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UH Manoa Laboratory Safety Training

Spring 2016

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UH EHSO

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UNIVERSITY
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Environmental Health
& Safety Office

Program Objectives

- Prevent lab injuries/incidents!
- Learn to build safety measures into productive research methods & protocols
- Create an atmosphere of safety and compliance
- Pay attention to safety details!



What We'll Cover.....

- Review some of the key issues related to lab safety
- Importance of being aware of your surroundings
- Short videos on lab incidents and common mistakes and expectations

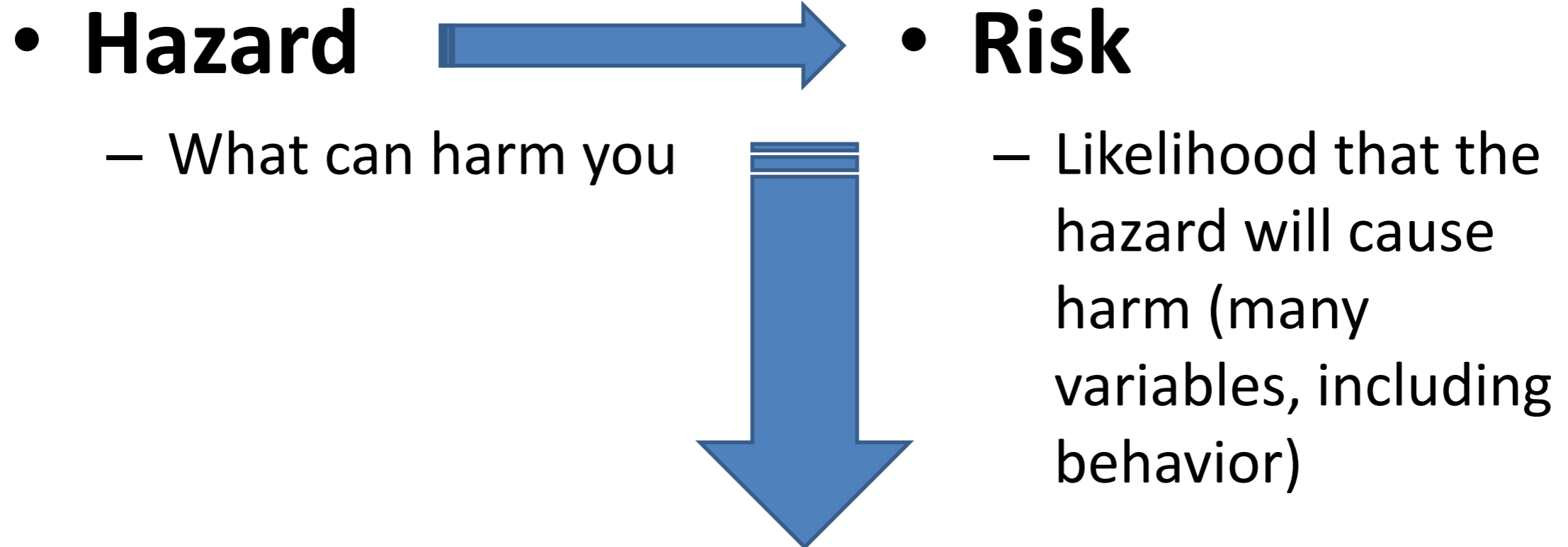


UH Manoa Lab Safety Program

- Policy program put in place to provide uniform requirements for safe lab work
 - Regulated by HIOSH/OSHA - Them
 - [Chemical Hygiene Plan \(CHP\) – Us \(EHSO\)](#)
 - [Standard Operating Procedures \(SOP's\) - You](#)
- Elements of the program are outlined in CHP
- MANY hazards in your lab – not just chemicals!

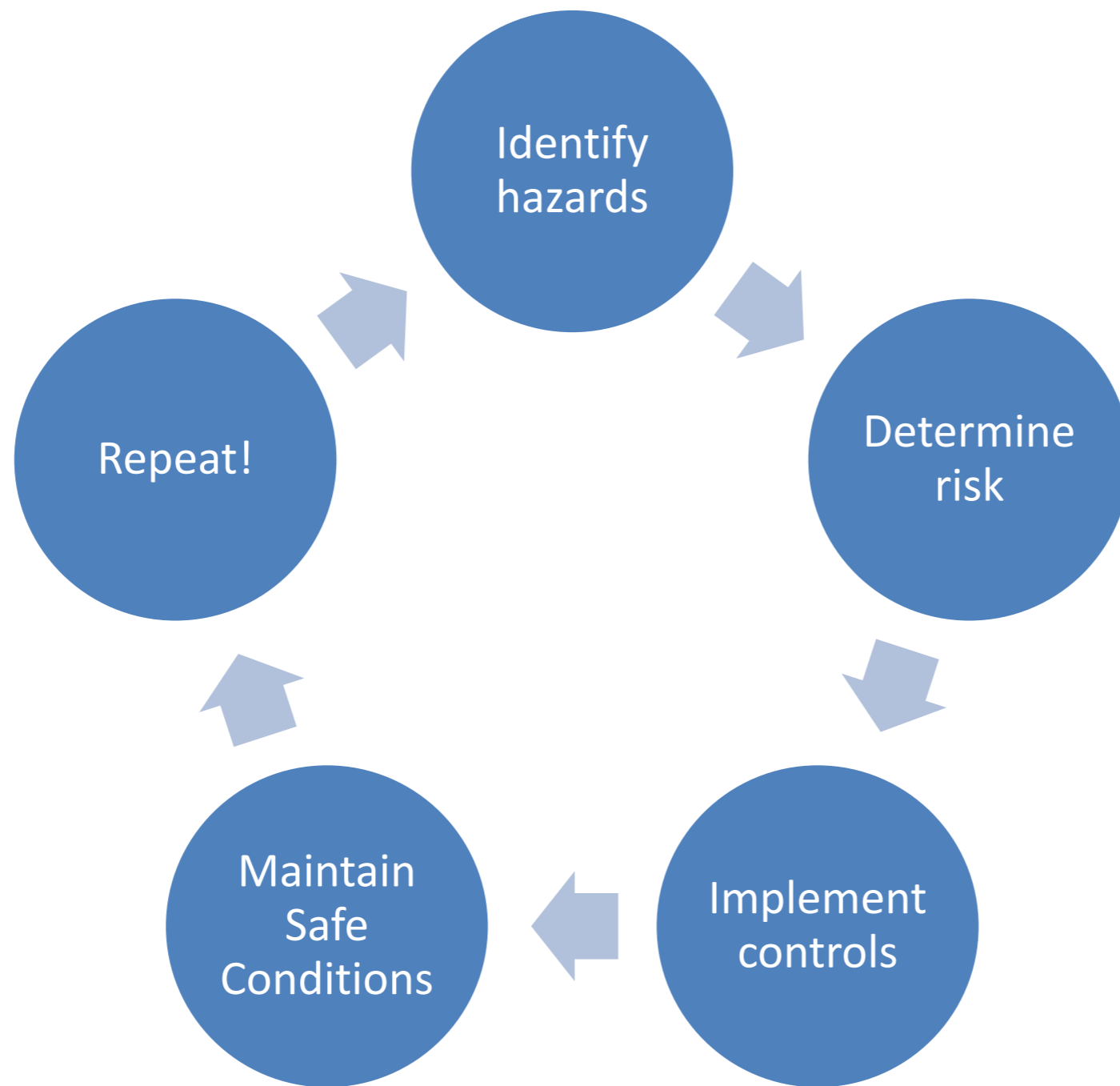


Hazard vs Risk



The goal for each experiment is to identify **HAZARDS**, determine risks and then address reducing these risks through controls

Hazard/Risk-Based Approach



Hazard Identification

- Chemicals
- Biological materials
- Radiation
- Lasers
- Equipment (ALL kinds of equipment: lab equipment, heavy construction equipment, mechanical shop equipment, electrical equipment, etc...)
- Physical hazards from the work area – trip hazards
- Hand/power tools
- Fire
- Compressed gases
- Noise
- Etc...

Teach your lab members the value of a WHAT-IF Analysis!

