SAFETY EDUCATION

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Why do we have academic safety programs?

- Fewer accidents
- OSHA compliant
- Industry wants our students to be more aware of safety concerns.
- Educating practitioners of science to react to emergencies.

Overview of today's material

- What makes a material hazardous?
- How do chemicals enter your body?
- Safety Equipment
  - Laboratory equipment
  - Personal protective equipment (PPE)
- Videos

Definitions:

dan·ger *n.*
1. Exposure or vulnerability to harm or risk.
2. A source or an instance of risk or peril.

haz·ard *n.*
1. A chance; an accident.
2. A possible source of danger: *a fire hazard.*

ac·ci·dent *n.*
1. An unexpected and undesirable event, especially one resulting in damage or harm.
2. an unfortunate event resulting from carelessness, unawareness, ignorance, or a combination of causes

e·mer·gen·cy *n.*
1. A serious situation or occurrence that happens unexpectedly and demands immediate action.

What makes a material hazardous?

- Paracelcus (15th cent.) recognized that all substances are toxic at some level.
  - Is arsenic toxic?
  - Is water toxic?
- Dosage can make a compound a medicine or a poison

http://wwwimage.cbsnews.com/stories/2005/02/04/national/main671781.shtml

- **Hazing Death: Too Much Water**

CHICO, Calif., Feb. 4, 2005

This family photo shows Matthew Carrington on his way to his 21st birthday celebration Monday, Nov. 22, 2004. (Photo: AP)

(AP) A California State University student died of "water intoxication" during hazing in the basement of a fraternity, authorities said Thursday.

Matthew Carrington, 21, died early Wednesday while drinking water from a five-gallon jug and doing exercises at the Chi Tau house near the Chico campus, said Chico Police Sgt. Dave Barrow.

An autopsy showed death was triggered by hyponatremia, a condition in which excess water in the body causes sodium levels in the blood to drop. Water is then absorbed into the blood and fluid builds up in the brain.

What makes a material hazardous?

- A complex relationship exists between a material and its biological effect in humans.
  - dosage
  - route of exposure
  - gender
  - reproductive cycle
  - age, race, lifestyle, metabolism

What makes a material hazardous?

- Many factors influence toxicity
  - no one knows the extent to which these factors are involved on an individual basis
  - therefore consider all chemicals as potentially hazardous.

Protect Yourself

- When should you become concerned about chemical safety issues?
- NOW

What makes a material hazardous?

- From a legal standpoint, a chemical is considered hazardous when it is
  - Cancer causing, toxic, corrosive, an irritant, a strong sensitizer, flammable, or reactive.
  - Specifically listed under OSHA, 29 CFR part 1910, Subpart Z
  - Exceeding the threshold limit value set (TLV) by the American Conference of Governmental Industrial Hygienists (ACGIH)

How do chemicals enter your body?

- Routes of entry:
  - Inhalation
  - Skin Contact/Absorption
  - Ingestion

Inhalation

- Gases and Vapors
  - Water solubility determines the amount of damage that can occur in the respiratory tract
  - Insoluble or poorly soluble gases can produce significant effects if they are absorbed into the bloodstream, e.g., carbon monoxide, acetone.

Inhalation

- Particulate Matter
  - Particles with size >10μ are generally filtered by nasal hairs.
  - Particles of size1-5μ pass through the nose and are trapped in the air passages by mucous and removed by ciliatic hairs.
  - Particles of size <1μ travel to the alveoli of the lungs and lead to respiratory diseases.

Inhalation: How do we reduce exposure?

- Hoods – used for reactions and transfer of liquids.
- Face masks – particulate and vapor types
- SCBA – primarily for use by emergency personnel. Training and practices in Z 88.2-1982.

How do chemicals enter your body?

- Routes of entry:
  - Inhalation
  - Skin or Eye Contact/Absorption
  - Ingestion

Eye Contact

- Irritation or even temporary or permanent blindness can result from exposure to chemicals.
- Explosions involving flying particles (glass, metal, etc.) may produce lacerations.

Eye Contact

- Your eyes have a natural defense system
  - bony structure around eyes
  - eyelashes
  - tears
- These defenses are LIMITED and in some cases (tears) cause more resultant damage.

ALWAYS WEAR GOGGLES WHEN IN A LABORATORY

- Eyeglasses (even with safety lenses) are **not** an acceptable substitute.
- More details to follow

What if a chemical gets in your eye?

- You should be able to get to the eyewash fountain and safety shower with your eyes closed.
- It is unreasonable to assume that injured persons can do this by themselves. They will need help.
- In general, an injured person will be very difficult to handle.

