LAB SAFETY TRAINING

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WHY DO WE TRAIN FOR SAFETY?

1. The health and safety of you and your colleagues must be the first concern when setting up and conducting experiments.

2. A moment's carelessness can have disastrous results. When setting up your experiments, ask yourself: "What would happen if…"

Case Study: Researcher Death

Dr. Wetterhahn died at age 48. She was a chemistry professor at Dartmouth University. She wore her PPE, but it was the wrong choice.

- **Dr. Karen Wetterhahn, 1948 – 1997**
  - Conducting heavy metal research at Dartmouth University in 1997 – She spilled a tiny drop of dimethyl mercury on a gloved hand
  - Symptoms: tingling in hands, nausea, weight loss, stumbling, gradual loss of sight and hearing
  - 6 months later she slipped into a coma
  - Within 10 months, she died.

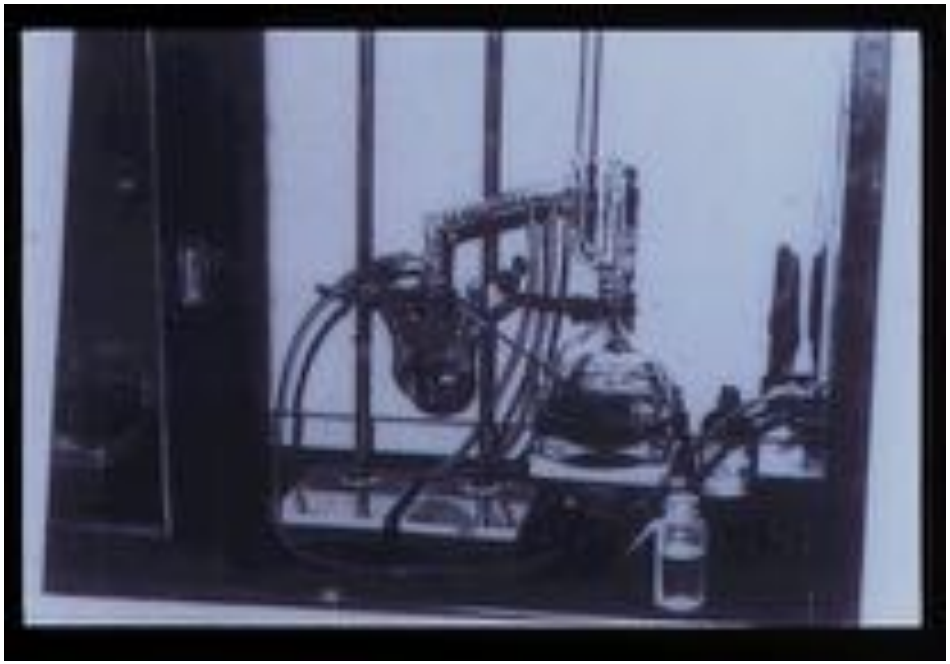
Case Study: Researcher Death

Sheri Sangji died as a result of an accidental fire in a research lab at UCLA in 2009.

- Student died as a result of improper use of an organolithium reagent
- She was not wearing a lab coat, hair was not tied back, and she brought the chemical out of the hood – all problems that accelerated the gravity of the situation

Case Study: Researcher Death

Case Study: UCB Lab Explosion



Experimental set-up in new fume hood.

Case Study: UCB Lab Explosion

Destroyed the lab and the adjoining office!

Laboratory Risk Assessment

Hazards

- Chemicals
- *Radiation

*Additional radiation training will be required at a future time

Hazard Transmission

- Absorption
- Ingestion
- Inhalation
- Injection

Hazard Modifiers

- Procedures
- Equipment
- Facility
- People

Hazard & risk must be communicated to ALL staff!

CHEMICAL HAZARDS

There are two general hazard classes that must be evaluated when assessing the safety of a chemical:

1. Physical hazards

2. Chemical hazards

CHEMICAL HAZARDS: Physical Hazards

- Compressed Gas - cylinders of compressed gas are under intense pressure. (Hydrogen, Argon, Chlorine gases)

- Corrosivity – strong acids and bases can cause visible destruction of metals at the site of contact. (Hydrochloric or sulfuric acids, sodium hydroxide)

- Flammability - both solid and liquid chemicals can serve as fuel sources to support a fire. (Acetone, methanol, ethyl acetate, ether)

- Reactivity - many substances will react violently if allowed contact with air, water or other chemicals. Friction, shock, light or heat can be enough to trigger some reactions. (Sodium metal, phosphorous, n-butyl lithium, picric acid)

