Texas A&M University-Kingsville

Lab Safety/Hazard Communications Training

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Topics Relative to Lab Safety

- Why are we covering this?
- Material Safety Data Sheets (MSDSs)
- Labeling and Marking Systems
- Micro-Biological Safety
- Emergency Procedures
- Experimental Protocol
§ 502.009. EMPLOYEE EDUCATION PROGRAM. (a) An employer shall provide an education and training program for employees who use or handle hazardous chemicals.

(b) An employer shall develop, implement, and maintain at the workplace a written hazard communication program for the workplace that describes how the criteria specified in this chapter will be met.

(c) An education and training program must include, as appropriate:

(1) information on interpreting labels and MSDSs and the relationship between those two methods of hazard communication;

(2) the location by work area, acute and chronic effects, and safe handling of hazardous chemicals known to be present in the employees' work area and to which the employees may be exposed;

(g) An employer shall keep the written hazard communication program and a record of each training session given to employees, including the date, a roster of the employees who attended, the subjects covered in the training session, and the names of the instructors. Those records shall be maintained for at least five years by the employer. The department shall have access to those records and may interview employees during inspections.

(h) Emergency service organizations shall provide, to their members or employees who may encounter hazardous chemicals during an emergency, information on recognizing, evaluating, and controlling exposure to the chemicals.

(i) As part of an outreach program created in accordance with Section 502.008, the director shall develop an education and training assistance program to assist employers who are unable to develop the programs because of size or other practical considerations. The program shall be made available to those employers on request.


http://www.capitol.state.tx.us/statutes/docs/HS/content/htm/hs.006.06.08/502.00.htm
Hazard Communication Act

(3) the proper use of protective equipment and first aid treatment to be used with respect to the hazardous chemicals to which the employees may be exposed; and

(4) general safety instructions on the handling, cleanup procedures, and disposal of hazardous chemicals.

(d) Training may be conducted by categories of chemicals. An employer must advise employees that information is available on the specific hazards of individual chemicals through the MSDSs. Protective equipment and first aid treatment may be by categories of hazardous chemicals.

(e) An employer shall provide additional instruction to an employee when the potential for exposure to hazardous chemicals in the employee’s work area increases significantly or when the employer receives new and significant information concerning the hazards of a chemical in the employee’s work area. The addition of new chemicals alone does not necessarily require additional training.

(f) An employer shall provide training to a new or newly assigned employee before the employee works with or in a work area containing a hazardous chemical.
Hazard Communications
Material Safety Data Sheets

- Company Information
- Hazardous Ingredients
- Physical Data
- Fire and Explosion Data
- Health Hazard Data
- Reactivity Data
- Spill & Leak Procedures
- Special Protection Information
- Special Precautions

Environmental Health and Safety
Material Safety Data Sheets: Your Rights

These MSDSs must be available to you the entire time you are in the workplace.

If you request to see a copy of an MSDS for a product you use, and your employer cannot provide it; after one working day, you may refuse to use that product or work in an area where it is being used.
MSDS Sheets Available on the Internet

Chemical companies provided MSDS information. Here is a list of government and private sites:

http://www.ilpi.com/msds/

Where To Find
Material Safety Data Sheets
On The Internet

Texas A&M University-Kingsville
Hazard Communications
Labeling and Marking Systems
Labeling: Hazard Communication Act

§ 502.007. LABEL.
(a) A label on an existing container of a hazardous chemical may not be removed or defaced unless it is illegible, inaccurate, or does not conform to the OSHA standard or other applicable labeling requirement. Primary containers must be relabeled with at least the identity appearing on the MSDS, the pertinent physical and health hazards, including the organs that would be affected, and the manufacturer's name and address. Except as provided by Subsection (b), secondary containers must be relabeled with at least the identity appearing on the MSDS and appropriate hazard warnings.

(b) An employee may not be required to work with a hazardous chemical from an unlabeled container except for a portable container intended for the immediate use of the employee who performs the transfer.