Control of Hazards

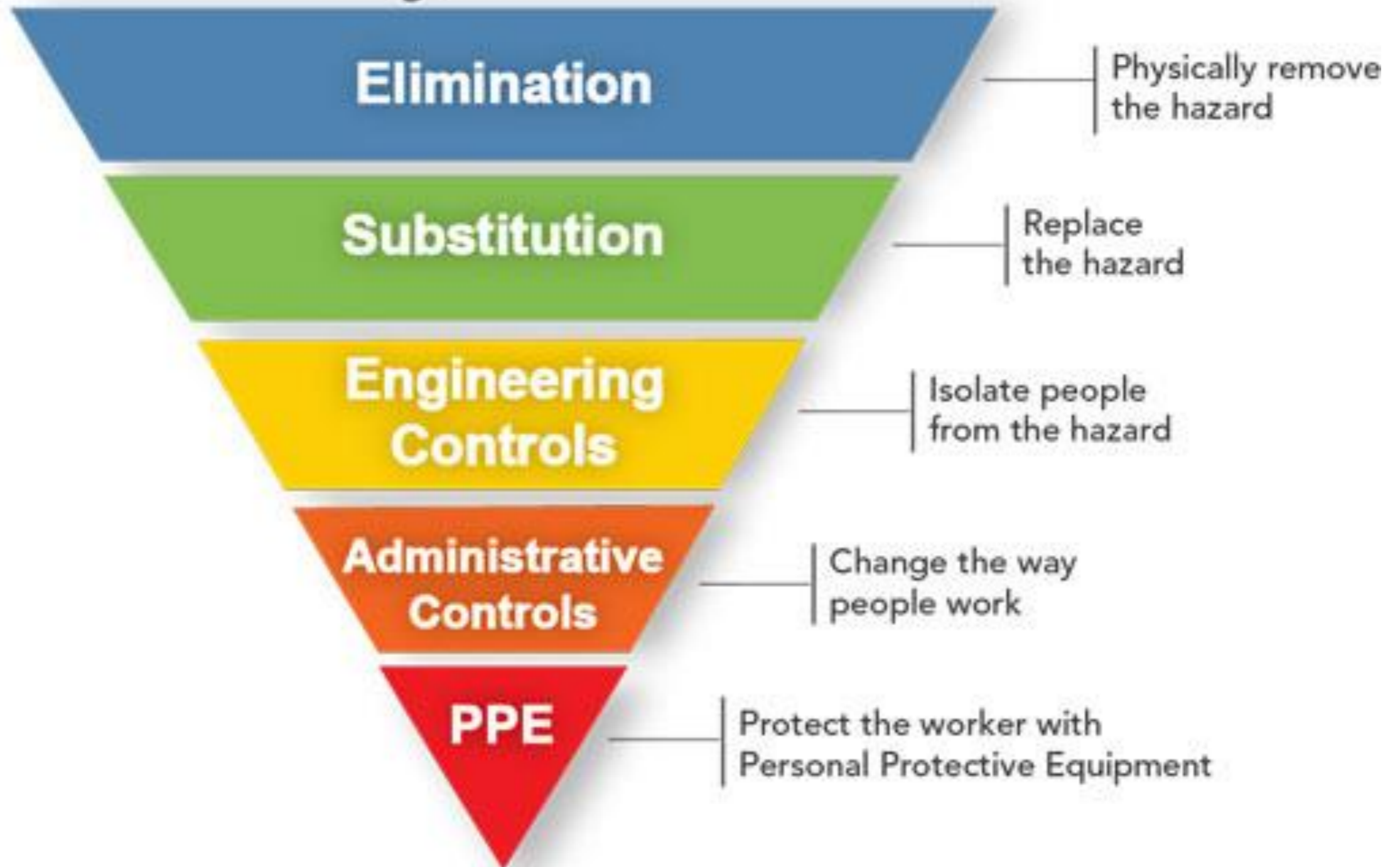
- There are inherent risks with the work you do
- First step is to identify hazards!
- If you can eliminate or substitute the hazard, GREAT!
- If not, three levels of controls to reduce risk
 - Engineering – fume hood, enclosure, barrier
 - Administration – training, limit work duration
 - PPE – LAST line of defense

Hierarchy of Controls

Most effective



Least effective



Basic Risk Assessment

A 3x3 matrix for Basic Risk Assessment. The vertical axis is labeled 'Likelihood' and the horizontal axis is labeled 'Impact'. The matrix cells contain risk levels and scores. The risk levels are: Very likely (Medium 2, High 3, Extreme 5), Likely (Low 1, Medium 2, High 3), and Unlikely (Low 1, Low 1, Medium 2). The impact levels are: Minor, Moderate, and Major.

Very likely	Medium 2	High 3	Extreme 5
Likely	Low 1	Medium 2	High 3
Unlikely	Low 1	Low 1	Medium 2
What is the chance it will happen?	Minor	Moderate	Major

Likelihood

Impact

UH: Lab Responsibility

- **Principal Investigator** – Direct and overall responsibility for safety and chemical hygiene. Identify hazards and implement controls
- **Lab Personnel and Visiting Students**– Know the hazards of chemicals & follow policies and protocols



Where Do We Start?

- Follow your Lab's safety "systems"
 - Attend and document UH and Lab Specific training
- Familiarize yourselves with:
 - CHP and written procedures & SDS
 - Location of chemicals
 - Personal Protective Equipment
- Start paying attention to details!

Standard Operating Procedures

- Must clearly answer “How do I safely conduct this process?”
- Identify potential hazards – Chemical and Physical
- Determine required PPE
- Outline controls (hood use, handling, storage)
- Outline spill/accident/waste procedures
- Protocols: Specific handling practices
- Must be communicated in writing!

CHEMICAL EXPOSURES: Health and Physical Hazards

How do I assess Chemical Hazards?

- Two means of determining if a chemical is hazardous:
 - Labels
 - Safety Data Sheets
- Look for “key” words and symbols on labels
 - Warning & Danger
- Toxic
- Reactive
- Flammable/Combustible
- Corrosive
- Oxidizers
- Carcinogens

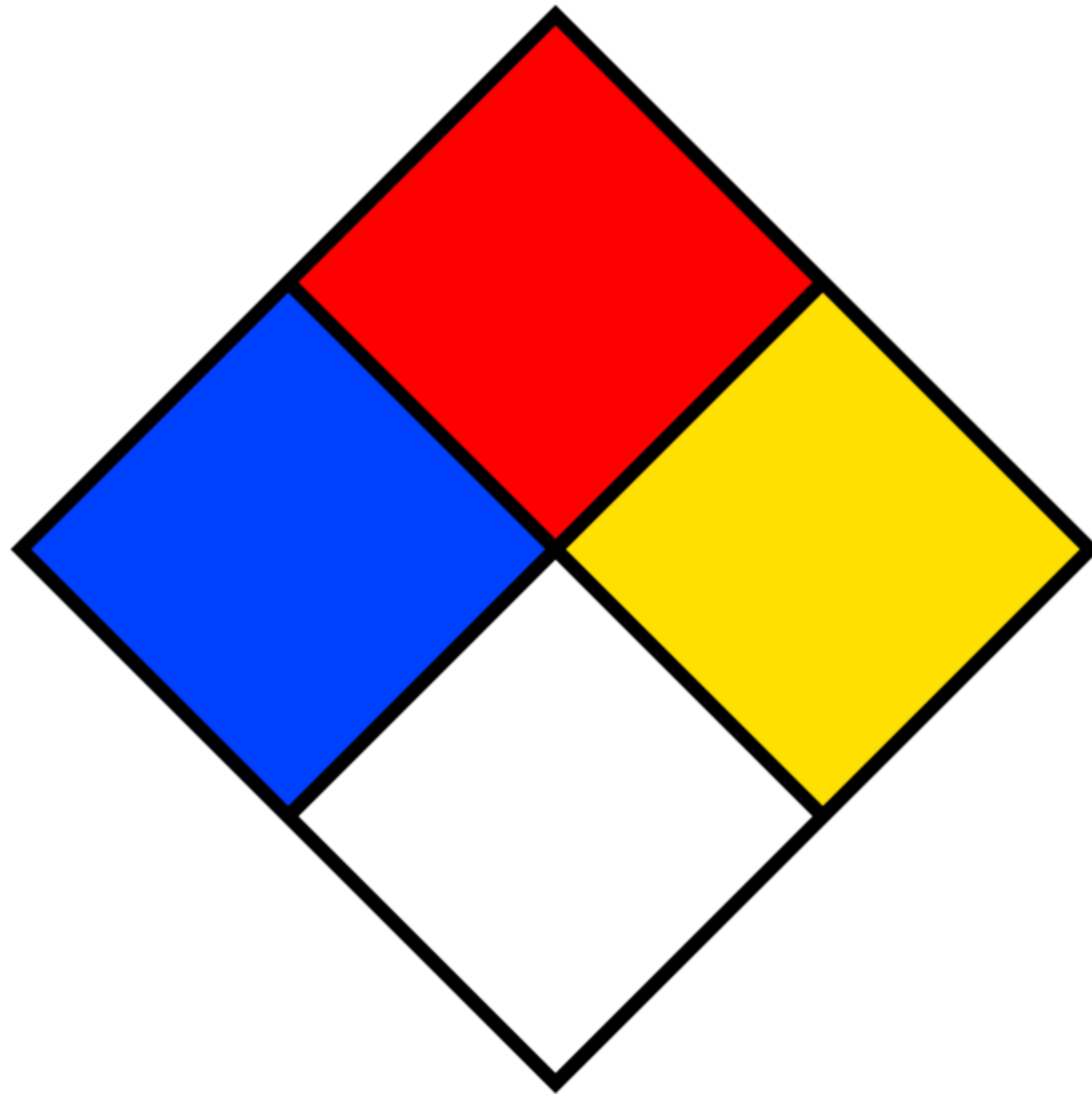


Identifying Hazards: Systems

- SDS Sheets, Chemical Labels, Shipping Boxes and Doors Signs all have (one or more):
 - NFPA Diamond System – 4 is highest hazard
 - GHS – 1 is highest hazard (mandatory as of Dec 2015)



