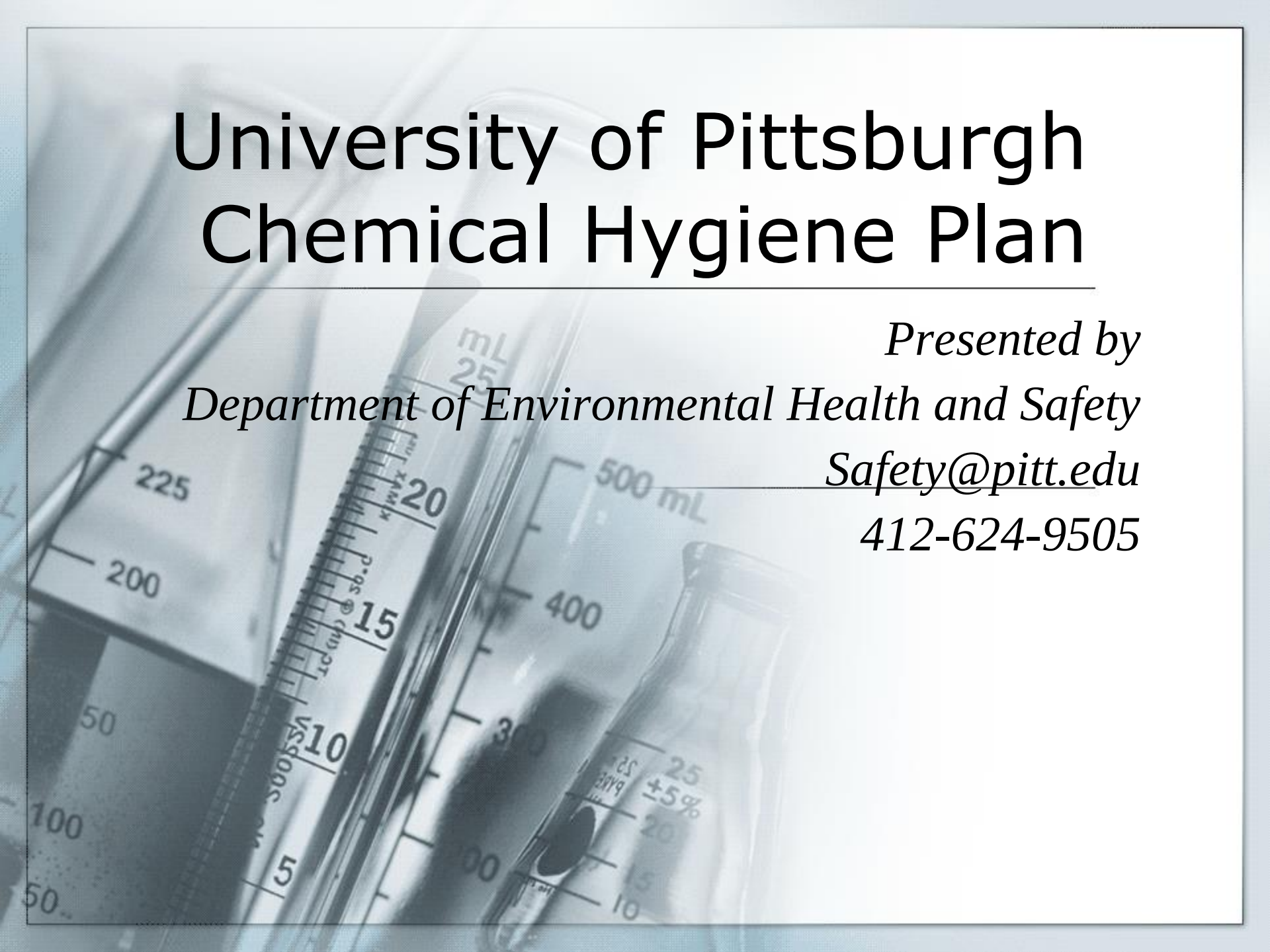
University of Pittsburgh Chemical Hygiene Plan



Presented by

Department of Environmental Health and Safety

Safety@pitt.edu

412-624-9505

At the end of this training, participants will be able to:

1. Identify the physical, health, and miscellaneous hazards of working in a laboratory.

2. List at least three methods that can be used to reduce exposures to chemicals.

3. Explain when to use emergency showers, eyewashes, campus emergency number, and where to go for emergency care.

4. Clean up a small spill in the laboratory and properly dispose of chemicals through the University chemical waste disposal program.

5. Describe the various ways to locate a Safety Data Sheet (SDS) and how to interpret proper chemical labeling.

OSHA Laboratory Standard Requirements

- Written Chemical Hygiene Plan
- Identify health and safety hazards in laboratories
- Train laboratory workers on hazard avoidance
- Monitor employees exposures to chemicals to ensure controls are working
- Explain how to access medical evaluations and what to do for medical emergencies
- Provide personal protective equipment (PPE)
- Comply with recordkeeping requirements

Laboratory Supervisor Responsibilities

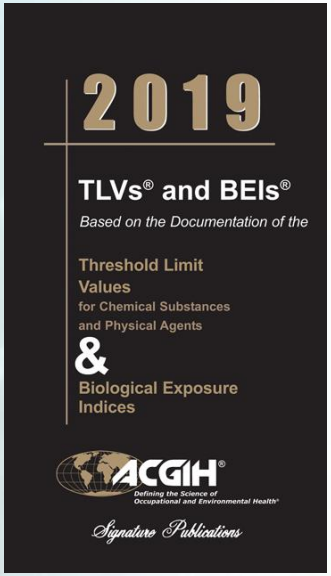
- Implement Chemical Hygiene Plan (CHP)
- Identify hazardous chemicals used
- Provide employee access to SDS
- Maintain chemical inventories
- Ensure engineering controls are in place and working
- Have proper PPE available –enforce use
- Supervise non-standard procedures
- Arrange employee training and medical exams
- Perform in house lab inspections
- Report spills/exposure incidents

