight i.e. mg/kg
- The smaller the number the more toxic the chemical.
- LD50 give a general idea of toxicity because they are tested on animals not people.

# LD50 Examples

Material	LD50 (mg/kg)	Subject, route
Sucrose	29700	Rat / oral
Sodium Bicarbonate	4220	Rat / oral
Sodium chloride	3000	Rat / oral
Ethanol	2080	Rat / oral
Caffeine	192	Rat / oral
Sodium Cyanide	6.4	Rat / oral
Vx (Nerve agent)	0.14	Human /skin

# Other health hazards

- Carcinogen – can cause cancer
- Teratogen – can cause birth defects
- Environmental toxin- can cause environmental damage if released to environment.

# MSDS Information

## Types of Exposure

- Inhalation
- Ingestion
- Skin contact
- Eye contact
- Acute exposure
- Chronic exposure

# Reducing Risk

- Personal Protective Equipment (PPE)
- Fume Hoods
- Labeling chemicals
- Chemical Hygiene
- Reporting hazards

# Personal Protective Equipment

## Eye Protection

- Eyes are vulnerable and irreplaceable.
- Eye protection must be worn whenever you are in the laboratory.
- Even if you are not doing something hazardous, you still need to wear eye protection.
- The type of eye protection depends on the level of risk.

# Personal Protective Equipment

## Eye Protection

- Safety glasses must be worn when conducting general lab work. 
- Goggles must be used when working around chemical such as acids and caustics that can damage the eye. 
- Goggles and face shield must be used when pouring or mixing hazardous chemicals 

# Personal Protective Equipment



## Lab Coat or Apron



- An apron or lab coat should be worn when working in the lab.
- Aprons and lab coats protect you and your clothes from coming in contact with chemicals.
- They keep you from bringing chemicals home on your clothes.
- Aprons are located by each fume hood.



# Personal Protective Equipment



## Gloves



- It is recommended to wear disposable gloves (nitrile or latex) when working in the laboratory.
- Disposable gloves provide protection from most powders and some liquids.
- Check a glove's technical specifications to determine its resistance to the chemicals being used.
- See lab technician for other types of gloves.

No open toe shoes or sandals can  
be worn in the lab.

# Fume Hoods

- Fume hoods must be used whenever working with chemicals that
  - Are volatile or flammable
  - Create hazardous fumes
  - Are strong acids or bases (greater than 2 normal)
  - Have a health rating of 3 or 4

# Fume Hoods

- Make sure the arrow on the sash is at or below the arrow on the hood.
- Check to make sure the blower is operating properly.
- Material in the hood must be at least 3 inches from the front of the hood.



# Fume Hood Safety



Window arrow below sash arrow indicates proper flow.



Tape indicates blower is working.

# Safety Eye Wash Showers

- Know where safety eye wash / showers are located.
  - You may need to find them with your eyes closed.
- Know how to use safety eye wash / showers.
- Don't place items on floor that will block access to showers



# Safety Eye Wash Shower Usage

- In case of chemical exposure, flush skin or eyes with cool water for at least 15 minutes. DO NOT RUB!
- Get medical assistance immediately following flushing.
- If possible, continue flushing while on way to medical help.
- Hold your eyes open with your hands while using an eyewash to be sure water reaches the eyes.
- Remove contaminated clothing after the shower has been activated.
- Immediately wash off even small amounts of chemicals.
- Safety showers can be used to extinguish fires on people.

# Safety Eye Wash



1. Press lever on right of bowl.



2. Water will come from nozzles. There is no to hold the handle once the water starts.



3. Place face in water streams and keep eyes open. Wash face and eyes at least 15 minutes.

# Safety Shower Use



1. Pull triangular handle to start water.
2. There is no need to hold handle once water starts.
3. Remove any contaminated clothing.
4. Wash at least 15 minutes.