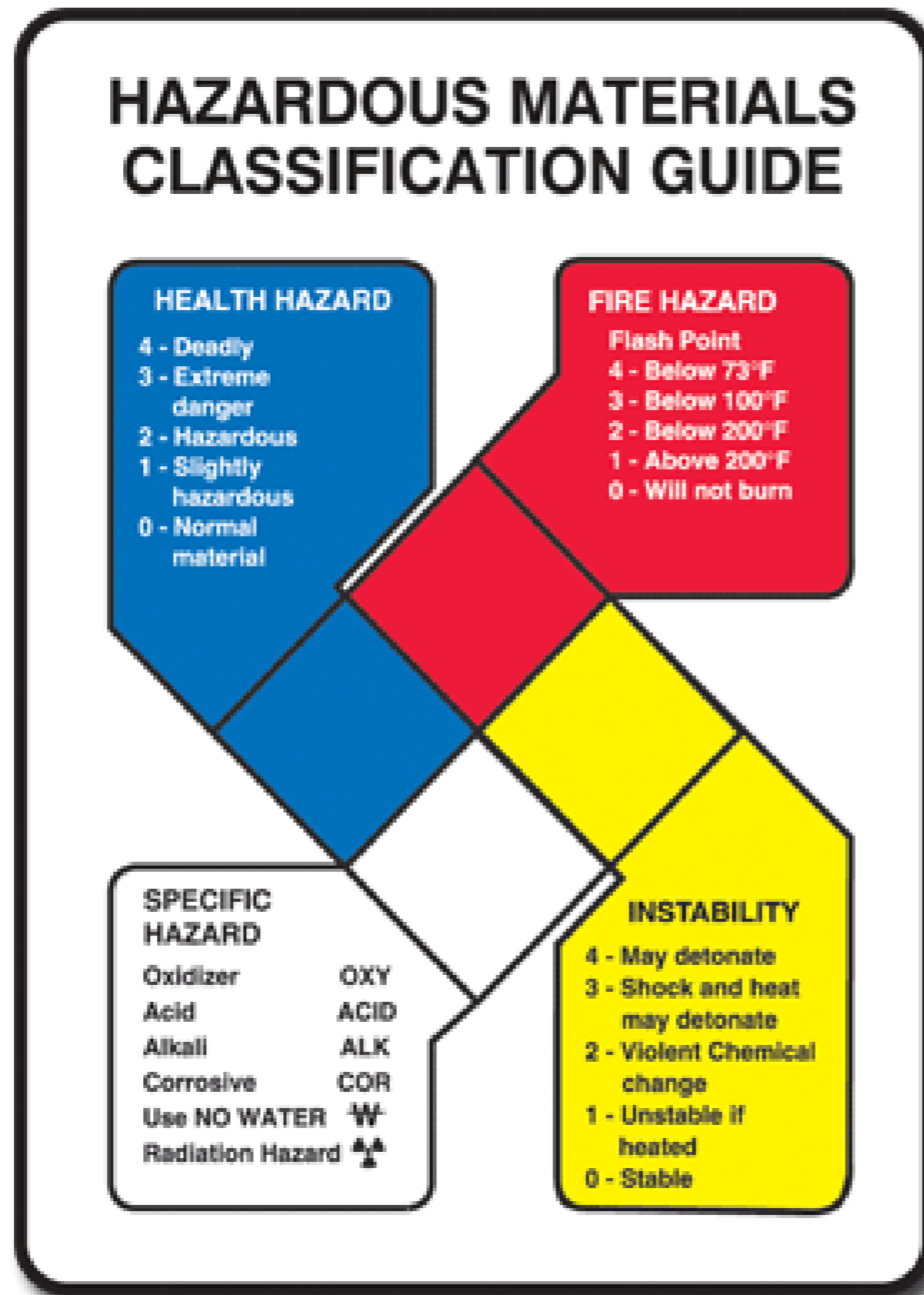
What Is This?



NFPA Diamond (0-4 Scale)






- 0-4 scale with 4 being the highest level hazard in each diamond
- Health (blue)
- Fire (red)
- Instability (yellow)
- Specific Hazard (white)
 - These diamonds are on MANY chemical containers and give general guidance for storage and handling






NFPA Diamond (0-4 Scale)



GHS System (1-5 Scale with 1 as Highest Level Hazard)

GHS – Hazard Pictograms and correlated exemplary Hazard Classes

Physical Hazards				
				
Explosives	Flammable Liquids	Oxidizing Liquids	Compressed Gases	Corrosive to Metals

Health Hazards				Env. Hazards
				
Acute Toxicity	Skin Corrosion	Skin Irritation	CMR ¹⁾ , STOT ²⁾ , Aspiration Hazard	Hazardous to the Aquatic Environment

1) carcinogenic, germ cell mutagenic, toxic to reproduction / 2) specific target organ toxicity

Chemical Labels

Hazardous chemicals must have labels which include:

Product Identifier

EPICHLOROHYDRIN

UN No. 2023
CAS No. 106-89-8

Pictograms

Signal Word

DANGER

Hazard Statement

Flammable liquid and vapor. Toxic if swallowed. Toxic in contact with skin. Causes severe skin burns and eye damage. May cause an allergic skin reaction. May cause cancer.

Precautionary Statement

Do not breathe dust/fume/gas/mist/vapors/spray. Wear protective gloves/protective clothing/eye protection.



Fill Weight: 18.52 lbs.
Gross Weight: 20 lbs
Expiration Date: 1/15/2018

Lot Number: A0323111323
Fill Date: 1/15/2012

Supplier Information

JACKSON CHEMICAL COMPANY - City of Industry, Los Angeles, California, USA (800)-444-456-8989

Chemical labels do not contain as much information as the SDS but provide quick reminders of key hazards. Labels must not be removed or defaced.

Hazard Identification

Many chemicals in the laboratory expose employees to health and physical hazards. Can you correctly identify these hazard pictograms?



explosives



irritants



acute toxicity



corrosives



aquatic toxicity



flammables



oxidizers



carcinogens



gases under pressure

When is a Chemical Hazardous to My Health?

- Acute effects

- Immediate damage; Large amount over short period of time - Dose is the key!

- Chronic effects

- Accumulated damage; small amount over long period of time - Dose is the key!



Chemical Exposure

- Odor: know “warning properties”
 - example: almonds or rotten eggs
- Taste: Strange taste in mouth
- Sight: Chemical spills
- Physical Symptoms:
 - Burning
 - Headache
 - Nausea