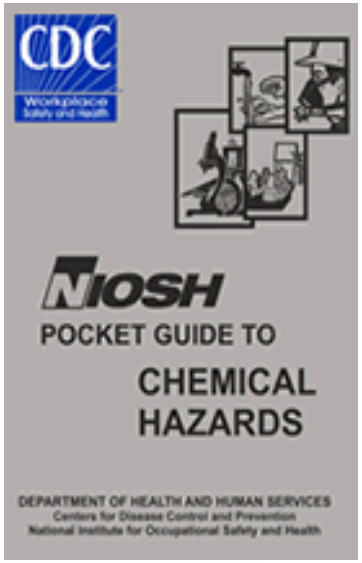
Laboratory Workers Responsibilities

- Attend training sessions
- Consult with supervisor before starting non-standard procedures
- Understand the use, function and limitations of PPE
- Use safety devices and engineering controls
- Read SDS for chemicals
- Report spills, emergency situations, accidents and injuries
- Be active in lab inspections, training, and CHP implementation
- Be aware of proper chemical waste handling procedures
- Develop good personal chemical hygiene habits

Laboratory Chemicals

- There are more than 350,000 chemical compounds
- Only 6000 or so have known health effects
- 800 or less of the 6000 have established exposure limits
  - OSHA
  - NIOSH
  - ACGIH





Chemical Accident Facts

- 10,000 laboratory accidents were reported in 2005
- 2 out of 100 injured researchers had OSHA recordable accidents
  - More than simple first aid
- Half of the accidents resulted in days away from work or restricted work.
- Accidents can happen suddenly or can take years to show their effects.

Source: Professional Safety January 2008, Investigating Laboratory Accidents By Kevin Coghlan

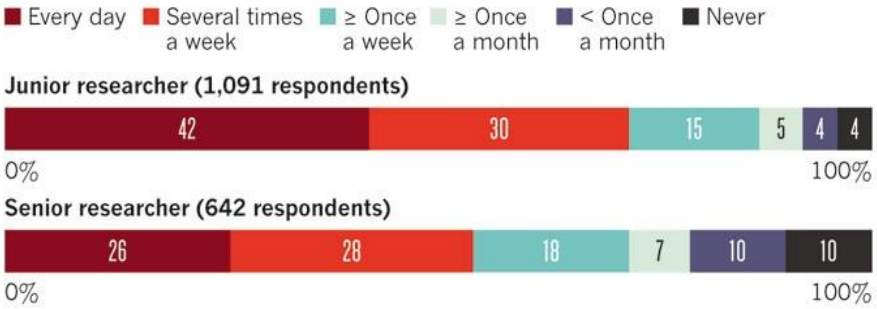
2012 "Nature" Survey of Lab Risks

A QUESTION OF SAFETY

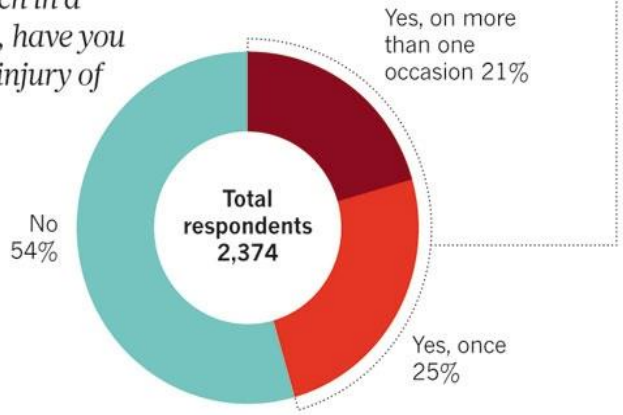
A survey of almost 2,400 scientists shows that although most believe their laboratories to be safe, about half have experienced injuries in the workplace. It also shows that junior and senior researchers have very different views of potentially hazardous practices.

1 *To what extent do you agree or disagree with the following statement? "I feel that my lab is a safe place to work."*

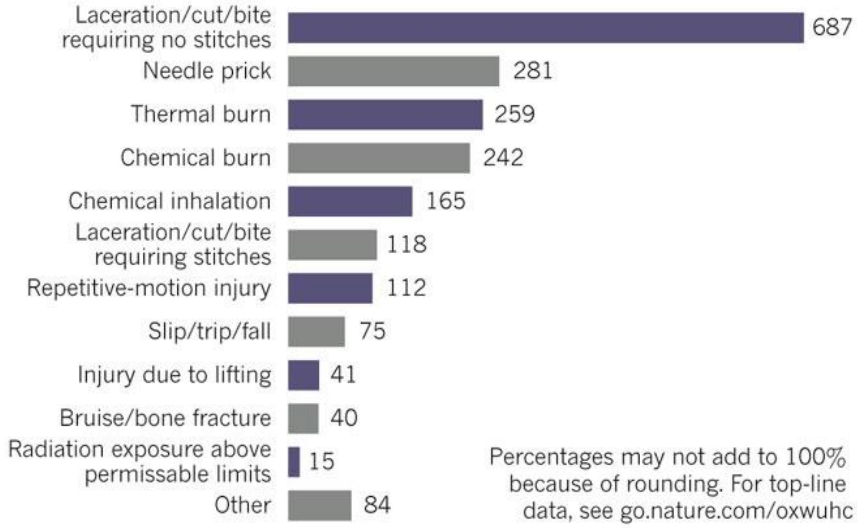
2 *In your lab, how frequently do people conduct experiments while working alone?*



