Introduction to Laboratory Safety & Hazard Communication
Environmental Health and Safety

Our Mission

*Environmental Health and Safety supports and enriches Texas A&M University by providing quality programs and services that instill safety, health, and environmental stewardship.*

Our Vision

We pledge to ensure that Texas A&M University provides the highest standard in health, safety, and environmental protection.

Our Core Values

- Safety – We believe safety is paramount.
- Communication – We provide education and assistance.
- Cooperation – We work together to achieve excellence.
- Integrity – We value respect, virtue, and professionalism.
Environmental Health & Safety Programs

- Chemical Safety
- Construction Plan Review
- Emergency Shower Testing
- Fire & Life Safety
- Fume Hood Testing
- Hazard Communication
- Hazardous Waste
- Industrial Hygiene
- Laboratory Safety
- Laser Safety
- Protocol Review
- Radiological Safety
- Respiratory Protection
- Safety Inspections
- Safety Training
- Spill Response
Why do we train?
Hazard Communication

Texas Hazard Communication Act

• Texas Hazard Communication Rules – 25 TAC §295
• Texas Health & Safety Code
  • Chapter 502, Hazard Communication Act

• What is required??
  – Written program
  – Employee right to know information and training
  – Identification of hazardous chemicals and workplace chemical lists (inventories)
  – Maintain Safety Data Sheets (SDS)
  – Provide protective equipment
Purpose of Hazard Communication

• To ensure employers provide employees with information on chemical hazards to which they may be exposed to in the work place and how to protect themselves from such hazards.

• The program is available at: http://ehsd.tamu.edu
Globally Harmonized System (GHS)

- **Hazard Classification**
  - Provides more specific criteria for health and physical hazards.

- **Labeling**
  - Chemical manufacturers and importers are required to provide labels conforming to standards that provide across-the-board harmonized information.

- **Safety Data Sheets**
  - Replaces Material Safety Data Sheets (MSDS) and now have a specific 16-section format.
Hazard Classification

NFPA, HMIS and GHS

**HMIS/NFPA**
- 0 = Minimal Hazard
- 1 = Slight Hazard
- 2 = Mod. Hazard
- 3 = Serious Hazard
- 4 = Severe Hazard

**GHS**
- Cat. 1 = Severe Hazard
- Cat. 2 = Serious Hazard
- Cat. 3 = Moderate Hazard
- Cat. 4 = Slight Hazard
- Cat. 5 = Minimal Hazard

*Make sure employees know the difference*

Know the difference. Classification is opposite of what we are traditionally used to.
### Health Hazard Classification

#### Chemical Classifications:

<table>
<thead>
<tr>
<th>Health Hazards</th>
<th>Hazard Class</th>
<th>Hazard Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Skin Corrosion/Irritation</td>
<td>1A</td>
<td>1B</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>1</td>
<td>2A</td>
</tr>
<tr>
<td>Respiratory or Skin Sensitization</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Germ Cell Mutagenicity</td>
<td>1A</td>
<td>1B</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>1A</td>
<td>1B</td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>1A</td>
<td>1B</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity – Single Exposure</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Specific Target Organ Toxicity – Repeated Exposure</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Aspiration</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Simple Asphyxiants</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Physical Hazard Classes

#### GHS BUILDING BLOCKS: PHYSICAL HAZARDS

<table>
<thead>
<tr>
<th>Hazard Class</th>
<th>Hazard Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosives</td>
<td>Unstable</td>
</tr>
<tr>
<td>Flammable Gases</td>
<td>Div 1.1</td>
</tr>
<tr>
<td>Flammable Aerosols</td>
<td>Div 1.2</td>
</tr>
<tr>
<td>Oxidizing Gases</td>
<td>Div 1.3</td>
</tr>
<tr>
<td>Gas Under Pressure</td>
<td>Div 1.4</td>
</tr>
<tr>
<td>Compressed Gases</td>
<td>Div 1.5</td>
</tr>
<tr>
<td>Liquefied Gases</td>
<td>Div 1.6</td>
</tr>
<tr>
<td>Refrigerated Liquefied Gases</td>
<td></td>
</tr>
<tr>
<td>Dissolved Gases</td>
<td></td>
</tr>
<tr>
<td>Flammable Liquids</td>
<td></td>
</tr>
<tr>
<td>Flammable Solids</td>
<td></td>
</tr>
<tr>
<td>Self Reactive Substances</td>
<td></td>
</tr>
<tr>
<td>Pyrophoric Liquids</td>
<td></td>
</tr>
<tr>
<td>Pyrophoric Solids</td>
<td></td>
</tr>
<tr>
<td>Self Heating Substances</td>
<td></td>
</tr>
<tr>
<td>Water reactive-&gt;Flammable Gases</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Liquids</td>
<td></td>
</tr>
<tr>
<td>Oxidizing Solids</td>
<td></td>
</tr>
<tr>
<td>Organic Peroxides</td>
<td></td>
</tr>
<tr>
<td>Corrosive to Metals</td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table above lists various physical hazard classes and their corresponding hazard categories.*
GHS Chemical Labeling System