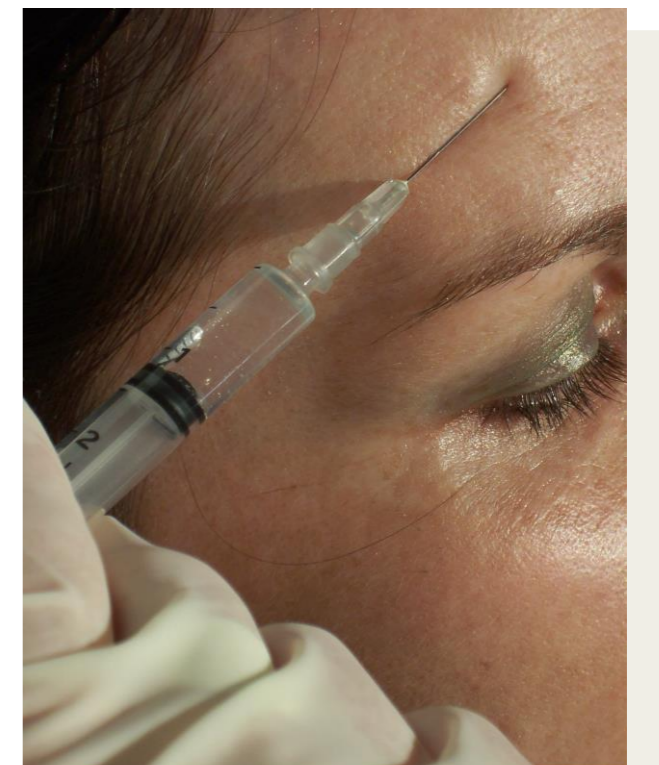
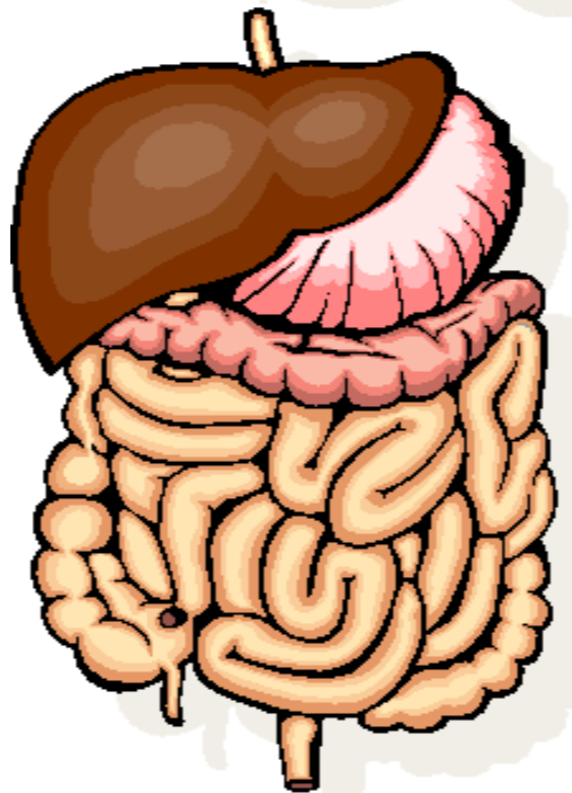
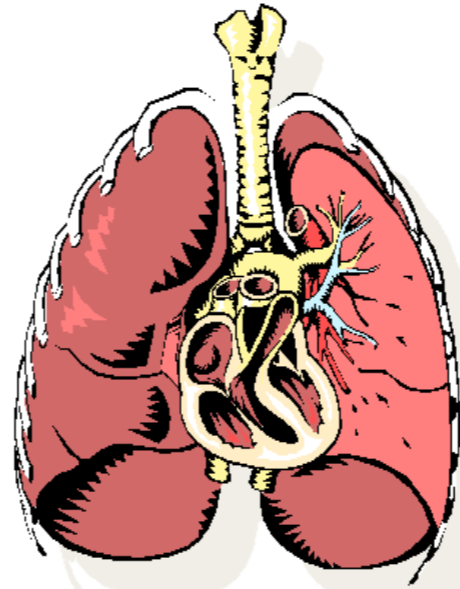
Remember – Chemicals also have PHYSICAL hazards!

- Can cause skin damage (acid/base/strong solvents)
- Fire (flammable liquids & gases)
- Projectiles – Gas cylinders



Typical Routes of Entry

- Inhalation
- Absorption
- Ingestion
- Injection



See SDS For Exposure Limits

- Most chemicals have exposure limits (see CHP appendix IV & SDS):
- Threshold Limit Value (TLV)
- Permissible Exposure Limit – (PEL)
- Use PPE and Hoods!



Safety Data Sheets

- Labels and SDS are the best source of chemical info.
- Internet and hard copy



Safety Data Sheets

A Safety Data Sheet (SDS) is the most basic source of information about a chemical. SDSs contain the following sections:

1. Identification

2. Hazards Identification

3. Composition/Ingredients

4. First Aid Measures

5. Fire Fighting Measures

6. Accidental Release Measures

7. Handling and Storage

8. Exposure Controls + Personal Protection

9. Physical and Chemical Properties

10. Stability and Reactivity

11. Toxicological Information

12. Ecological Information

13. Disposal Considerations

14. Transport Information

15. Regulatory Information

16. Other Information

How Do I Prevent Exposure?

- First and foremost – UNDERSTAND the chemical!
- Always wear PPE, and wear proper attire (we'll come back to this...)
- Follow SDS & SOPs
- Do not eat/drink in the lab
- Wash hands after handling chemicals and before leaving



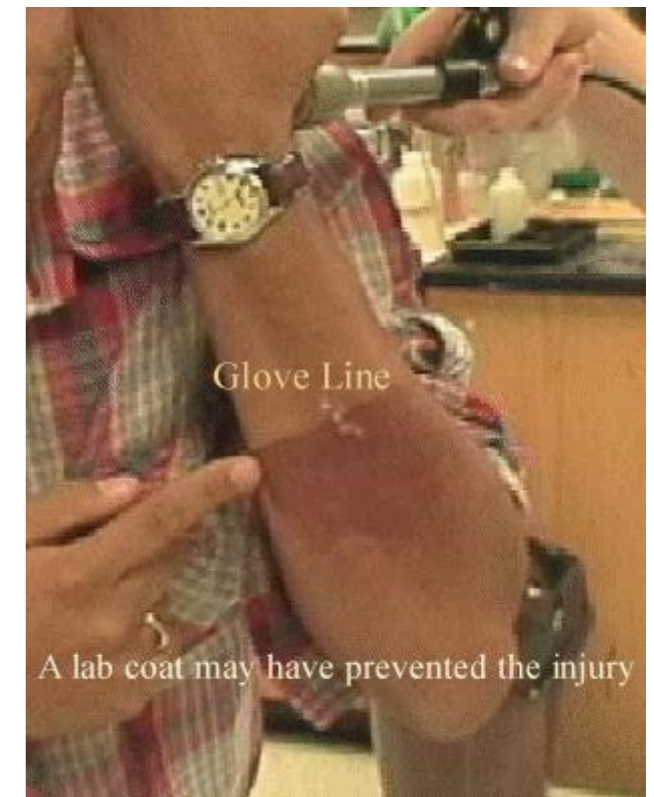
NOTICE

**AVOID
CONTAMINATION
WASH YOUR
HANDS**



Selecting Proper PPE

- Identify your hazards and select appropriate PPE – use SDS, Glove Guides, Distributors
- Use it properly - every time
- It is your **LAST** line of defense





abphoto.tumblr.com
Kristof Hegedüs

Glove Guide Sample

Material	Advantages	Intended use
Latex (natural rubber)	Good for <i>biological and water-based</i> materials. Poor for organic solvents.	Incidental contact
Nitrile	Good for solvents, <i>oils</i> , greases, and some acids and bases; and as an alternative for latex allergies.	Incidental contact
Butyl	Good for <i>ketones</i> and esters. Poor for gasoline and aliphatic, aromatic, and halogenated hydrocarbons	Extended contact
Neoprene	Good for acids, bases, alcohols, fuels, peroxides, hydrocarbons, and <i>phenols</i>	Extended contact
Norfoil	Good for most hazardous chemicals	Extended contact
Viton	Good for chlorinated and aromatic solvents. Poor for ketones.	Extended contact
Polyvinyl chloride (PVC)	Good for acids, bases, oils, fats, peroxides, and amines	Specific use
Polyvinyl alcohol (PVA)	Good for aromatic and chlorinated solvents. Poor for water-based solutions.	Specific use

Comparison of Eye Protection Options

*Safety Glasses With Vented
Side Shields* (Impact Only)



*Safety Glasses With
Nonvented Side Shields*
(Impact Only)



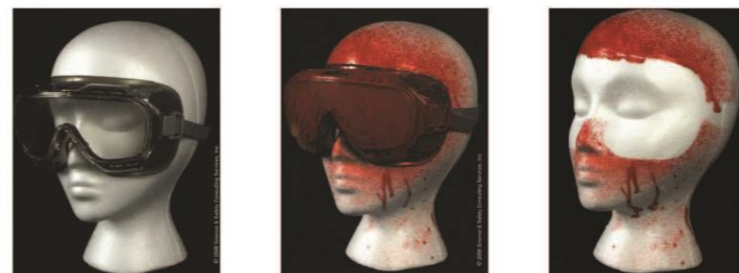
Visorgogs® (Impact Only)



Impact Safety Goggles
(Impact Only)



*Chemical Splash Safety
Goggles* (Impact and Splash Protection)



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Proper Lab Attire...



Option A?



Option B?

Which Clothing for Lower Body?

Choose one:



Which Clothing for Upper Body?



Which Eye Protection?

Choose one:



Which Hand Protection?



Which Foot Protection?