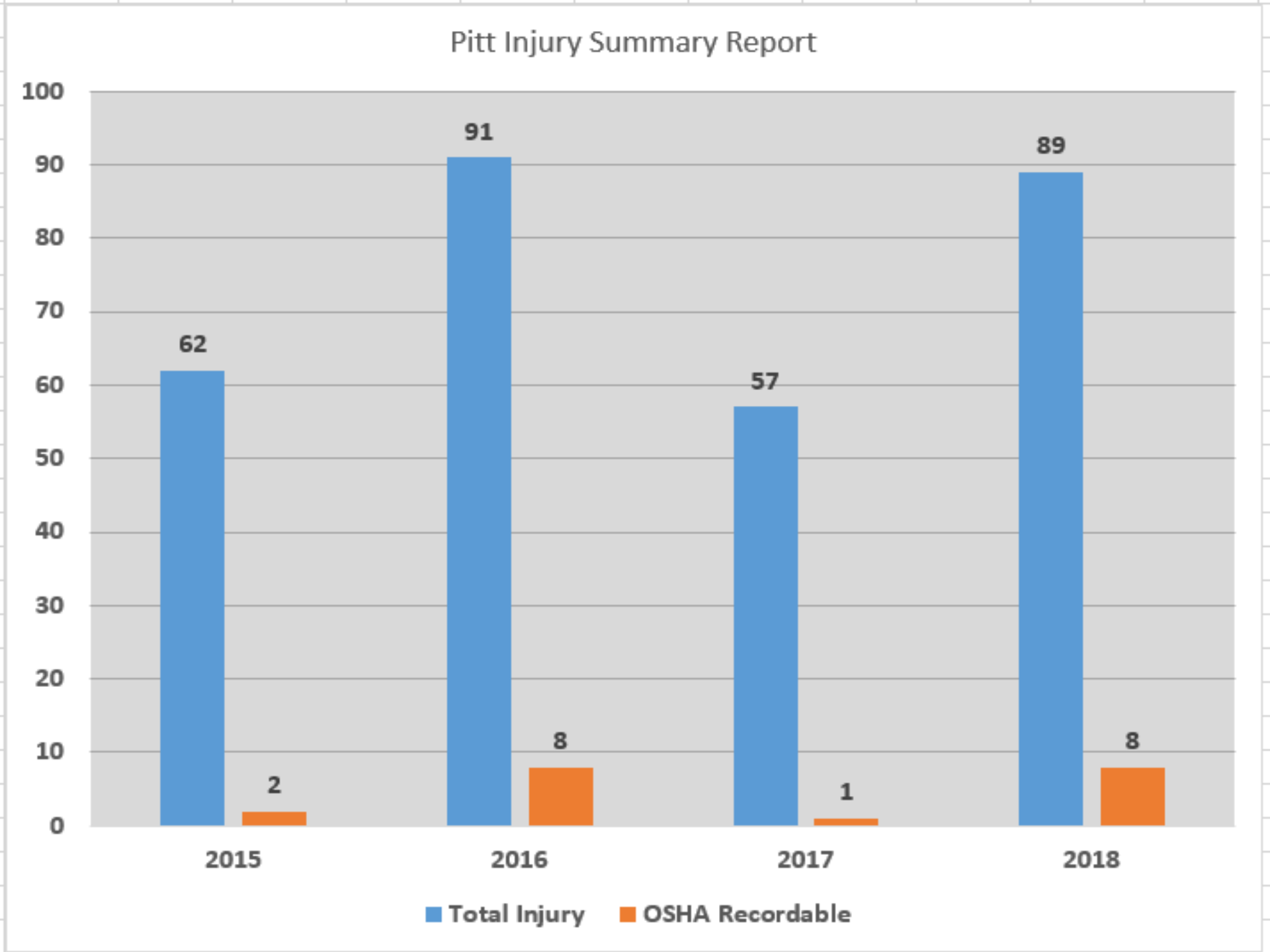
3 *In the time that you've been conducting research in a laboratory setting, have you ever sustained an injury of any kind?*



4 *What was the nature of your injury or injuries?*



Percentages may not add to 100% because of rounding. For top-line data, see go.nature.com/oxwuhc


Pitt Injury Summary Report
100
90
80
70
60
50
40
30
20
10
0
62
2
91
8
57
1
89
8
2015
2016
2017
2018
Total Injury
OSHA Recordable

Accidents - Outside of Pitt

Solvent storage cabinet collapses at OSU

http://pubs.acs.org/cen/news/83/i21/8321ohio.html

Original shelves had been replaced by “unstable” shelves from a different vendor.

Schools have a 10 to 50 times greater frequency of accidents than the chemical industry, lab safety expert James A. Kaufman says. "It's 100 to 500 times greater than in places like Dow and DuPont"

UCAL Fatality

- 2008 – Sheharbano "Sheri" Sangji research assistant at UCLA
- Plastic syringe came apart exposing t-butyl lithium (pyrophoric) to air
- 18 days later she died of serious burns at 23 years old
- Cal OSHA Inadequate training
- Criminal charges against UCL and PI
- UCLA Settled in 2012 agreed to comprehensive correction safety measures and established a scholarship

UCLA

- PI charged with 4 felony counts of willfully violating state OSHA standards faced up to 4 ½ years in prison
- 2014 PI strikes deal with prosecutors
- Pays $10,000 to the Grossman Burn Center and perform 800 hours of community service

Recent University of Pittsburgh Accident History

- Researcher opening a bottle of trifloroacetic acid with a stuck cap. Pulling the bottle close to her body for more leverage the cap suddenly became undone causing TFA to splash from the bottle onto her face arm and hand causing 2nd and 3rd degree burns.
- Researcher poured water reactive acetyl chloride into lab sink; resulting HCl gas forced evacuation of lab.
- Student startled by reaction throws scoupla w sodium into sink; reaction starts acetone fire, suffered 3rd degree burn to leg.
- A postdoc performing a reaction involving mercury perchlorate improperly upsized the experiment causing a powerful explosion shattering the flask, stir rod, lab jack and hood sash. He suffered an eye laceration and multiple shrapnel wounds. He was wearing eye protection.

Injuries from the Chemical Exposure

- Researcher suffered trifloroacetic acid burns to the face and arm
- Photos provided by the researcher showing the initial affects of the injury at Day 2 and the healing process at Day 30

Day 2

Day 30

Safety Data Sheet

- Primary source of information on physical and health hazards of the chemical.
- Proper storage and handling of the chemical.
- Personal Protective Equipment (PPE) to provide protection from the chemical.
- Can be found though your chemical supplier, department, supervisor, or on the internet.
- 16 sections compose a complete SDS (Formaldehyde Example)

Finding Safety Data Sheet

- SDS Binder in Lab on shelf or in files
- Link to Fisher, Sigma-Aldrich, and others from www.ehs.pitt.edu
- Contact chemical manufacturer directly
- Call EH&S office if you are still having problems locating SDS