- Oxidizability – compounds that release oxygen as they decompose. React with flammables (potassium permanganate, sulfuric and nitric acid, ammonium nitrate)

CHEMICAL HAZARDS: Health Hazards

- Irritants - cause reversible inflammation of skin, eyes or nasal passages. (Cleaning compounds, powdered salts)
- Sensitizers - cause allergic reaction after repeated exposures. Individual sensitivities vary. (Cupferron and hydrazobenzene)
- Carcinogens - alter DNA or cause cells with altered DNA to multiply. (Benzene, Acetaldehyde, Acrylamide, Acrylonitrile, butadiene)
- Systemic Toxins - typically target a specific organ or system (liver, kidney, blood, nervous system, reproductive system, etc.).
- Toxins – based on dose. Anything can be poisonous. (Ethidium bromide, phenol, Sodium cyanide)
- Corrosives – cause burns to the skin, eyes, mucous membranes and respiratory tract. HF is not like typical mineral acids. It is extremely toxic and penetrates to the bone. Calcium gluconate is the only antidote that should be used on an HF burn. (Common acids and bases, phenol)

HCS Pictograms and Hazards

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

Exclamation Mark

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

Gas Cylinder

- Gases Under Pressure

Corrosion

- Skin Corrosion/Burns
- Eye Damage
- Corrosive to Metals

Exploding Bomb

- Explosives
- Self-Reactives
- Organic Peroxides

Flame Over Circle

- Oxidizers

Environment

(Non-Mandatory)

- Aquatic Toxicity

Skull and Crossbones

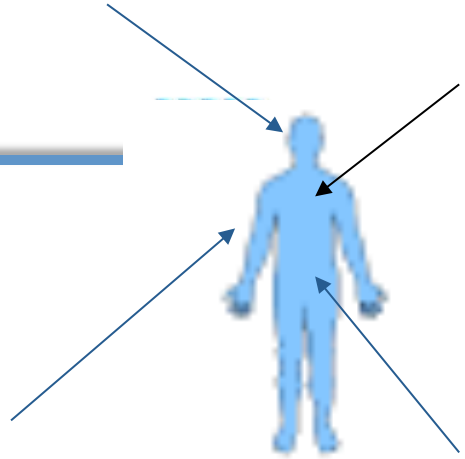
- Acute Toxicity (fatal or toxic)

Hazard Classes

- The previous slides describe hazard classes and several examples were given.

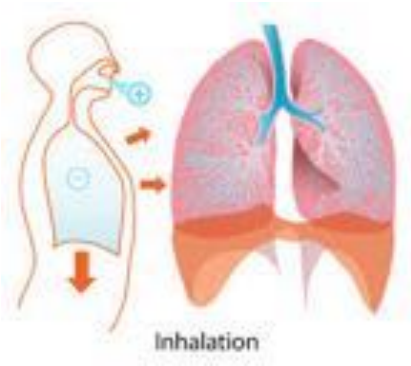
- It is your responsibility to understand the hazards of the materials that you are working with. Ask Binh check bottle label and MSDS for the products you are working with.

Routes of Entry!



The link between hazardous chemicals and adverse health effects lies in exposure.

Inhalation



Skin Absorption

Ingestion

Injection

Know the Hazards! MSDS

- Material Safety Data Sheet includes:
  - Product information
  - Fire and explosion
  - Toxicology
  - Health effects
  - **P**ersonal **P**rotective **E**quipment (**PPE**)
  - Storage
  - Leaks and spills
  - Waste disposal
  - First Aid

Finding a MSDS

- Chemical manufacturers and distributors CANNOT refuse a request for an MSDS.

- There are excellent on-line MSDS databases:

http://www.hazard.com/msds/index.php

http://riskmanagement.nd.edu/MSDS

How we protect you…

Personal Protective Equipment

Top 5 Reasons PPE is Not Worn

1. It doesn't match my outfit..
2. It makes me look dorky…
3. It is uncomfortable…
4. I can't perform with this on…
5. It won't happen to me…

Personal Protective Equipment

- **EVEN IF YOU THINK THE CHEMICALS ARE NON-HAZARDOUS YOU MUST:**

- **Wear the appropriate gloves anytime you are handling chemicals**
- **Wear safety glasses THE SECOND YOU WALK INTO THE LAB where others are working with chemicals that pose a splash hazard**
- **Lab coats are required when working with chemicals**
- **Open toed shoes do not protect your feet and ARE NOT allowed in the laboratory (NO FLIP FLOPS, SANDALS, etc.)**

PPE SHOULD NOT BE WORN OUTSIDE THE LABORATORY!!!