# Labeling Chemicals

- All chemical containers must have labels with the following information:
  - All Chemical contents of container
    - Full name of chemical
      - Example: 1M Hydrochloric acid in water not 1M HCl
  - Name or initials of researcher
    - Initials must be on file with lab technician
  - Date chemical was prepared

# Chemical Labels

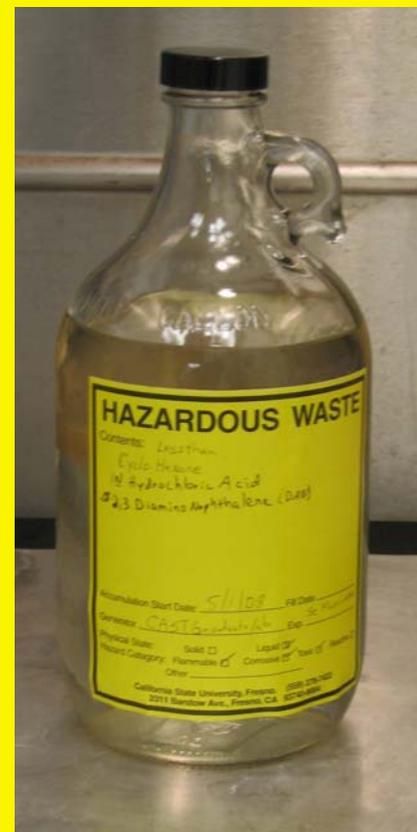
- Phosphate buffer
  - 5.5 g potassium phosphate monobasic
  - .1g sodium hydroxide
  - In 100ml of water
  
- 11/9/07 DJB

# Sample labels

- Individual samples do not need detailed content information as long as they are kept in containers that have content, researcher and date information.

# Hazardous Waste

- No chemical waste can be put down the drain or thrown in the trash.
- Contact the laboratory technician for directions on handling chemical waste.
- All chemical waste must be placed in properly labeled containers.



# Hazardous Waste Labels

- All hazardous waste must use the label at right.
- Chemical names must be spelled out.

**HAZARDOUS WASTE**

Contents: \_\_\_\_\_

Accumulation Start Date: \_\_\_\_\_ Fill Date \_\_\_\_\_

Generator \_\_\_\_\_ Exp. \_\_\_\_\_

Physical State: Solid  Liquid

Hazard Category: Flammable  Corrosive  Toxic  Reactive

Other \_\_\_\_\_

California State University, Fresno. (559) 278-7422  
2311 Barstow Ave., Fresno, CA 93740-8004

# Sample Hazardous Waste Label

- Chemical abbreviations can be used but the name must also be spelled out.
- The fill date must be completed when container is full.
- Once the fill date is completed it should be disposed of within 90 days.
- Partially filled containers must be disposed of within 180 days
- Contact Campus Environmental Health and Safety (x 8-7422) for disposal.

HAZARDOUS WASTE	
Contents: <u>Less than</u> <u>1N Hydrochloric acid (HCl)</u> <u>1N Nitric Acid (HNO<sub>3</sub>)</u> <u>1% Calcium (Ca)</u> <u>1% Lanthanum (La)</u> <u>1% Magnesium (Mg)</u>	
Accumulation Start Date: <u>5/23/08</u>	Fill Date _____
Generator <u>CAST Graduate Lab</u>	Exp. <u>Atomic AA</u> <u>Absorption</u>
Physical State: Solid <input type="checkbox"/>	Liquid <input checked="" type="checkbox"/>
Hazard Category: Flammable <input type="checkbox"/>	Corrosive <input checked="" type="checkbox"/> Toxic <input checked="" type="checkbox"/> Reactive <input type="checkbox"/>
Other _____	
California State University, Fresno. (559) 278-7422 2311 Barstow Ave., Fresno, CA 93740-8004	

# Chemical Hygiene

- Clean balance area after using.
- Clean counters after using.
- Put away all chemicals before leaving lab.
- Wash hands before leaving the lab, even if you were wearing gloves.
- Have a separate pen for lab work.
- Never eat or drink in the lab.
- Never take chemicals to non lab areas

# Report unsafe conditions.

- Wet or slippery floors
- Frayed or damaged electrical cords.
- Blocked safety eyewash showers
- Unmarked chemical containers
- Anything you consider unsafe

# Emergency Response Assistance

- Call campus police for all emergencies.
- Dial 911 from campus on lab phones.
- Use emergency blue phones located North of Graduate lab.
- Dial 278-8400 from cell phones.