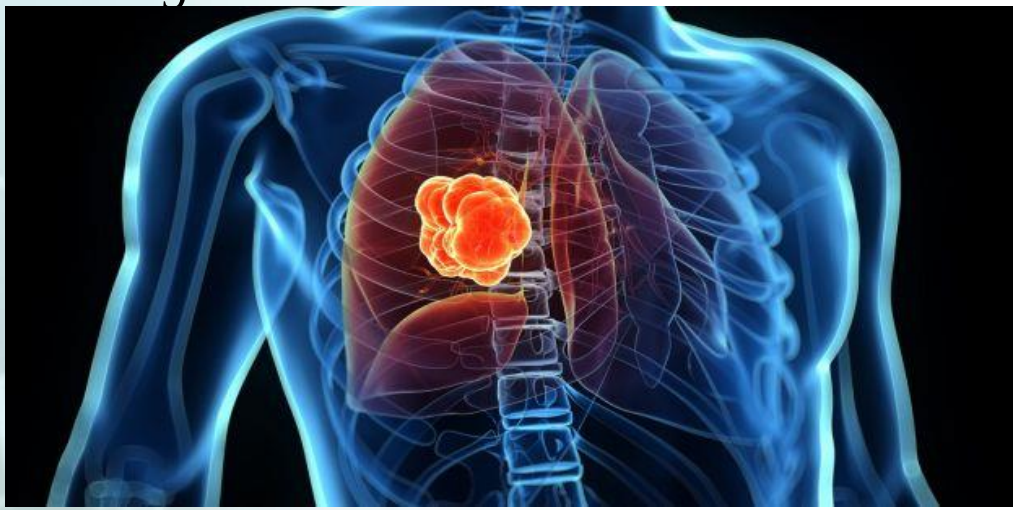
Physical Hazards of Chemicals

Fires or flying objects can result from the following characteristics of certain chemicals:

- Flammable
- Combustible
- Explosive
- Pyrophoric
- Uncontrolled Increase or Decrease in Pressure
- Water Reactive

Health Hazards

- Carcinogen
  - Internal Agency for Research on Caner
  - Since 1971, more than 900 agents have been evaluated, of which more than 400 have been identified as *carcinogenic*, *probably carcinogenic*, or *possibly carcinogenic* to humans.
- Irritant
- Corrosive to skin
- Toxic
- Organ specific Hazards
- Radioactive
- Reproductive effects
  - Teratogens cause birth defects in pregnant women
  - Mutagens alter eggs or sperm DNA long before fertilization



Organ Specific Health Hazards

- Hepatotoxins - Produce Liver Damage
  - Carbon tetrachloride; nitrosamines
- Nephrotoxins – Produce Kidney Damage
  - Halogenated hydrocarbons: Uranium
- Neurotoxins - Effect Nervous System
  - Mercury; Carbon disulfide
- Hematopoietic system - Act on blood, Decrease hemoglobin function
  - Carbon monoxide; Cyanides
- Pulmonary Tissue – Lung Function
  - Silica, Asbestos

Signs and Symptoms of Exposure

- Can be different for every chemical
- Can be acute or chronic
- Symptoms can be headache, rash, nausea, coughing, tearing, irritation or redness of the eyes, irritation of the nose or throat, dizziness, loss of neuromuscular control and others.
- Pay attention to what your body is telling you.
- Read SDS for more information on the specific chemical you are using

Miscellaneous Hazards

- Chemical splash or reactions should be anticipated
- Burns from heat or intense cold are frequent.
- Electrical shock can kill lab workers
- Slips, trips and falls are most common

Chemical Labels

- Common product identifier and chemical signal word
- GHS Compliant pictogram
- Hazard warning/precaution statement
- Name, address and phone number of manufacturer or responsible party
- Date received or made

The Basic Parts of A GHS-Compliant Label

1

n-Propyl Alcohol

UN No. 1274

CAS No. 71-23-8

2

DANGER

3

Highly flammable liquid and vapor. Causes serious eye damage.
May cause drowsiness and dizziness.

4

Keep away from heat/sparks/open flames/hot surfaces. No smoking. Avoid breathing fumes/mist/vapours/spray. Wear protective gloves/protective clothing/eye protection/face protection. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present. Continue rinsing.

6

Fill Weight: 18.65 lbs.
Gross Weight: 20 lbs.
Expiration Date: 6/21/2020

Lot Number: B56754434
Fill Date: 6/21/2013

See SDS for further information.