Safety Goggles

- **All lab users, including visitors, must wear approved eye protection upon entering a lab.**
- Prescription glasses do not protect against splashing of chemicals – This is not a good reason to not wear safety goggles
  - You can wear the larger goggles to fit over your glasses
- **No goggles = No chemistry!!!**

Protective Clothing

- **Closed toed shoes ONLY!**
- Clothing that covers arms and no shorts
- **Lab coats must be worn when you are working with chemicals**
- **Remove all potentially contaminated clothing before leaving the lab!**
- For women (and men): long hair should be tied back so that it does not get caught in rotating parts (rotovap) or is exposed to chemicals.

Gloves

- Be sure you know which type of glove is appropriate for the work you are doing:
  - Cryogenics
  - Thermal
  - Toxics/solvents

Please review this website: http://www.ehs.berkeley.edu/hs/63-laboratory-safety/94-glove-selection-and-usage.html

Gloves

- **Remove gloves and wash hands before leaving the lab!!!**
- Inspect your gloves before you use them or touch chemicals (it is important to make sure that no holes or chemicals are present in order to minimize potential issues)
- **Discard immediately after use!**
- **Do not use latex gloves for chemical protection – they are useless!**

Personal Hygiene

- No food or beverages
- No smoking
- Do not apply make-up
- Do not consume lab deionized water

- Wash hands/arms before leaving lab
- Never pipette by mouth
- Do not smell or taste chemicals
- Constrain long hair/loose clothing

What corrosives can do…

Has anyone used HCl?
How about NaOH?
Sulfuric Acid?
Cryogenics like LN_2?

Transporting Chemicals

- Cap all containers
- Tightly sealed, inside secondary containment
  - Beakers are ok to transport, but do not carry glassware with chemicals by themselves
- Do not remove chemical containers from MANAR
  - If you need to, please see me
- Remember gloves should not be used outside of lab, so keep your secondary container free of chemicals, by following these rules

Chemical Fume Hood

Airflow into the hood prevents chemicals inside from migrating out into your breathing zone.

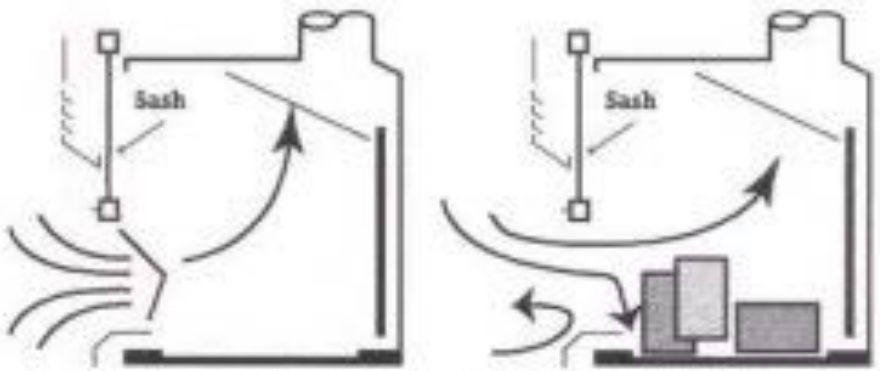
If air velocity into the hood is impeded or slowed, the hoods ability to capture chemicals is compromised.

Factors that affect airflow:

- Sash Height – don't exceed marked max height
- Drafts (people walking behind)
- Bulky objects: blocking baffles or airfoils

Reduce Clutter in Fume Hoods

Proper containment of substances may not occur due to inadequate flow rates, a sash being left open or opened too high, or due to excess clutter



Demonstration of Airflow Patterns through empty & cluttered fume hoods.

Housekeeping

- Keep chemical use areas (countertops) free from contamination
- Close/Cap all containers not in use
- Clean drips and spillage off of container exterior
- Maintain the minimum on the work surface

- Maintain clear working aisles
- Maintain clear access to fire extinguishers, safety showers and eyewashes
- Keep storage off of the floor and out of the halls

Personal Safety

- Do not remove lab equipment and chemical containers
- If you leave a reaction unattended, please feel out form to let other people know what reaction you are doing

- USE THE BUDDY SYSTEM!
- NEVER WORK IN THE LAB ALONE WHEN NO ONE IS AROUND
- THIS INCLUDES WEEKENDS AND NIGHTS!!