# Emergency Response Building Evacuation

- Quickly leave building using nearest exit.
- Go to the building evacuation assembly point – Grassy area in front of the Dairy.
- Do not leave assembly point without notifying emergency response personnel.
- Report location of persons unable to leave building.

# Graduate Lab Evacuation Assembly Point



In case of fire or other emergencies, everyone will leave building and meet on the grassy area in front of the dairy. (North of Graduate lab)

# Emergency Channels of Communication

- Building Safety coordinator
  - Will be wearing red vest.
  - Will have “walkie talkie” tuned to 911
- Emergency personnel i.e. police, firemen
- Listen to radios tuned to 1040 AM for campus status.
- Call the campus hotline at 278-4000 to receive status of campus incidents.

# Fire Extinguishers

- Know where fire extinguishers are located.



# Fire Extinguishers

- Know how to use fire extinguishers

# Fire Extinguisher Use



**Pull pin from Fire Extinguisher**

# Fire Extinguisher Use



Point at base of fire.

# Fire Extinguisher Use



Squeeze handle to dispense contents.

Do not work alone in the lab  
when conducting hazardous  
procedures.

- An additional person needs to be present to call campus police, if there is an emergency.
- Check with the laboratory technician for more details.
- E.g. Kjeldahl, fat extraction, soil grinding

All flammable solvents should be kept in flammable solvent cabinets.