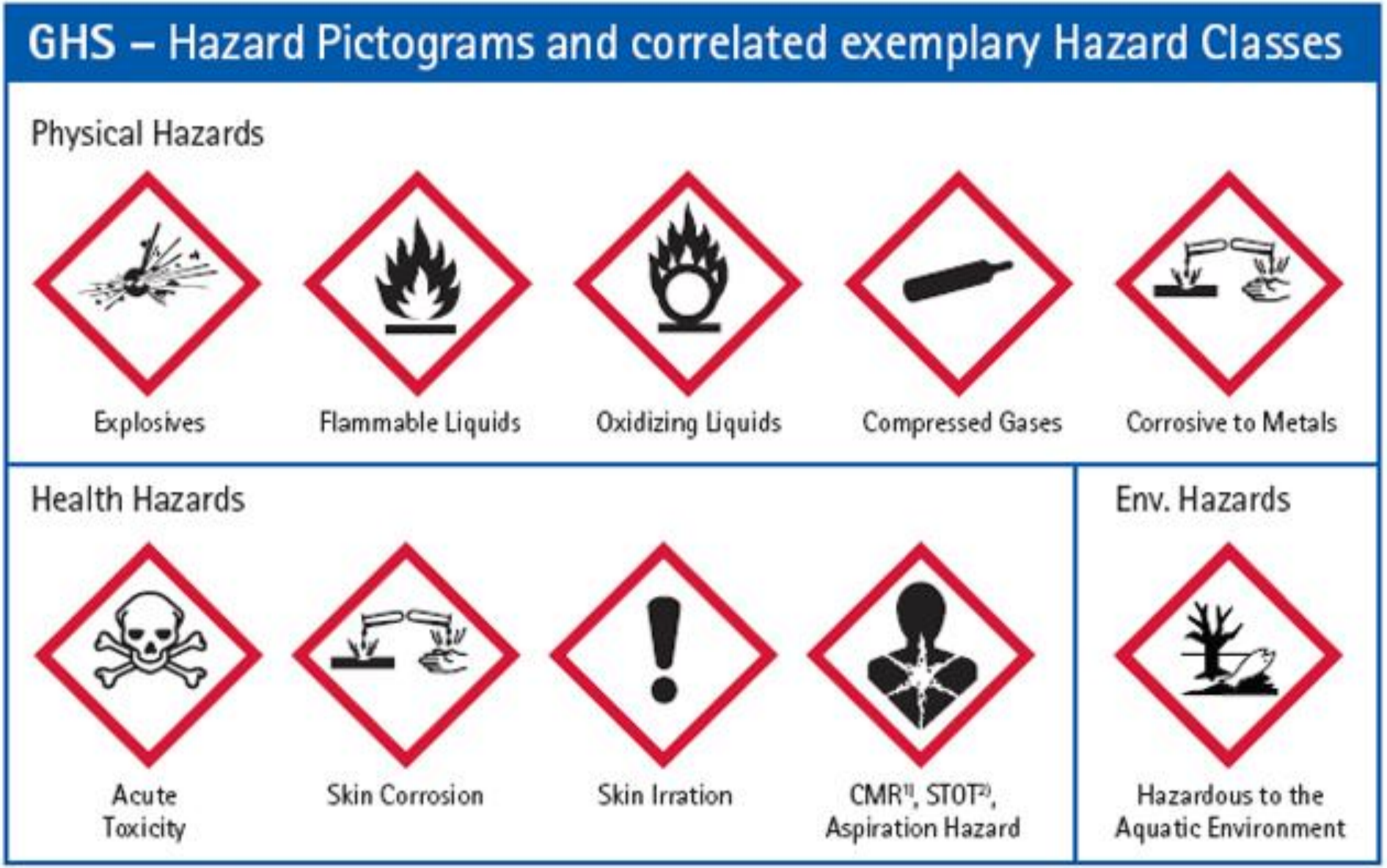
5

Acme Chemical Company • 711 Roadrunner St. • Chicago, IL 60601 USA • www.acmechem.com • 123-444-5567

1. **Product Identifier** - Should match the product identifier on the Safety Data Sheet.
2. **Signal Word** - Either use "Danger" (severe) or "Warning" (less severe)
3. **Hazard Statements** - A phrase assigned to a hazard class that describes the nature of the product's hazards
4. **Precautionary Statements** - Describes recommended measures to minimize or prevent adverse effects resulting from exposure.
5. **Supplier Identification** - The name, address and telephone number of the manufacturer or supplier.
6. **Pictograms** - Graphical symbols intended to convey specific hazard information visually.

Sample label courtesy of Weber Packaging Solutions • www.weberpackaging.com

New Globally Harmonized System



Chemical Storage

- Do not store incompatible chemicals next to each other
- Separate into compatible groups
  - Alphabetical order acceptable once in compatible groups
- Do not store liquids above eye level
- Do not store chemicals on the floor or on high shelves
- Carcinogens and highly toxic chemicals should be stored in a locked cabinet
- Liquid chemicals should be in secondary containment when stored in refrigerator

Flammable Liquid Storage

This incident happened at U of Maryland when ethanol stored inside a non-explosion-proof refrigerator leaked, evaporated and was ignited by a spark from the thermostat, light or fan motor.

The unit was blown apart, the door flew out the window and landed in the parking lot. Luckily, in this incident, no one was injured and damage was minimal. Other similar incidents have injured researchers, started fires and destroyed labs.

http://www.ehs.pitt.edu/assets/docs/04025CompChemStor.pdf

COMPATIBLE CHEMICAL STORAGE GROUPS

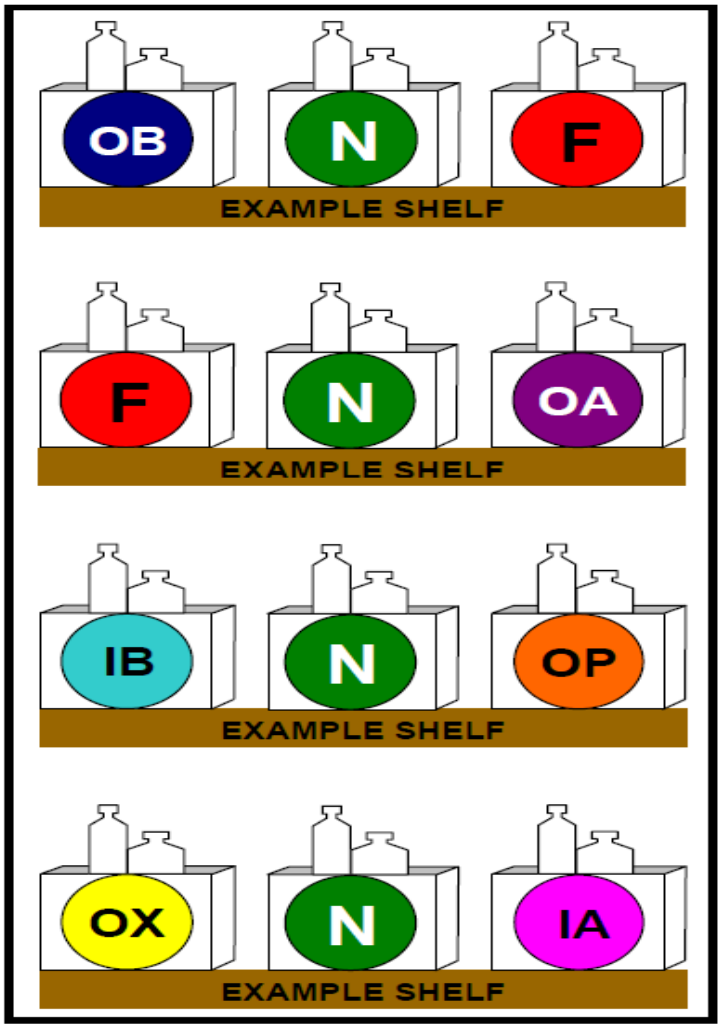
Laboratory chemicals should be stored in groups that prevent potential co-mingling of incompatible materials. Incompatible chemicals should ideally be stored in separate cabinets. Chemicals may be stored in the same cabinet only if placed in compatible storage groups. The use of secondary containment bins as shown is required to minimize the possibility for incompatible materials to mix when being stored in the same cabinet.

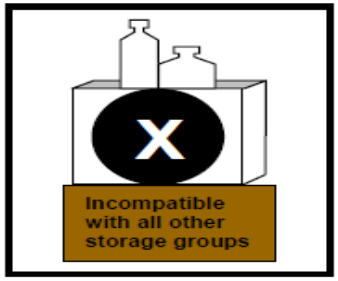
Specific storage recommendations and compatibility information on each chemical can be found on the manufacturer's label and/or SDS (Safety Data Sheet). These information sources should be consulted in conjunction with the use of this storage system.