- **Signal Words**
  - Danger: Used for more severe hazards
  - Warning: Used for less severe hazards
- **GHS Pictogram**
- **Hazard Statement**: assigned statement to a hazard class and category
- **Precautionary Statement**: minimizes or prevents adverse affects from exposure
- **Supplier Identification**
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 (harmful), 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)
GHS Compliant Label

The Basic Parts of A GHS-Compliant Label

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.weberspackaging.com
Secondary Container Labeling

- **Identity** - As it appears on the SDS
- **Hazards** - Words, pictures and/or symbols

**Exemption – Research Laboratories**

Chemicals must be readily identifiable (full name), but hazards do not have to be listed.
Flash Point
4-Below 73°F
3-Below 100°F
2-Above 100°F Not Exceeding 200°F
1-Above 200°F
0-Will Not Burn

OX-Oxidizer
ACID-Acid
ALK-Alkali
W-Use no Water
Cor-corrosive

Labeling: N.F.P.A. 704

4-Deadly
3-Extreme Danger
2-Hazardous
1-Slightly Hazardous
0-Normal
Deface Labels Correctly

**YES**
Original labels must be completely covered or removed

**NO**
Original label still readable
Safety Data Sheets

- Material Safety Data Sheets are now called **Safety Data Sheets**.
- All SDS have a standardized 16 section format
- SDS must be readily accessible to employees
Safety Data Sheet Sections

- Section 1 - Identification
- Section 2 – Hazard(s) Classification
- Section 3 – Composition / Info on Ingredients
- Section 4 – First Aid Measures
- Section 5 – Firefighting Measures
- Section 6 – Accidental Release Measures
- Section 7 – Handling and Storage
- Section 8 – Exposure Controls / Personal Protection
Safety Data Sheet Sections

- Section 9 – Physical and Chemical Properties
- Section 10 – Stability and Reactivity
- Section 11 – Toxicology Information
- Section 12 – Ecological Information
- Section 13 – Disposal Consideration
- Section 14 – Transport Information
- Section 15 – Regulatory Information
- Section 16 – Other information including date of preparation of last revision
Texas A&M University Complies With

• The Texas Hazard Communication Act
• The TAMU Safety Manual
• The TAMU Laboratory Safety Manual

The Texas A&M University safety manual and the laboratory safety manual are available on the environmental Health & safety website

http://ehsd.tamu.edu
Follow Lab Rules

• Lock lab doors

• No food or drink in the lab

• Avoid working alone
General Lab Safety Training

- Information on SDS (MSDS) and how to obtain them
- Information on labels
- Generic information on hazardous chemicals
- First Aid
- Personal Protective Equipment (PPE)
- Chemical spill clean-up
- Chemical waste disposal
Work Area Specific Training

*Responsibility of Lab Manager / PI*

- Information on hazardous chemicals
- Location of SDS (MSDS)
- PPE (Personal Protective Equipment)
- First Aid
- Chemical storage and handling
- Chemical spill clean-up
- Chemical waste disposal
Chemicals in a research laboratory are exempt from secondary labeling requirements and inventory requirements if:

1) The lab is under the direct supervision or guidance of a technically qualified individual

2) Labels on primary containers of chemicals are not removed or defaced

3) Personnel training requirements are fulfilled

4) SDS access requirements are satisfied

5) The laboratory is not used primarily to produce hazardous chemicals in bulk for commercial purposes
Safety Contact Numbers