Hazard Communications
Labeling and Marking Systems

- NFPA (National Fire Protection Association) Diamonds
- HMIS (Hazardous Material Identity System) Labels
- Uniform Laboratory Hazard Signage System
Labeling and Marking Systems
NFPA Diamonds

- Color coded, numerical rating system
- Will be located near main entrances, fire alarm panels, or on outside entrance doors
- Provide at-a-glance hazard information

Labeling and Marking Systems
NFPA Diamonds

- Blue = Health
- Red = Flammability
- Yellow = Instability
- White = Special hazard information
Labeling and Marking Systems
NFPA Diamonds

- 4 = Deadly Hazard
- 3 = Severe Hazard
- 2 = Moderate Hazard
- 1 = Slight Hazard
- 0 = No Hazard

Labeling and Marking Systems
HMIS (Hazardous Material Identity System) Labels

- Designed to go on individual containers of products that don’t have manufacturer’s labels
- Same color code/numerical rating system as the NFPA diamonds
**Labeling and Marking Systems HMIS Labels**

- **Blue** = Health
- **Red** = Flammability
- **Yellow** = Instability
- **White** = Personal Protective Equipment or special protection information
- **Numerical Rating of 0-4**

**HMIS-PPE (white part label)**

A = Safety glasses  
B = Safety glasses, gloves  
C = Safety glasses, gloves, chemical apron  
D = Face shield, gloves, chemical apron  
E = Safety glasses, gloves, dust respirator  
F = Safety glasses, gloves, chemical apron, dust respirator  
G = Safety glasses, gloves, vapor respirator  
H = Splash goggles, gloves, chemical apron, vapor respirator  
I = Safety glasses, gloves, dust and vapor respirator  
J = Splash goggles, gloves, chemical apron, dust and vapor respirator  
K = Air line hood or mask, gloves, full chemical suit, boots  
X = Ask Supervisor
Labeling and Marking Systems

You should never have any unattended, unlabeled containers in your workplace!

Labeling

For collected samples and prepared solutions, write chemical name in long hand, date mixed, your name, and professor.
Labeling and Marking Systems

Uniform Laboratory Signage

- Located on laboratory and chemical storage area doors
- Pictographs depict worst hazards present in lab or area

Warning Signs
Hazard Communications
The Written Plan

A copy is available in each laboratory and online.

Hazard Communications
The Written Plan

If you are exposed to a hazardous substance at work or injured, you should report it to your supervisor who will complete an “Employee Exposure Report Form”
Chemical Inventory List

- Chemical Inventory Lists (CILs) are available online in the Public Folder called “Deptlabinfo” under CHEMICAL INVENTORY.
- I can’t maintain this list alone. If you order a chemical, please tell me so it can be added to the list. I must submit this list to the university’s Environmental Health and Safety Department once a year.
- PLEASE do not move chemicals around from room to room. If you use it, put it back!

Good Laboratory Practices

- No smoking, food or beverages in the labs
- Required PPE must be worn while in the lab (goggles, gloves, close toed shoes, long pants)
- Aisles & exits are free from obstruction
- Lab benches must be cleaned, disinfected or decontaminated after work is completed
- Do not use hoods for storage
- Work surface is protected from contamination
- Heavy objects are confined to lower shelves
- Glassware is free from crack, breaks or chips
- Broken glass containers are not used
Environmental Health and Safety

Cleanup after yourself!
General Safe Handling Procedures

- Date chemicals upon receipt
- Store chemicals according to hazard class - NOT alphabetically
- No breakable containers on floor
- No hazardous chemicals above 5’6”
- Minimize chemicals stored in the area
- Keep chemical labels in good condition

You are the expert on the hazards of materials in your possession.

- know properties of biologicals/chemicals you use before you handle them
- Know what appropriate work practices are & use them
- know what the worst case scenario is for a spill of the chemicals you use
- Think about how you will react to a spill of the materials you use
- know what appropriate clean-up procedures are for the materials you use
Nuisance Spills

Spills of less than 4L of material that you know the hazards of and are comfortable cleaning up that you have the ability to clean up

- assess the hazard
- wear appropriate PPE

If you are unsure of the hazard of a spill or need assistance with PPE selection, call Safety

Potentially Hazardous Spills

Spills of
- greater than 4L
- smaller spills of materials of
  - low LD$_{50}$
  - carcinogens
  - flammable liquids or metals
  - compounds of unknown toxicity
Clean Up Procedures

Have a clean up kit with the following:
• Absorbent material
• Plastic scoop
• Several plastic bags
• Sodium bicarbonate and citric acid
• Chemically resistant gloves and goggles
• 5-gallon plastic bucket

Preventing Spills

- Eliminate clutter
- Know proper work practices for biological, chemical materials you use
- Use unbreakable secondary containers
- Store chemicals properly
- Dispose of waste and excess chemicals in a timely manner
Preparation

- What are the physical and toxicological properties of the biological and chemical materials you use?
- What is the worst thing that could happen if you dropped/spilled a bottle of each chemical you use?
  - inconvenience
  - skin burns
  - fire
  - chemical exposure (fatality? permanent injury?)