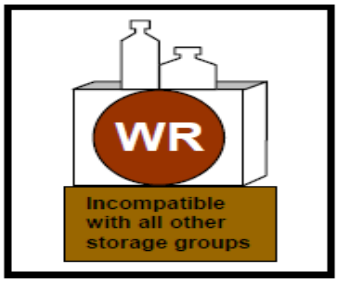
Compatible Chemical Groupings

F.	Non-Reactive Flammables and Combustibles (including solvents) (Alcohols, Xylene, Acetone)
HR.	Highly Reactive/Unstable Materials (Picric Acid, Azobisisobutyronitrile)
IA.	Inorganic Acids (Sulfuric Acid, Nitric Acid)
IB.	Inorganic Bases (Sodium Hydroxide, Ammonium Hydroxide)
N.	Not Intrinsically Reactive, Flammable, or Combustible (Sodium Chloride, Buffer Solutions)
OA.	Organic Acids (Acetic Acid, Formic Acid)
OB.	Organic Bases (Triethylamine, Diethanolamine)
OP.	Organic Peroxides (Benzoyl Peroxide, Chloroperoxybenzoic Acid)
OX.	Compatible Oxidizers and Peroxides (Nitrates, Permanganates, Inorganic Peroxides)
TG.	Toxic Compressed Gases (Carbon Monoxide, Hydrogen Sulfide)
WR.	Water-Reactive/Pyrophoric Materials (Sodium Metal, Potassium Metal, Zinc Dust)
X.	Incompatible with ALL other storage groups

For storage groups HR, TG, and X, contact EH&S at 412-624-9505 for additional safety measures and recommendations.



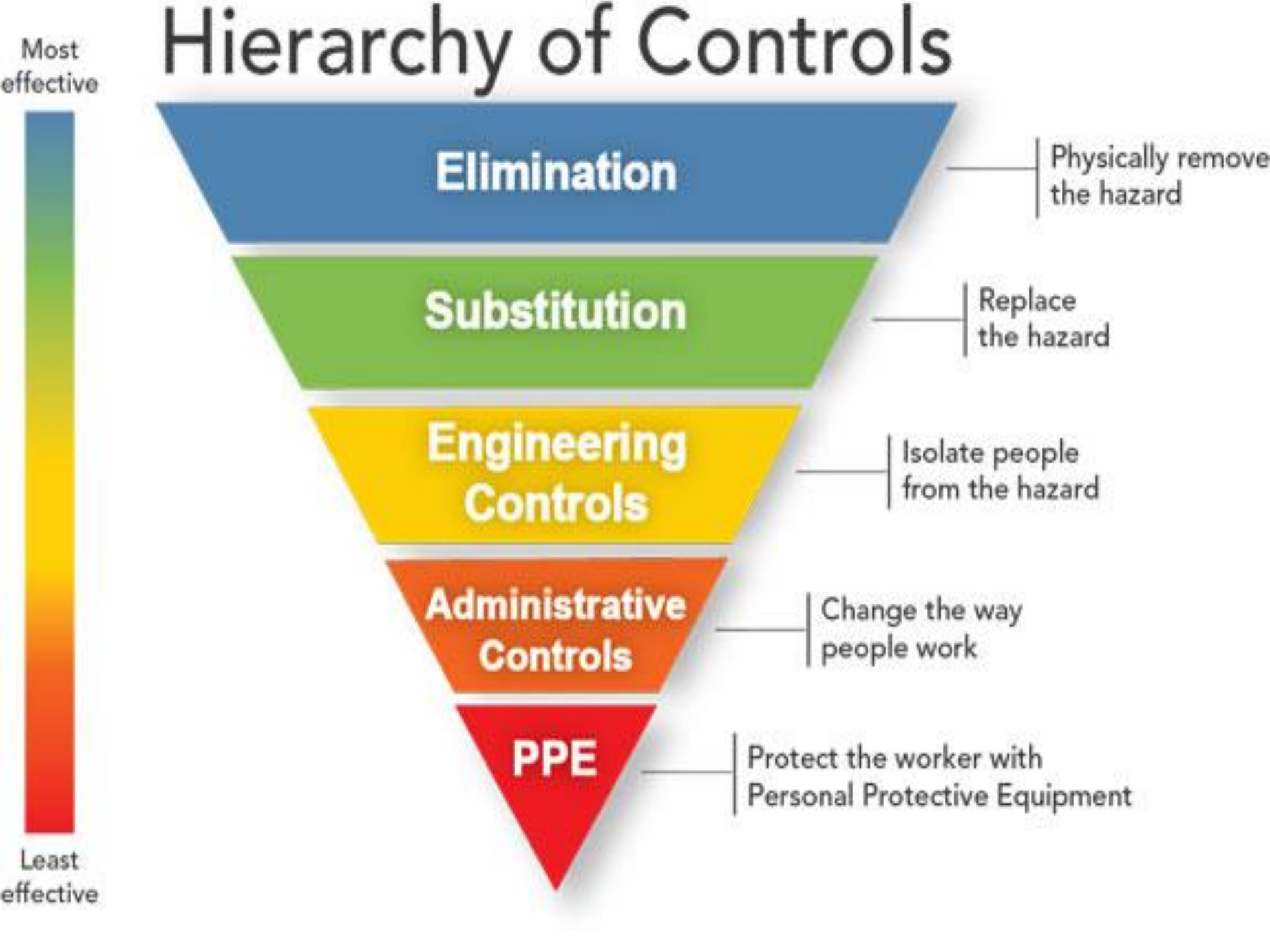




Compressed Gas Cylinders

- Store in compatible groups
- Keep cap on securely when storing or moving
- Use hand truck for cylinders to move
- Use strap, chain, or stands for storage