♦ **EMERGENCY**
  - From a campus phone
  - **911** (Fire dept., Police dept., EMS)

♦ **Environmental Health & Safety (EHS) (8-5)**
  - 845-2132

♦ **EHS (after hours emergency)**
  - 979-845-4311

_________________________________________________________

♦ **Email**
  - ehsd@tamu.edu

♦ **UPD (non-emergency)**
  - 845-2345

♦ **Ethics Point (reporting unsafe conditions)**
  - 1.888.501.3850
Reporting Accidents

**Actual Accidents and Injuries: Report **Immediately**!

FIRST REPORT OF INJURY
For Employee
Completed by Supervisor
or
Student/Visitor Incident Report

Forms available on EHS website:
https://ehsd.tamu.edu/Pages/OccSafety.aspx

Near Accidents and Hazardous Conditions: Inform Supervisor & EHS
Hazard Reduction

- Engineering Controls
- Substitution
- Elimination of the hazard
- Administrative (rules, signs, training)
- Personal Protective Equipment (PPE)

Safety Considerations

- **Hazard** is the source of danger (chemical, electrical, hot surface, etc.)
- **Risk** is the likelihood of occurrence (Taking into account the length of exposure to the hazard)
- **Consequence** is the outcome & Impact (due to exposure to the hazard)
Chemical Fume Hood

- Keep sash closed
- Raise large equipment
- Keep equipment at least 6” from face
- Keep clean
- Not for storage
- No perchloric acid
- Do not modify
- Do not block airflow
- Avoid rapid movement
Safety Equipment to look for:
Eyewash Operation
Personal Protective Equipment

- **Eyes**
  - Safety glasses, chemical splash goggles, full face shield (with protective eyewear)

- **Hands**
  - Appropriate type of gloves

- **Body**
  - Full pants, lab coat, apron, tie long hair back, closed shoes with no skin showing, and other appropriate clothing

- **Respiratory**
  - Dust mask, full and half face respirators, SCBA
Spill Clean-up

- Develop plan of action
  - Identify the spilled chemical
  - Notify others in the immediate area
  - Assess the risk to determine if you can safely clean up the spill; obtain assistance as necessary
  - Know when to call for HELP!
  - Attend to injured or exposed people
  - Know how to contain a spill / leak
  - Know who is responsible for the clean up
  - Know how to decontaminate the area
**Don’t Take Unnecessary Risks**

Call the EHSD Spill Response Team When:

- Large Volume Involved
- Very Hazardous Material
- Very Hazardous Condition
  - Fire, Explosion, Toxicity
- Strong Odor
Chemical Storage

- Store by hazard class
- Date when received and when opened
- Separate incompatibles
- Keep from heat/sunlight
- Label properly (secondary container)
- Minimize quantities
- Do not store flammables in household refrigerator or freezer
- Protect against spills
- Dispose of outdated, questionable or unneeded
Corrosives

- Destroy tissue at the point of contact
  - Acids
  - Bases
  - Dehydrating Agents
  - Strong Oxidizing Agents

- Protect Eyes and Skin
- Work in a Fume Hood
- Wear protective clothing
- A-W Dilution

- Contact with Corrosives
  - Remove contaminated clothing
  - Rinse in safety shower or eyewash for at least 15 minutes
  - Seek medical attention
Reactives

- Undergo violent reaction under certain conditions
  - Explosive
  - Readily Polymerize
  - Water Reactive
  - Air Reactive
  - Strong Oxidizers

Storage
- Separate from other chemicals
- Keep in Cool/dry area
- Out of sunlight

Isolate from cause of reaction

When Reactives React

- Emergency Equipment
  - Fire Extinguisher
  - Respiratory Equipment

- Contact
  - Flush for 15 minutes
  (except with water reactives)
Flammable Liquids

Any liquid that has a flash point below 100°F

Differs from Combustible Liquid (Any liquid that has a flash point at or above 100°F)

- Remove Ignition Source (heat or spark)
- Keep away from oxidizers and combustible materials
- Work in a fume hood or a well ventilated area
- Know location of fire extinguishers
- Observe building alarms and know procedures

STORAGE

- Well ventilated area
- Flammable storage cabinet
- Lab-safe refrigerator
- Isolated from incompatible chemicals
Flammable Solids