NIOSH Pocket Guide to Chemical Hazards (NPG)

http://www.cdc.gov/niosh/npg/npg.html

The NPG is intended as a source of general industrial hygiene information on several hundred chemicals/classes for workers, employers, and occupational health professionals. The NPG does not contain an analysis of all pertinent data, rather it presents key information and data in abbreviated or tabular form for chemicals or substance groupings (e.g. cyanides, fluorides, manganese compounds) that are found in the work environment. The information found in the NPG should help users recognize and control occupational chemical hazards.
**Waste Disposal**

- Separate waste streams by type (biological, chemical)
- Use approved containers for each waste stream
- Label all containers with approved labels
- Do not allow waste to accumulate on floors, in corners or under shelves

**Chemical Storage**

- Incompatible materials must be segregated
- Corrosives & flammables must be stored below eye level
- Unused & outdated materials must be disposed of properly
- Safety carriers must be used to transport all chemicals
- Lab carts must have side rails
Caustic Chemical Hazards

- Acids & Bases (organic and inorganic)
- ex. : HCl, Nitric Acid, NaOH, phenol, triethylamine
- skin burns
- permanent eye damage
- inhalation hazards
- Know the differences in hazards between concentrated vs. dilute solutions

Wooden Cabinet with Secondary Containment
Flammable Storage Cabinet

Flammability Hazards

- Location, location, location
- Ignition sources
- Ventilation
- Other fuels in the area
  - Don’t store more than 10 gallons of flammable liquids outside of flammable liquid storage cabinets per laboratory
**Flammables and Combustibles**

- Keep container closed when not in use
- Do not use near open flame or ignition source
- Flammable liquids:
  - Store in flammable storage cabinets
  - Ground and bond containers over 5 gallons
  - Refrigerate in a lab safe refrigerator if necessary

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**Flash Point** - The lowest temperature at which a liquid has sufficient vapor pressure to form an ignitable mixture with air near the surface of the liquid

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Flash Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>-2.2 F</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>42.0 F</td>
</tr>
<tr>
<td>Methanol</td>
<td>51.8 F</td>
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<tr>
<td>Diethyl Ether</td>
<td>-54.0 F</td>
</tr>
<tr>
<td>Gasoline</td>
<td>-45.0 F</td>
</tr>
</tbody>
</table>
Reactives

- Store in isolation from other chemicals
- Make efforts to substitute with less hazardous materials
- Dispose of peroxide forming compounds within one year if not opened; if opened, dispose within 6 months unless regularly tested for absence of peroxides
- Make sure pyrophorics and water reactives are sufficiently covered by their solvent
- Keep picric acid moist

Oxidizers

Oxidizers are substances that increase the burning of fuels by increasing the oxygen.

Organic peroxides

Other oxidizers
- concentrated nitric acid,
- sodium hypochlorite (bleach)
**Oxidizers**

**Health Hazards**

**Acute Effects** - inflammation/destruction of tissue, severe irritation of the upper respiratory tract, irritation of nose and eyes

**Chronic Effects** - damage to the nervous system, fertility disorders, carcinogenic (chromium compounds)

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**Flammables and Combustibles**

**Health Hazards**

- **Acute Effects** - headache, dizziness, nausea, dry and irritated skin, watery and stinging eyes, inflammation of eyelids.
- **Chronic Effects** - general damage to lungs, liver, kidneys, possible cancer risk.
Compressed Gases

Physical Hazards:
- Sudden release of gas may propel cylinder at high speeds with extreme force

Health Hazards:
- Varies based on gas in cylinder
- Check MSDS for specific health hazards

- Ventilate area where gases are used
- Identify cylinders by name, not color
- Firmly close valve when not in use
- Keep safety cap on cylinder when not in use
- Firmly secure cylinders during storage and use
Radioactivity

- At this time, the department does not directly work with radioactive materials of any type.
- (3) Gas Chromatographs do have a small Ni-63 source for the ECD which is marked. The source, when disposed, is classified as Low Level Radioactive Waste.