Hierarchy of Controls



Methods of Exposure Control

Engineering Controls

- Chemical Fume Hoods
- Special Ventilation

Work Practice Controls

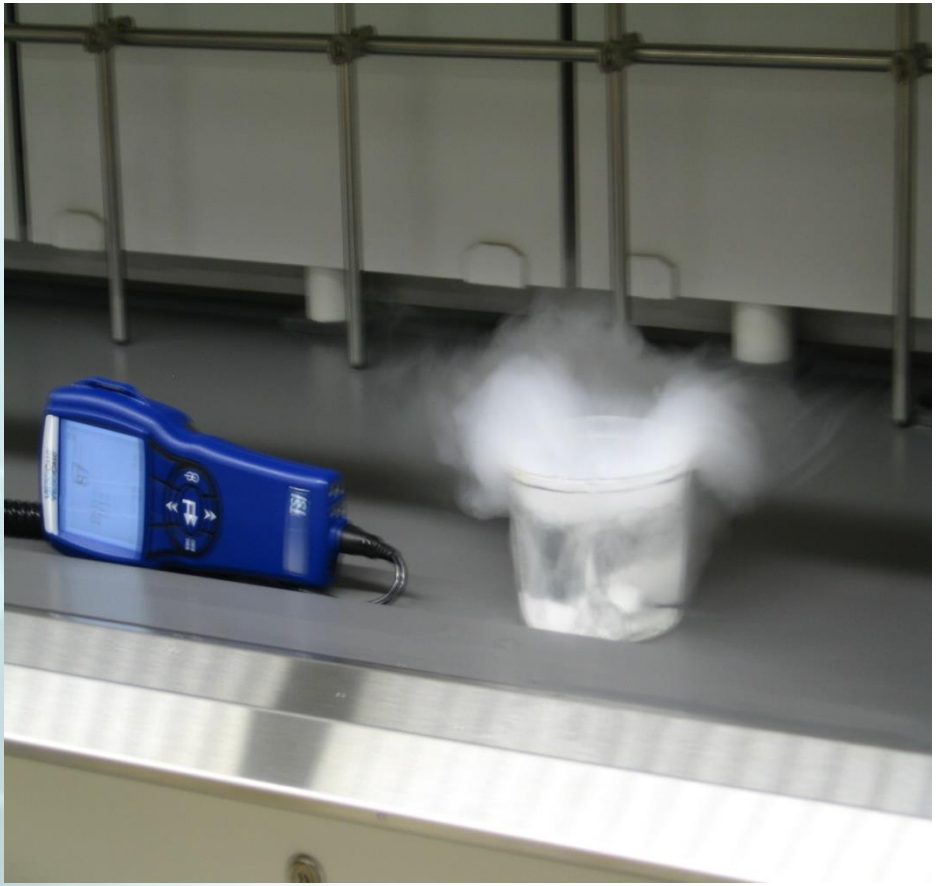
- Follow SOP's
- Minimize use
- Substitute for less hazardous

Personal Protective Equipment

Researcher Training

Chemical Fume Hoods

- Protect you from hazards
  - Airborne chemicals
  - Splashes
  - Flying debris
  - Small fires or explosions
- Lower sash when using
- Keep hood free of clutter
- Not for chemical storage



Chemical Fume Hoods

- Several types across campus
  - Constant Air Volume (CAV)
  - Variable Air Volume (VAV)
  - Low Airflow
- Certified annually by EHS
- Building exhaust

Hood Monitor

- Safety feature on most hoods
- Alerts when low airflow
  - Audible/visual alarm
- When in alarm lower sash suspend work
- Contact Facilities Management

Standard Operating Procedures (SOP)

- Written documentation for carrying out specific operations
- Departments and labs must develop for specific operations
- EH&S develops general SOP's or guidelines for common laboratory tasks
- SOP's are required by the OSHA laboratory standard

Selection of PPE

- Lab coats or aprons and gloves should be worn when working with corrosive chemicals and other skin absorbed toxins.

- Use eye protection at all times suitable for splash hazard (glasses, goggles, face shield as needed).

- Gloves must be resistant to chemicals being used.

This is Jeremiah. Jeremiah wore safety goggles while angle grinding. Jeremiah still has his right eye. Be like Jeremiah.

How not to dress for lunch!

Don’t spread contamination

Leave protective equipment in the lab

Special laundering of PPE may be required

Permissible Exposure Limits (PEL)

PEL's OSHA set as a "safe" airborne level

- 8-hour Time Weighted Average (TWA)
- 15 minute Short Term Exposure Limit (STEL)
- Action Level

- Other organizations (ACGIH & NIOSH) have additional exposure limits
- Additional control measures are needed if PEL's are exceeded.

Exposure Monitoring

- EH&S is available to provide monitoring
- Data may be used to establish controls
- Check function of controls
- Notify of results within 15 days

Emergency Equipment

- Know the location of eyewash and emergency shower
- Be able to operate with eyes closed
- Irrigate for 15 minutes
- Test eyewash weekly

Accidents and Injuries -
Report all Injuries to Supervisor

- **Medical Emergency**

  Call Campus Police at 412-624-2121 or seek treatment at UPMC Presbyterian ER

- **Non-Emergency Medical Care** (employees)

  Concentra Medical Ctr,

  120 Lytton Ave, Suite 275

  412-621-5430

- **Employee Health Services/Student Health**

  5th Floor Medical Arts Building

  3708 Fifth Avenue

  412-647-3695 (employees); 412-383-1800 (students)

Chemical Releases & Spills

- Labs should be able to handle small spills
- Put on appropriate PPE if qualified to clean spill
- Follow Emergency Response Guide
- If spill is beyond your control evacuate the area
- Turn off or isolate ignition sources
- If lab is equipped with a red emergency exhaust button, press it and leave the lab immediately

Chemical Releases & Spills

- Contain the spill with pigs, towels or absorbent material
- Do not flush concentrated spills into drains
- Absorb spills and contact EH&S for disposal
- Call EH&S if you need assistance 412-624-9505
- Dial 412-624-2121 for major spill emergency during off hours.