A solid that is liable to cause fires through friction, absorption of moisture, etc. or which can be readily ignited (I.E. sodium metal)
Flammables: Key Terms

Flash point: The temperature at which vapors burn when ignited

Fire Point: The temperature at which liquid burns when ignited

Auto-ignition temperature: The lowest temperature at which a substance will ignite spontaneously (without ignition source)

Upper Explosive Limit (UEL) – The mixture of substance and air is too rich to burn (not enough oxygen)

Lower Explosive Limit (LEL) – The mixture of substance and air lacks sufficient fuel (substance) to burn
Irritants

- A chemical which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.
- It is sometimes difficult to tell whether an itch, redness, or other irritation is the result of a chemical exposure. Always wear PPE that is effective for the kind of irritant you are working with.
- First aid treatment for skin irritation is to flush the affected area with water for at least 15 minutes. Consult a physician if the symptoms persist or if you have concerns about possible toxicity.
- First aid treatment for eye irritation is to flush the eyes for at least 15 minutes with water. Consult a physician if a foreign body was involved (corneal abrasions or scratches are possible) or if the chemical was basic (bases can cause severe eye damage even with water flushing).
Toxins

Cause illness or injury by upsetting biological functions or damaging biological structures
- Acute exposure
- Chronic exposure

Factors affecting toxicity
- Dosage
- Duration of exposure
- Exposure to other chemicals
- Mixtures
- Routes of entry
- Physical health
- Inherited parameters
- Sensitivity to the chemical

Types of Toxins
- Carcinogens
  - Cause growth of abnormal tissue
- Reproductive Toxins
  - Interfere with reproduction of adult
- Teratogens
  - Interfere with embryo/fetus development
- Mutagens
  - Alter DNA
- Neurotoxins
  - Damage nervous system

Read SDS for exposure limits and proper handling information
- Use Fume Hood
- Proper Protective Gear
- No food or drinks in lab
- When in doubt, contact EHS
Working with Toxins

Safe levels of exposure are established by three entities: NIOSH, OSHA, and ACGIH

Explanation of acronyms

- REL – Recommended Exposure Limit (NIOSH)
- PEL – Permissible Exposure Limit (OSHA)
- TLV – Threshold Limit Value (ACGIH)
- STEL – Short Term Exposure Limit
- IDLH - Immediately Dangerous to Life and Health
- C - Ceiling value (a concentration that must not be exceeded during any part of the work day)
- TWA - Time-Weighted Average

Example from NIOSH Pocket Guide to Chemical Hazards

- Hydrogen fluoride (HF)
  - CAS: 7664-39-3
  - Exposure Limits
    - NIOSH REL: TWA 3 ppm (2.5 mg/m3) C 6 ppm (5 mg/m3) [15-minute]
    - OSHA PEL: TWA 3 ppm
    - IDLH: 30 ppm
    - Conversion 1 ppm = 0.82 mg/m3
# Hazardous Waste

- **Use an appropriate container**
- **Label as “Hazardous Waste”** – Deface or remove original label so that previous contents are not readable
- **Identify contents**
- **Do not mix “Incompatible Waste”**
- **Allow for expansion**
- **Keep lid closed**

---

### Hazardous Waste Disposal Tag

- **REQUESTOR:**
- **DEPT/PART:**
- **PHONE:**
- **CHEMICAL(S):**
- **PHYSICAL PROPERTY:**
  - Liquid
  - Solid
  - Gas
  - Other
- **QUANTITY:**
  - Print
  - Quart
  - Gallon
  - 5-Gallon
  - Other
- **CONTAINER TYPE:**
  - Glass
  - Metal
  - Other
- **REACTS WITH:**
  - None
  - Air
  - Water
  - Other
- **HAZARDS:**
  - Flammable
  - Explosive
  - Carcinogenic
  - Toxic
  - Corrosive
  - Other
- **REMARKS:**

---

Using string or wire, attach the disposal tag to each new waste container when the first chemical is added. Print the information on the tag legibly.

---

Mail lower portion of tag to Safety & Health Office when container is ready for pickup. (MS 4472; Campus: 945-2122) SHO Form 15-13
Never pour hazardous waste / chemicals down the drain!!!
Physical Hazards

Electrical

- Extension cords are not to be used for permanent use (8hr or less).