Skin Contact/Absorption

- Many chemicals can easily be absorbed by skin.
- Damage may be localized to the outer layer of skin or if penetration has occurred, damage to blood cells, nerves, liver and kidney may occur.

How do chemicals enter your body?

- Routes of entry:
  - Inhalation
  - Skin Contact/Absorption
  - Ingestion

Ingestion

- **Eating food in the laboratory is not allowed.**
- You should always wash your hands when leaving a laboratory before eating and before using restroom facilities.

Chemical Exposure
How much is too much?

- Dose depends on:
  - Chemical strength (concentration)
  - Duration and frequency of exposure
- Acute exposure: Brief exposure that may pose significant health risk.
- Chronic exposure: Exposure over a period of time (months, years). Low level exposure that does not produce immediate observed health change, harmful in the long term

Chemical Exposure
How much is too much?

- Other considerations
  - Biological pathway
  - Threshold and latency period
- Reduce your risk!
  - Avoid/reduce exposure
  - **Use safety equipment** to reduce risk.

Safety Equipment, overview

- Eyewash Fountain
- Safety Shower
  - Video on eyewashes and safety showers
- Fire Blanket
- Fume Hoods
  - Video
- Personal Protective Equipment

Eyewash Fountains should:

be used for at least 15 minutes.
provide two gentle streams.
use tempered water if possible.

Seek medical assistance immediately.

- Assist the victim in keeping eyes open.
- Practice using the eyewash and getting to it with your eyes closed.

Safety Showers

- Located within 25 feet of work area.
- Used for washing off spilled chemicals.
- Wash for at least 15 minutes.
- Remove goggles after washing head and face.
- Remove contaminated clothing immediately.
- Seek medical assistance immediately.

Fire Blanket

- Every lab should have one.
- Uses:
  - Smothering flames.
  - Keeping emergency victim warm.
  - Cover for someone disrobing in shower.
  - Temporary stretcher.

Fume Hoods

- Use for work with hazardous chemicals.
- Do not use for chemical storage.
- Do not obstruct back slot or air foil at front edge.
- Set up equipment at least 6 inches from the front edge.
- Never put your head inside the hood.

Fume Hoods

- Try not to create turbulence by walking quickly past the hood opening.
- Test for positive air flow by hanging a piece of tissue paper from the sash.
- Recommended air velocity:
  - average 80-100 linear feet per minute, lfpm
  - minimum: 60 lfpm
- Close the sash when you are not working in the hood.

Personal Protective Equipment Overview

- Safety Goggles
- Clothing
- Gloves

Safety Goggles

- Provide chemical splash and impact protection.
- Must meet ANSI Z87.1-1989 standard.
- Should be cleaned regularly.
- Should not be shared with others.
- Required at all times by MN law.
- Contacts are allowed under goggles.

Clothing

- Acid splashes and spills can be hazardous to your clothes as well as your skin.
  - Don't wear your best clothes to lab.
  - Wear leather shoes. Cloth shoes absorb spills. Don't wear sandals.
- Lab coats or aprons are very practical.

Gloves

- Use the proper glove for the task.
- Different glove materials are good for different chemicals.
- Degradation: How long will a glove last?
  - Rated by %weight change after being immersed in a chemical.
  - Significant degradation may not be visibly apparent.

Effect of Electrical Current on Man

	60 Hertz AC Current, mA	
Effect	Men	Women
Slight sensation on hand	0.4	0.3
Perception threshold, median	1.1	0.7
Shock-not painful, muscular control not lost	1.8	1.2
Painful shock-muscular control lost by 0.5%	9	6
Painful shock- let-go threshold, median	16	10.5
Painful and severe shock-breathing difficult, muscular control lost by 99.5%	23	15
Possible ventricular fibrillation		
Three second shocks	675	675
Short shocks(T in seconds)	166/√T	116/√T

- Reprinted with permission from "Handbook of Laboratory Safety", N.V.Steere, Ed., 1981. CRC Press, Boca Raton, FL
- Note that a normal household or lab circuit is 15-20A (20,000 mA !)

Electrical Hazards

- The current to blow a standard fuse or circuit breaker can cause serious injury or death.
- Inspect apparatus regularly for worn power cords and defects.
- Heating mantles, hot plates, mechanical stirrers.

Laboratory Safety Instruction

- Remember:
  - Take responsibility for your own safety.
- Read Section I, II and III of “Safety in Academic Chemistry Laboratories”. (http://membership.acs.org/c/ccs/pub_3.htm) Click “view online”.