Emergency Procedures

- Post in all labs
- Near telephone
- Commit to memory

University of Pittsburgh
Department of Chemistry
Chevron Science Center

MEDICAL EMERGENCY	Call 412-624-2121
CHEMICAL SPLASH	1. Rinse affected area immediately with water for 15 minutes. 2. Seek medical attention.
NON-EMERGENCY MEDICAL CARE	1. Notify supervisor. 2. Proceed to: Concentra Medical Center 120 Lytton Avenue, Suite 275 412-621-5430 During non-business hours seek treatment at UPMC Presbyterian.
CHEMICAL SPILL	1. Evaluate spill. 2. If flammable, highly toxic, or large, evacuate area and call 412-624-2121. a. If incidental, contain spill. b. If necessary, contact EH&S for assistance. c. Neutralize or absorb spilled material. d. Promptly decontaminate.
FIRE	1. Alert others in immediate danger and close door. 2. Pull alarm. 3. Evacuate.
UPON HEARING BUILDING ALARM	1. If possible, prepare lab for evacuation by shutting off gas, securing experiments, capping containers. 2. Close lab doors. 3. Evacuate using stairs. Evacuate short term = (K or G Lot) Evacuate long term = (Alumni Hall)

Chemical Waste

Chemical waste must be:

- collected
- identified
- kept capped/closed
- labeled appropriately

DO NOT use sinks or regular trash for disposal of chemical wastes

Chemical Waste Handling

Chemical waste labels must be placed on the container when waste is initially added to the container

Chemical waste containers MUST be kept closed at all times (except when adding waste to the bottle)

Waste containers should NOT be stored in or near sinks (spills can lead to chemical waste entering the sanitary sewer)

Use secondary containment

Chemical Waste Labeling

Fill out WASTE CHEMICALS label completely

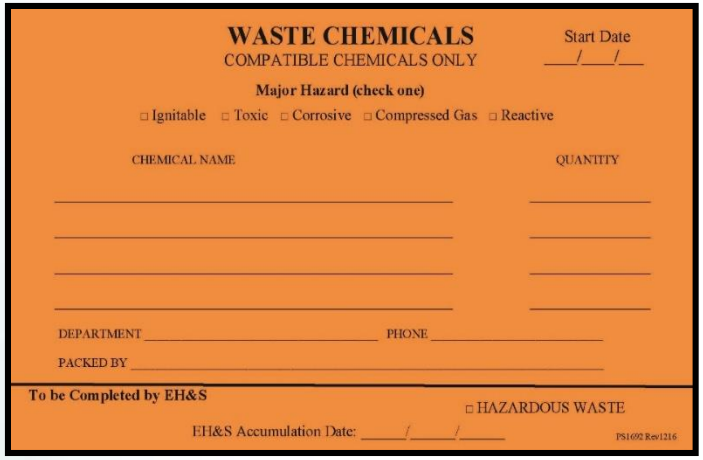
Identify chemical constituents by common chemical name (avoid using formulas, structures, or abbreviations)

Select Major Hazard (Ignitable, Toxic, Corrosive, Compressed Gas, Reactive)

Enter start date (when waste is first added to container)

Provide name, department and phone number

Chemical waste labels must be completed and placed on the container when the waste is initially added

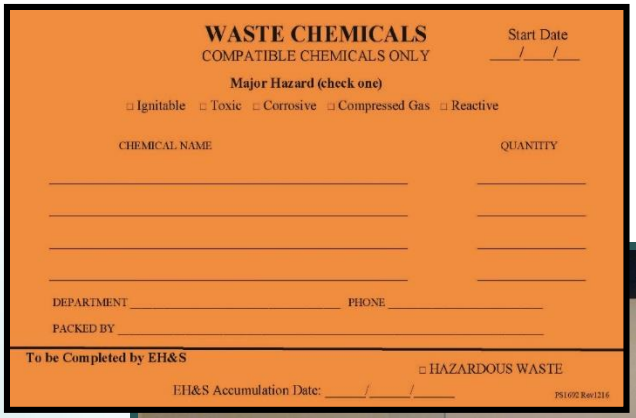

WASTE CHEMICALS
COMPATIBLE CHEMICALS ONLY
Start Date ___/___/___
Major Hazard (check one)
□ Ignitable □ Toxic □ Corrosive □ Compressed Gas □ Reactive
CHEMICAL NAME
QUANTITY
DEPARTMENT _____ PHONE _____
PACKED BY _____
To be Completed by EH&S
□ HAZARDOUS WASTE
EH&S Accumulation Date: _____/_____/_____
PS1692 Rev1216

Chemical Waste Handling

Waste containers should be stored in secondary containment with other compatible wastes.

Remove chemical wastes from the lab on a routine basis.

Waste chemicals must be removed from the lab within 12 months of the start date.



Chemical Waste Handling

When transporting chemicals within buildings always use secondary containment (such as a plastic bucket or bin)

Use carts with sidewalls

Use freight elevator

Chemical Waste Pick Up

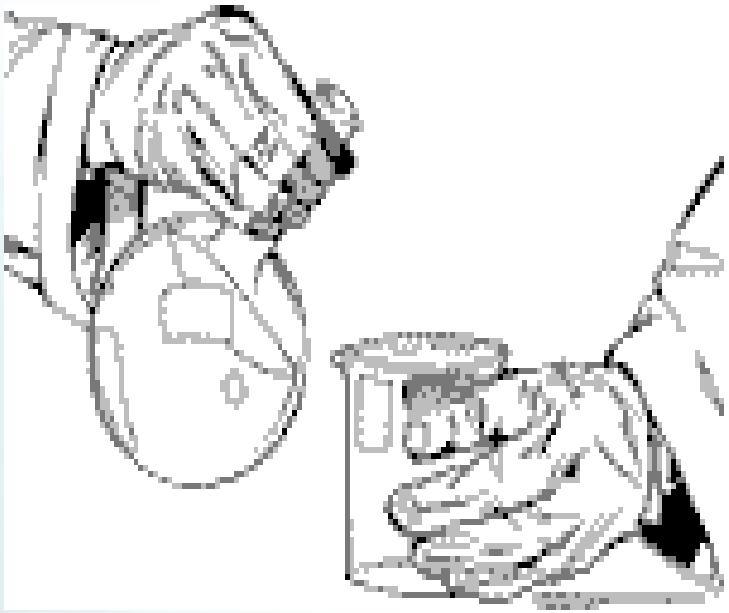
EH&S Website (www.ehs.pitt.edu) has more details on:

- Chemical Waste Disposal
  - Bi-weekly pickup schedule
  - Chemical waste disposal guidelines
  - Chemical Hygiene Plan – Waste Disposal Section
- Biological Waste Disposal
  - Weekly Pickup Schedule SOP for infectious Waste Disposal
  - Segregate Chemical and Biological waste

Questions or Comments

Remember to Practice Safe Science

- Follow good protocols
- Control exposures
- Wear PPE as required
- Keep learning!
- Repeat CHP Training every 3 years online or at live session



General Contact Information

Public Safety Building, Fourth Floor

3412 Forbes Avenue

Pittsburgh PA 15260

Phone: 412-624-9505

Email: safety@pitt.edu