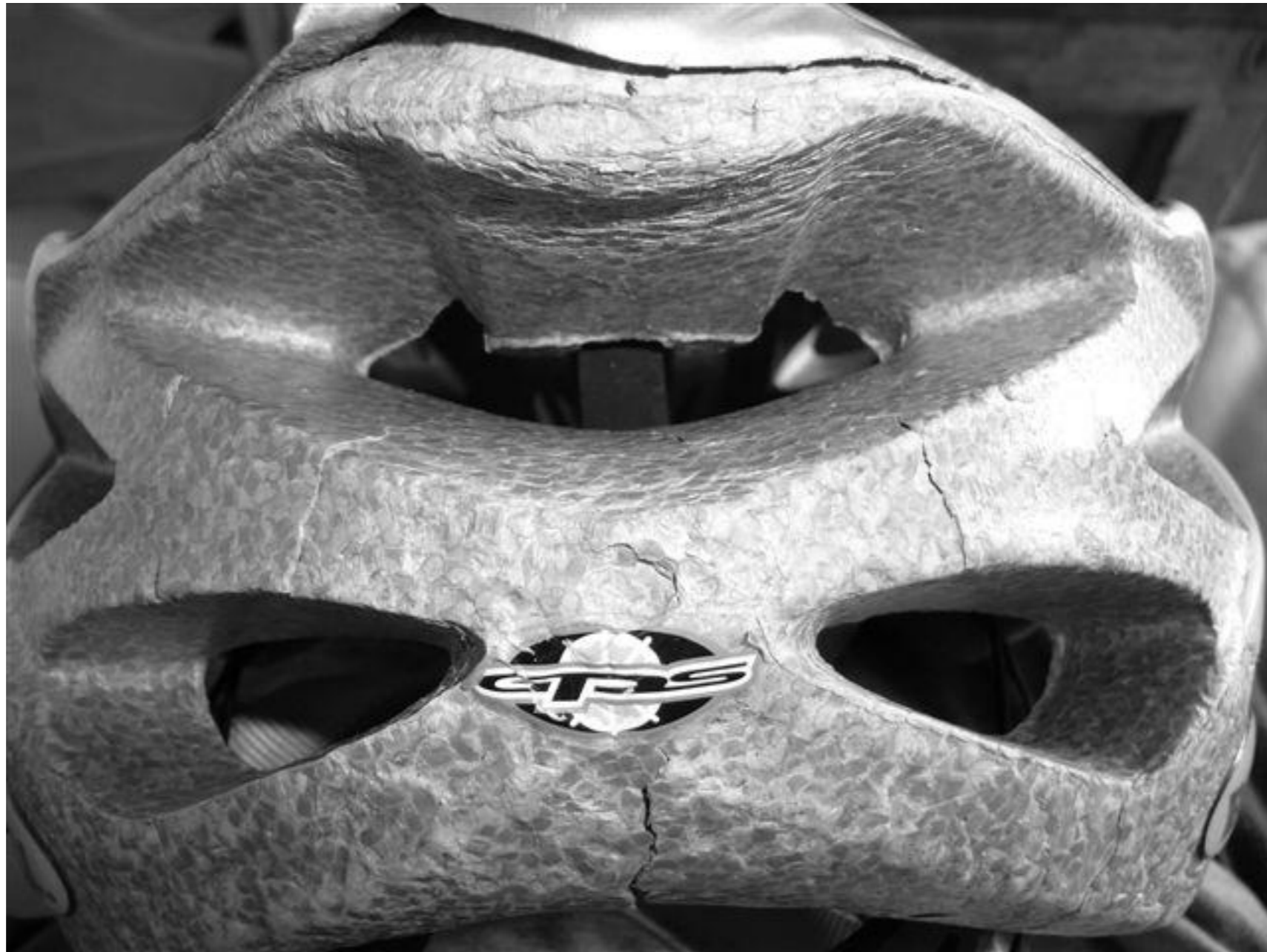
Choose one:



No Slippers, Please!



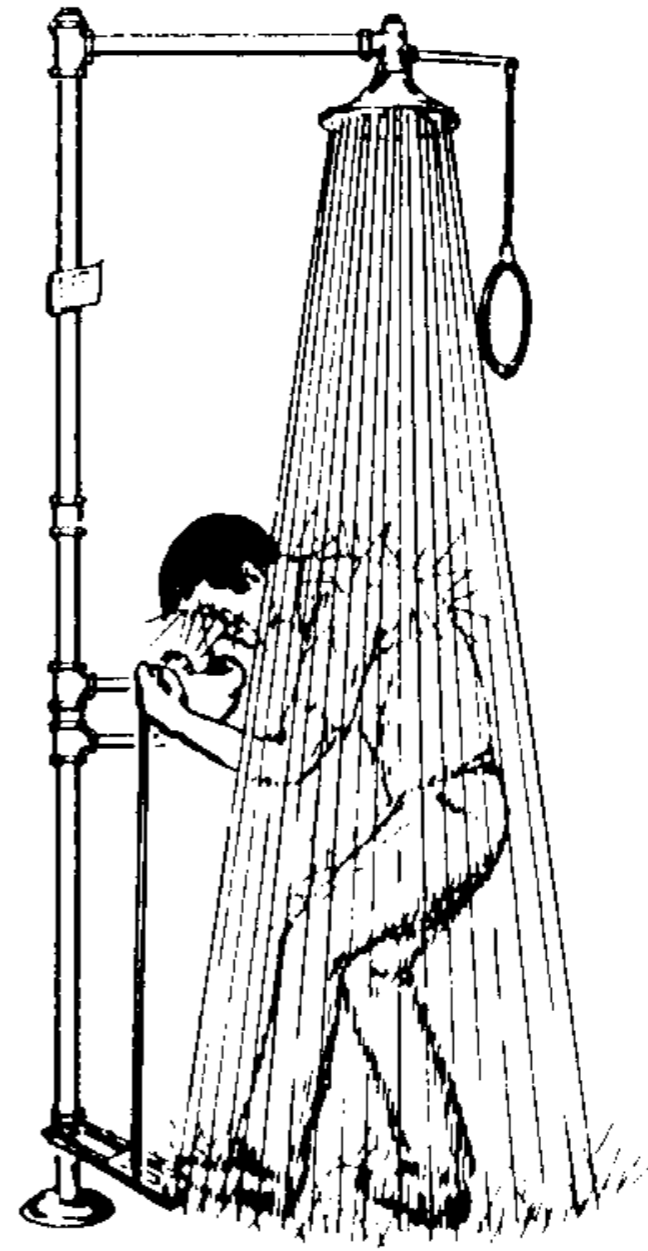
PPE - it works!





What If I Am Exposed?

- At Manoa -Call 66911 (or UH Guardian App) and get SDS!!!!!!
- Skin/Eyes: Flush with water (15 minutes)
- Inhalation: Move to fresh air
- Injection: Flush with water
- Ingestion: Poison Control Center



Injury Follow-Up

- Report any injury to the professor – no matter how small
- Fill out injury/illness form
 - UH Official [Forms](#) on UH EHSO Website
 - RCUH Employees – contact RCUH HR Office for forms

Video: Chemical Safety Board - After The Rainbow

<https://www.youtube.com/watch?v=g6vR0BdRCNY>



Other Lab Controls

Chemical Storage Controls

- Imperative to use best management
- Annual inventory of hazardous chemicals is required!
- Keep track of peroxide formers! Ethyl ether, THF, Dioxane, etc.
- Store in a cool & dry area with caps and lids tightly closed
- Look for replacement chemicals
- Segregate incompatibles

Chemical Storage Families

- Chemicals must be segregated by “family”
 - Flammables
 - Corrosives
 - Oxidizers
 - Low Reactivity Chemicals
 - Water Reactive and potentially Explosive Chemicals
 - Should be purchased and stored in smallest quantities possible
 - Check SDS, call EHSO or GOOGLE it, if in doubt!

Example of “Incompatible”



Acids and bases are incompatible with each other. Mixing the two could result in an aggressive reaction.