Micro-Biological Safety

1. Treat all microorganisms as potential pathogens.
2. Sterilize equipment and materials. All materials, media, tubes, plates, loops, needles, pipettes, and other items used for culturing microorganisms should be sterilized by autoclaving. Otherwise, use commercially sterilized products. Understand the operation and safe use of all equipment and materials needed for the laboratory.
3. Disinfect work areas before and after use. Use a disinfectant, such as a 10% bleach or 70% ethanol solution, to wipe down benches and work areas both before and after working with cultures.
4. Wash your hands. Use a disinfectant soap to wash your hands before and after working with microorganisms. Nondisinfectant soap will remove surface bacteria and can be used if disinfectant soap is not available. Gloves may be worn as extra protection.
Microbiological Safety (cont.)

5. **Never pipet by mouth.**

6. **Do not eat or drink in the lab,** nor store food in areas where microorganisms are stored. Never eat or drink in the laboratory while working with microorganisms.

7. **Label everything clearly.** All cultures, chemicals, disinfectant, and medias should be clearly and securely labeled with their names and dates. If they are hazardous, label them with proper warning and hazardous information.

9. **Autoclave or disinfect all waste material.** All items to be discarded after a class, such as culture tubes, culture plates, swabs, toothpicks, wipes, disposable transfer needles, and gloves, should be placed in a biohazard autoclave bag and autoclaved 30 to 40 minutes at 121° C at 20 pounds of pressure. If no autoclave is available and you are not working with pathogens, the materials can be covered with a 10% bleach solution and allowed to soak for at least 1 to 2 hours.

10. **Clean up spills with care.** Cover any spills or broken culture tubes with a 70% ethanol or 10% bleach solution; then cover with paper towels. After allowing the spill to sit with the disinfectant for a short time, carefully clean up and place the materials in a biohazard autoclave bag to be autoclaved. Wash the area again with disinfectant. Never pick up glass fragments with your fingers or stick your fingers into the culture itself; instead, use a brush and dustpan. If working with animal or plant pathogens, keep the area clear and notify your instructor.
Biosafety Level 1:

- A basic level of containment that relies on standard microbiological practices with no special primary or secondary barriers recommended, other than a sink for handwashing.

- Biosafety Level 1 practices, safety equipment and facilities are appropriate for undergraduate and secondary educational training and teaching laboratories. Moreover, it classifies other facilities where work is done on defined and characterized strains of viable microorganisms not known to cause disease in healthy adult humans. Bacillus subtilis, Naegleria gruberi and the infectious canine hepatitis virus are representative of those microorganisms meeting these criteria. Many agents not ordinarily associated with disease processes in humans are, however, opportunistic pathogens that may cause infection in the young, the aged and immunodeficient or immunosuppressed individuals. Vaccine strains which have undergone multiple in-vivo passages should not be considered avirulent simply because they are strains.

Emergency Procedures

Prepare yourself by:
- Reading the MSDS prior to use
- Know where emergency equipment is located—eyewash, shower, first aid kit, fire extinguisher
- South Texas Poison Center-Emergency Phone: (800) 222-1222
- Emergency contact numbers: Fire, UPD 911, (2611)
Emergency Procedures

CHEMICAL CONTACT
- Flush eyes for 15 to 20 minutes
- Flush from inside to outside
- Do not apply neutralizers or creams
- Seek medical attention

CHEMICAL CONTACT WITH SKIN
- Remove contaminated clothing
- Flush the skin for 15 to 20 minutes
- Do not scrub affected area
- Do not put on contaminated clothing
- Seek medical attention
**Emergency Procedures**

**INHALATION OF CHEMICAL VAPORS**
- Get to fresh air immediately
- Seek medical attention

**INGESTION OF CHEMICALS**
- Seek medical attention immediately

**Experimental Protocol**

- Research chemicals you will be using (MSDS Sheets, NIOSH Pocket Guide)
- Substitute a non-carcinogenic compound whenever possible (ENGINEER the experiment).
- Know procedure to handle chemical spills and materials on hand before beginning.
- Know emergency procedures.
Chemical Injuries

Acid Burn of Arm

Blisters caused by ethyl aziridinyl formate

Alkali Burn

Chemical Eye Injuries

Severe Acid (left) and Mild Acid Injury

Mild Alkali Injury

Severe Alkali Injury