# All needles and glass should be put in special containers.



Put broken glass in green bucket

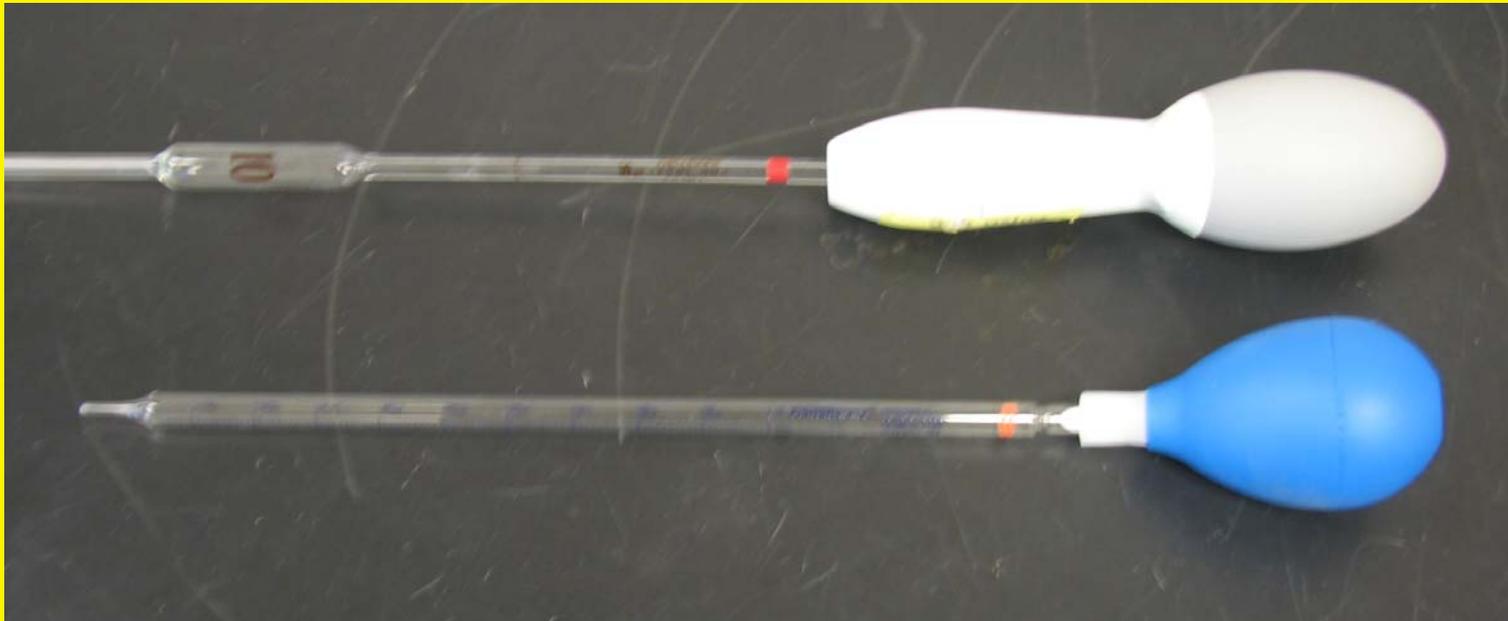


Put needles, razor blades and other sharp items in sharps container.

No sharp objects are to be put into trash cans.

- This prevents injury to the custodian who removes trash from the building.

Always use pipette bulbs to pipette solutions.  
Never use your mouth to pipette solutions.



Pipette bulbs, also called pipette aids, are used to fill pipettes.

# Chemical Spills

- If chemicals are spilled, follow spill procedure posted in the hallway.
- Alert lab technician or campus police at 278-2132.
- Place signs on doors to alert personnel of spill hazard.
- Do not attempt to clean up spill.

# Spills that Produce Toxic Fumes

- E.g. Hydrochloric acid, Nitric acid, acetic acid, Ammonium Hydroxide, solvents etc.
- Leave immediately.
- Lock door and place sign on door warning of spill. (Signs are located by first aid kit in hallway.)
- Inform lab technician.
- If no lab technician is present call campus police at 278-2132.

# Chemical Spills that don't Produce Toxic Fumes

- E.g. Concentrated Sulfuric Acid
- Block off area so that personnel won't walk through spill.
- Lock door and place sign on door warning of spill. (Signs are located by first aid kit in hallway.)
- Inform lab technician.
- If no lab technician is present, call campus police at 278-2132.

# Illness and Injury prevention Plan IIPP

- If you are employed on the Fresno State campus you must receive instruction about the Illness and Injury Prevention Plan (IIPP) for your area.
- You must sign a document that indicates you have received this training.
- A record of your training must be on file in the department or center you work for.

# Safe Lab Practices Review

- 1. Know where fire extinguishers are located and how to use them.
- 2. Know where eyewash/ showers are located and how to use them.
- 3. Eye protection must be worn at all times in the lab. This can be goggles or safety glasses. Goggles must be worn when working with acids or bases with concentrations greater than 1 n.
- 4. Aprons or lab coats should be worn.
- 5. You must work in the hood when using strong acids or bases i.e. Greater than 2 normal.
- 6. Goggles, face shield, gloves, and apron must be worn when working with chemicals in the fume hood.
- 7. All containers must be labeled as to contents. (use a marking pen)
- 8. Do not work alone in the lab when conducting hazardous procedures.
- 9. All waste from experiments should be put in a labeled bottle.
- see the technician for more information.
- 10. All lab procedures should be checked out with the lab technician.
- 11. Clean the balance area after you are finished.

# Safe Lab Practices Review

- 11. Clean the balance area after you are finished.
- 12. All flammable solvents should be kept in flammable solvent cabinets.
- 13. Report all accidents to the lab technician.
- 14. Call 911 for all emergencies.
- 15. Know the location of telephones in the lab.
- 16. Read and understand the material safety data sheets, MSDS, for all chemicals.
- 17. Know the safety concerns of all procedures and equipment you use.
- 18. Always use pipette bulbs to pipette solutions. Never use your mouth to pipette solutions.
- 19. Report unsafe conditions.
- 20. All needles and glass should be put in special containers.
- 21. If chemicals are spilled, follow spill procedure posted in the hallway.
- 22. No open toe shoes or sandals can be worn in the lab.