Clearly ID storage areas (flammables, acids, etc.) - this includes highly toxic areas

Flammables

(Alcohols, Acetone, Ethers)

Corrosives

(segregated by plastic containers by type & store below eye level)

Oxidizers

(Persulfates, Perchlorates, Halogens, Peroxides, Nitrates)

Low Reactivity Chemicals (Buffers, most weak acids/bases and salts)

Highly Toxic Area (Sodium azide, etc)

Pyrophoric and Explosive (Water & air reactive, etc)

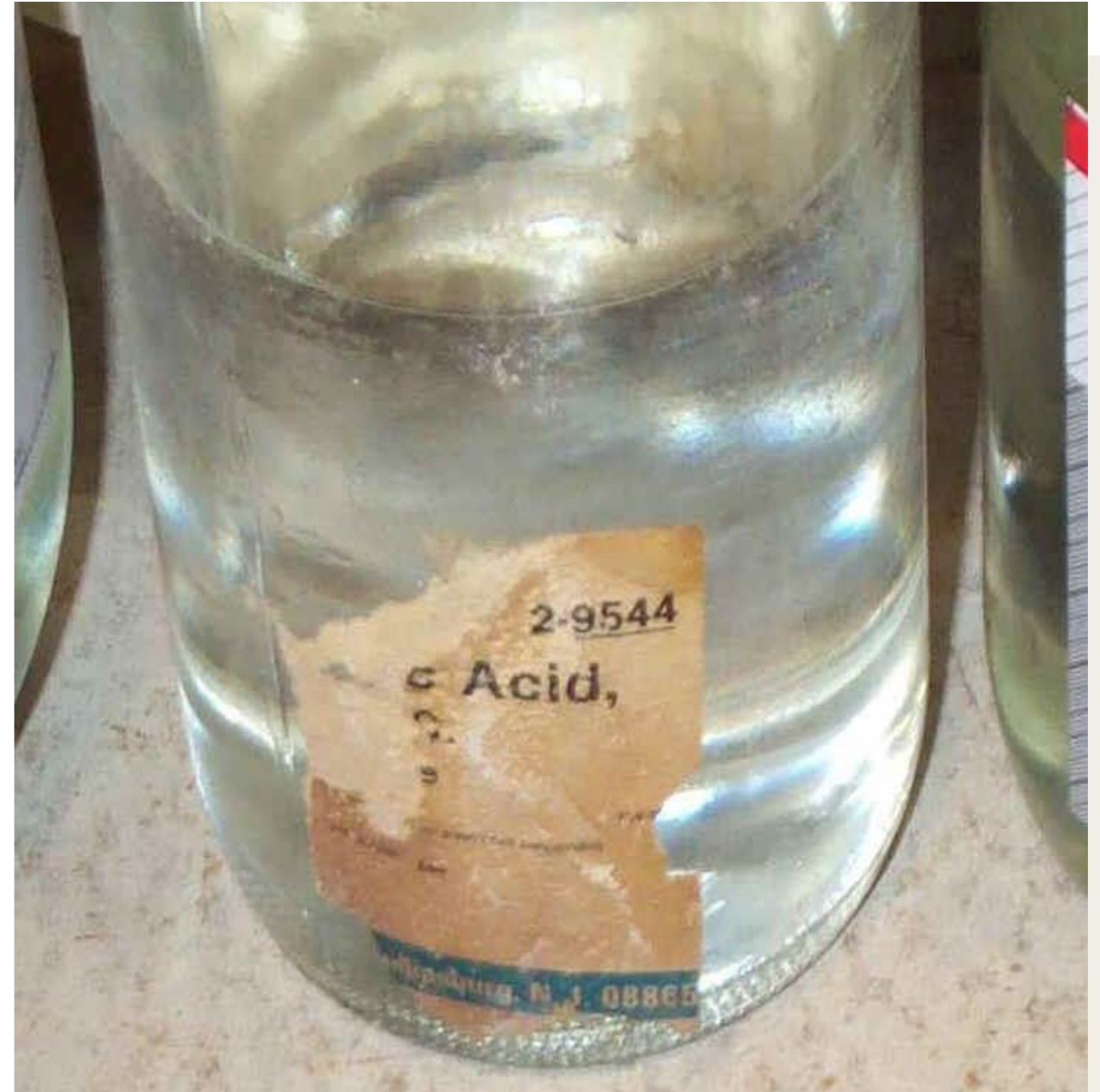
Chemical Storage Controls

- Ask yourself “Do I need to buy _____ in bulk?”
- Be careful about inheriting chemicals
- Housekeeping - a well organized lab leads to proper chemical management



Controls – Labels!

- ALL chemicals MUST be labeled
- Labels must be in good condition
- Hazard class identified (flammable, etc.)
- Transfer containers –
Chemical name and
Hazard Class





Flam Liquid Refrigerator

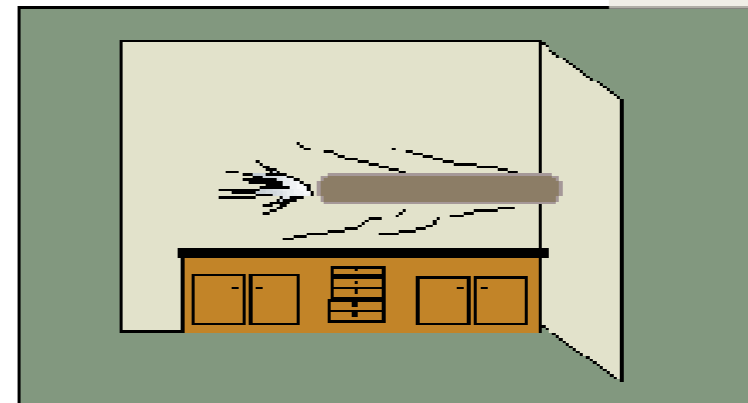
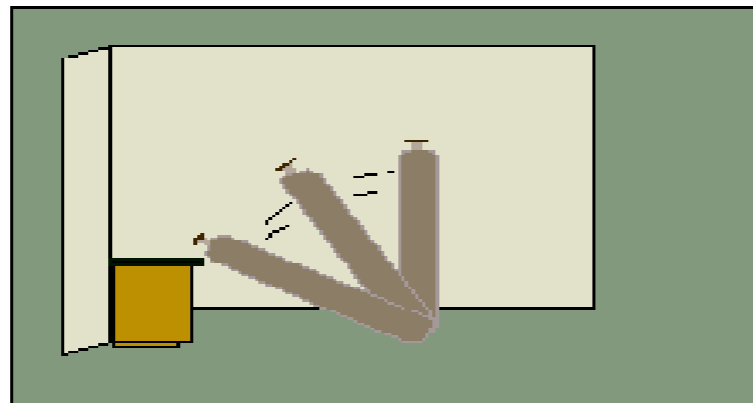
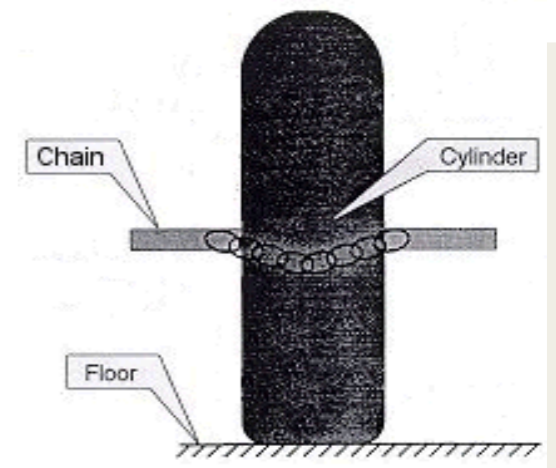


Effectiveness of a Flammable Liquid Storage Cabinet



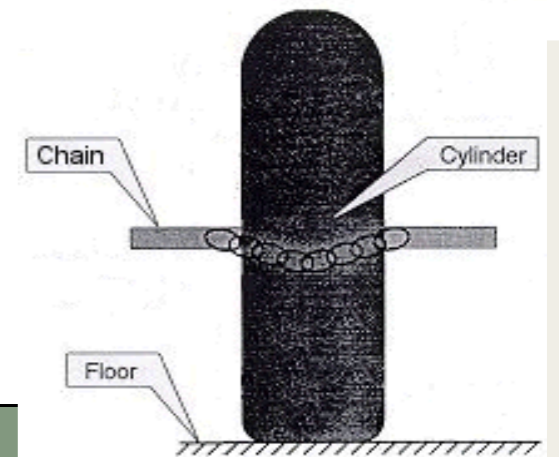
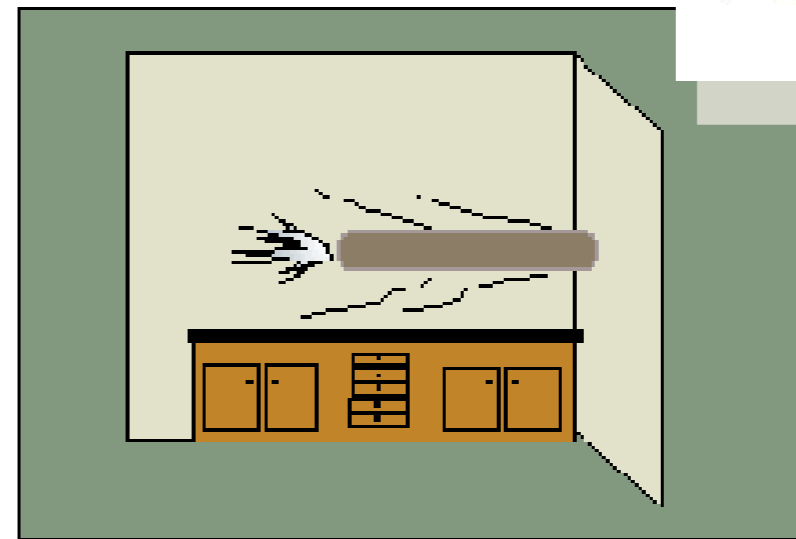
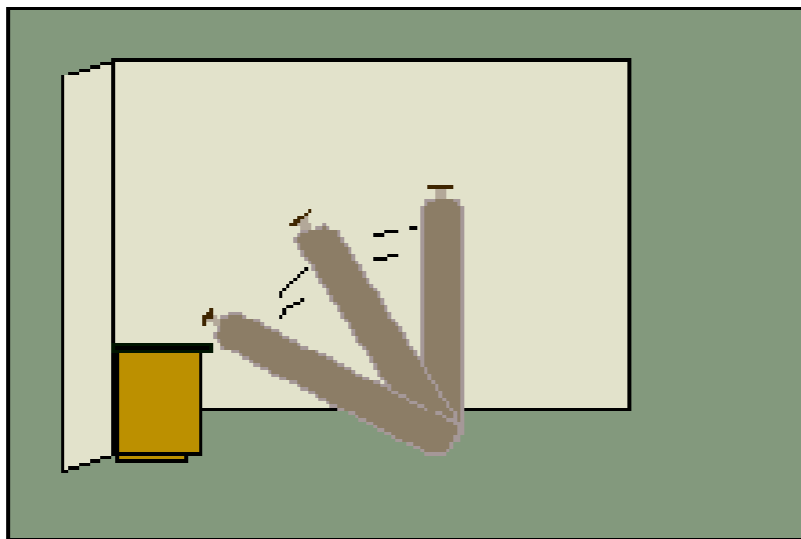
Compressed Gas Cylinders: “The Sleeping Giant”

- Have training and SOPs in place at the lab level for gases used!
- Must be secured at all times (at 2/3 height of the cylinder)
- Incompatible gases must be stored separately
- Keep caps on all GC not in use



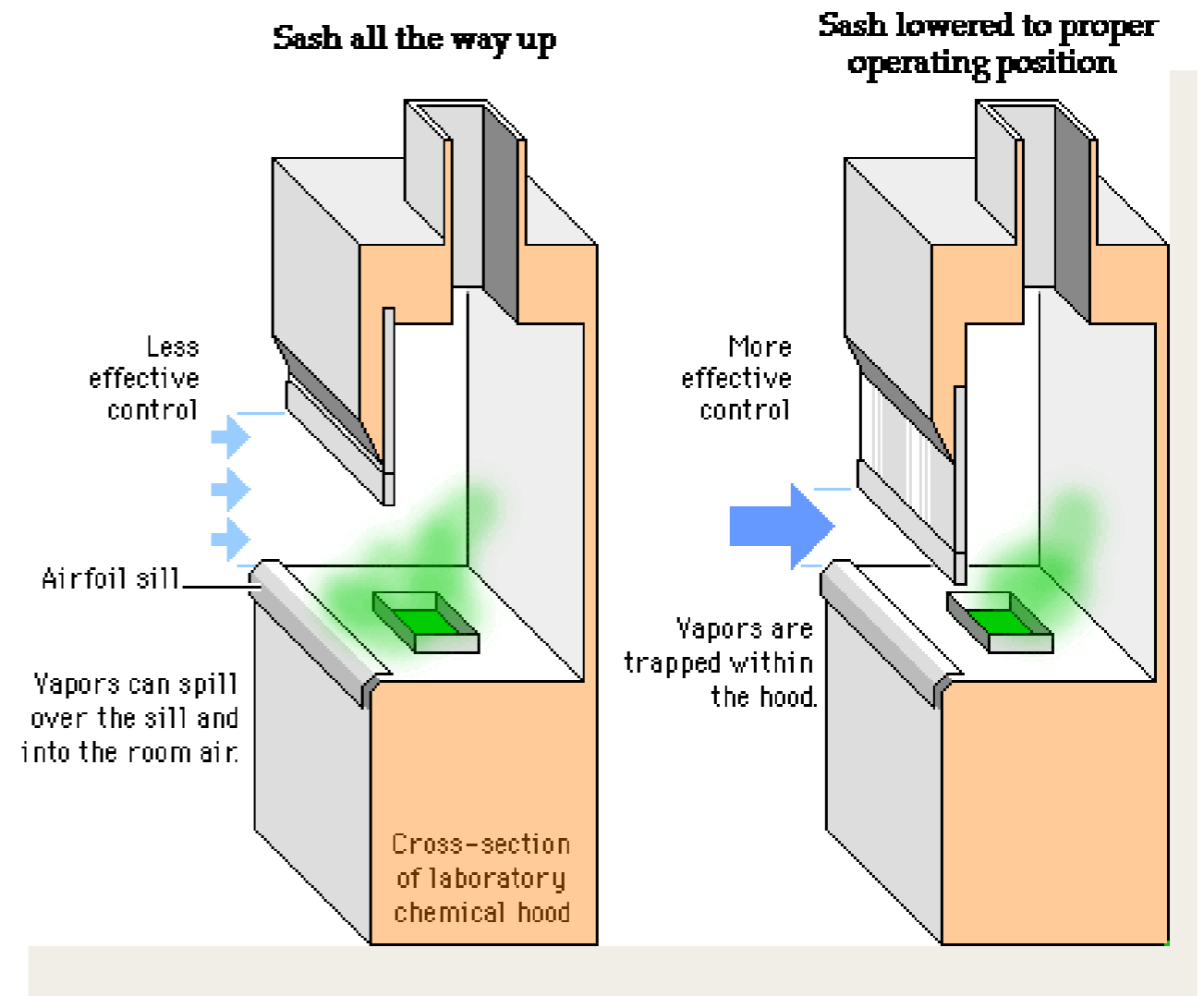
Compressed Gas Cylinders: General Hazards

- Can reduce oxygen in the air
- Can be flammable or increase fire hazard
- Can be poisonous
- Can be explosive/reactive



Chemical Fume Hoods

- Laboratory fume hoods
 - Work at least 6" inside hood
 - Elevate equip.
 - Use lowest sash height
 - Continuously monitor
 - Do not use if hood fan is not running



Hazardous Waste Management

- Imperative to properly manage hazardous waste – labeling and storage!
- Regulated by EPA (State DOH)
- Hazardous Materials Management Plan ([HMMP](#)) covers rules related to chemical/hazardous waste
- Must attend training in order to turn in waste!

- IF IN DOUBT - CALL US!

Objective: Compliance and Safety

- The “4 L’s” of Haz Waste Management
 - **Location:** Establish a “Waste Accumulation Area”
 - **Labels:** Provide complete waste labels
 - Full chemical names, relative percentages and the word “waste”
 - **Leak Prevention:** Provide secondary containment to prevent large spills and to segregate incompatibles
 - **Lids on Good Containers** Keep lids on good containers

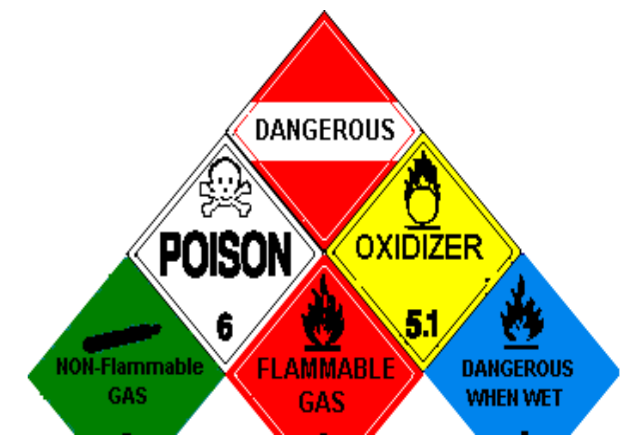
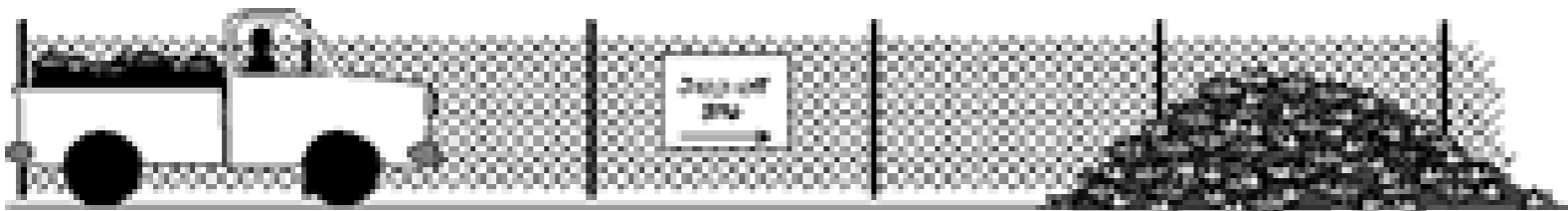


Haz Waste - Example



Note: Shipping Hazardous Materials !!!

- DOT requires training in order to ship subject materials If not in a UH Vehicle
- Records MUST be kept by the shipper for two years
- Contact Tim O'Callaghan, UH Hazardous Materials Management Officer @ 63198 or by e-mail ocallagh@hawaii.edu for more information









General Safety Precautions and Emergencies

General Safety and Emergency Preparedness

- Emergency notification /phone numbers (KEEP CURRENT!)
- Evacuation routes
- Fire Alarms
- Designated contact
- List and meeting area

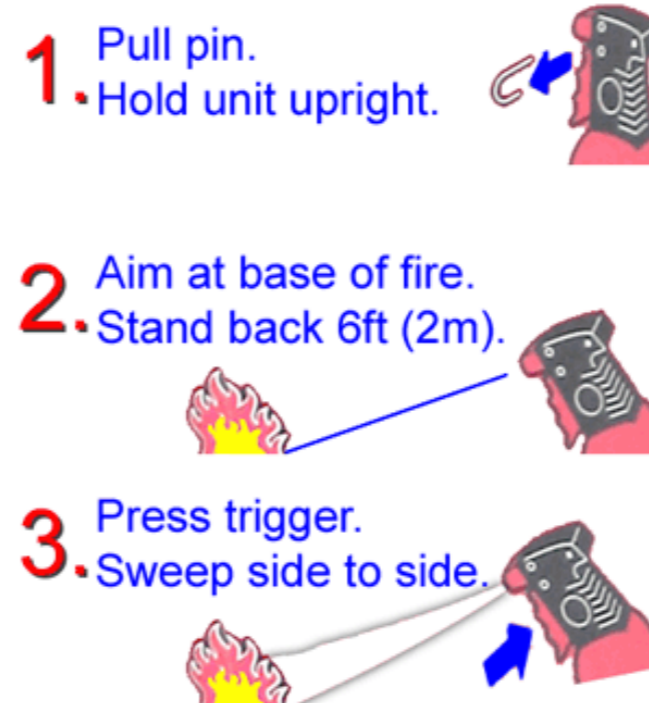


Lab Door and Bench Signs – Contact EHSO for New Sign!

LABORATORY HAZARD INFORMATION			
			
Hazard Information: Flammables, Corrosives, Toxics, Air & Water Reactives, Oxidizers			
EMERGENCY CONTACT INFORMATION	Contact (Location)	Office Phone	Alternate Phone
 UNIVERSITY of HAWAII MĀNOA	Call Department of Public Safety for all Emergencies at 956-6911		

Know Where to Find...

- Eyewash and Shower
- Fire Extinguisher
- Spill Kit
- First Aid Kit



Medical Monitoring

- You have the right to monitoring for possible exposures
- Right to medical surveillance and care
- Contact supervisor and UH EHSO



Near Miss

- All near misses must be reported to the supervisor and EHSO using this [form](#)
- Near misses give an opportunity to evaluate work and prevent incidents!

Chemical Spill Identification and Response



Video: Northwestern– Chemical Spill

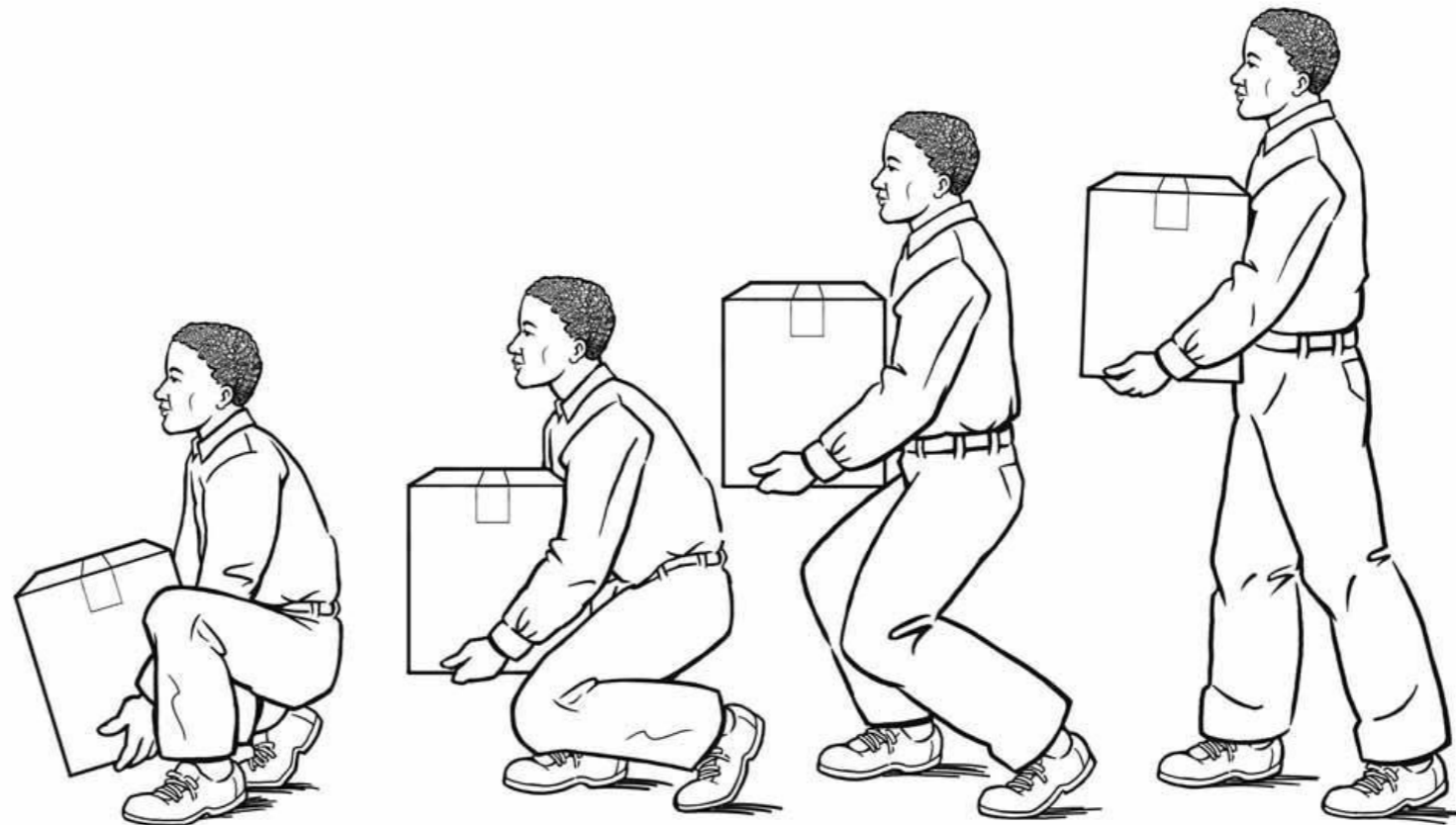
<https://www.youtube.com/watch?v=PxRXor36BXs>

Is This a Minor Spill?

- 4 Qualifications: What..., No Injuries, Not accessing the environment, Do I know how to deal with it
 - Notify supervisor and others
 - Don PPE
 - get kit, surround the spill with pads or absorbent, neutralize (if corrosive)
 - Place clean up items in a bag, contact EHSO and turn in spill clean up materials
- All other chemical spills are considered major!
 - Call for help! 66911
 - Evacuate the area

Lifting Safely

- Your work may require lifting heavy items
 - Back straight!
 - Knees bent!
 - Keep load close to your body
 - Don't twist
 - Use carts



Summary



I Should Always...

- Learn your chemical and physical hazards!
- Check glassware (star cracking, etc.)
- Take time during procedures
- Carefully manage chemicals
- Safely move chemicals between labs
- Check before I pour ____ down the sink*
- Keep walkways clear
- Wear PPE and eat/drink elsewhere

Call Anytime for Assistance!

UH EHSO

Chemical Hygiene Officer

2040 East-West Rd.

Phone: 956-5097 Fax: 956-3205

E-mail: labsafe@hawaii.edu

[UH Lab Safety Program](#)