- Do not penetrate the ceiling tiles as they are the smoke and heat barriers.

- Replace damaged cables

- Do not run the cables around lab sinks or around safety equipment.
Physical Hazards

Cuts & Punctures

- Dispose sharps in appropriate containers (not in regular trash cans)

- Autoclave all biohazard sharps before disposal

- Once autoclaved place the orange autoclave bag in a black trash bag and then throw in dumpster

- Use a sturdy cardboard box with a lid that can be closed and taped off for disposal

- DO NOT RECAP NEEDLES
Physical Hazards

Mechanical

- All moving parts must be guarded

- Check to ensure that the required maintenance was done

- Protect yourself from part of machinery that may heat up during operation

- Follow the Standard Operating Procedures (SOPs)

- Lab workers must be trained if and when a new equipment is introduced in the work place
Physical Hazards

Noise

- Contact Donna Adams
deadams@tamu.edu
  - Noise survey
  - Help with hearing protection
Physical Hazards

Temperature

- Protect your self from extreme temperatures by wearing appropriate PPE
- Unplug equipment when not in use
- Protect your eyes and skin when working with liquid cryogens
- Follow the SOPs when working with autoclave machines
Physical Hazards

Projectiles

- Glass under pressure can implode and injure you. Protect yourself by
  - Setting up the experiment in a fume hood
  - Use safety netting to prevent the scatter of glass, should it explode
  - For bulky equipment that cannot be setup in a fume hood, use Plexiglas shield
Physical Hazards

Housekeeping

- Prevent cross contamination of personal items
- Clutter workspaces can lead to cross contamination or other hazards like slip trips and falls
- Dispose trash in appropriate containers and designate a place to store waste containers
- Avoid excess combustible storage in labs
- Clean up/inform EHS of spills immediately!
Liquid Cryogens

- Cryogens, such as liquid nitrogen, oxygen, and helium are extremely cold liquids that can produce a painful burn.
- Cryogens can expand rapidly and must never be contained in a closed system.
- Eyes and bare skin can be injured immediately if they come into contact with cryogens.
What should you look for on Cryogenic Cylinders?

- Cylinder safety valves should be replaced every five years. Contact EHS for details.
- Look for swelling (ribbing) of the external tank. If evidence exists, contact EHS immediately!
What should you look for on Cryogenic Cylinders?

- Report any excessive venting or leakage to the vendor and EHS.
- Always check that a pressure relief valve and rupture disc are present on the cylinder prior to filling or usage.
Liquid Nitrogen Cylinder Explosion
Compressed Gases

- Gases -- Toxic, Corrosive, Flammable, Explosive
- Hazards
  - Weight
  - Sudden release of pressure
- Regulator (appropriate type)
- Properly Secured
- Report any Leaks
- Have Identification
- Know Procedures
- Remove Empty Cylinders
What’s wrong with these pictures?
General Services Complex
750 Agronomy Road, Suite 3501  MS 1186
College Station, TX  77843-1186

For questions related to standard biosafety practices, biosafety levels, approved decontamination procedures, bio-hazardous waste disposal, and autoclave use, please contact:
Phone: (979) 458-3525
Fax: (979) 862-3176
biosafety@tamu.edu

Christine McFarland
Director and Biological Safety Officer
979.845.6475

OFFICE OF RESEARCH COMPLIANCE AND BIOSAFETY

• Provides guidance and outreach through training.

• Develops and implements ongoing monitoring and inspections of Biosafety Level 1, 2, and 3 laboratories.

• Conducts risk analyses of research operations with bio-hazardous agents and/or activities.

• Identifies appropriate mitigation measures to reduce or eliminate identified risk factors.
Conclusion

- Know the safety contact numbers
- Report any accidents immediately
- Have the appropriate training when a new hazard is introduced
- Use a current SDS to know the characteristics of each chemical
- Label all containers with their contents
- Know the hazards and risks in your lab and the consequences of an incident
- Keep in mind the dangers of compressed gas and cryogenic cylinders
- Practice good chemical storage and handling techniques
- Wear the Proper Protective Equipment at all times
- Use the fume hood when appropriate and operate properly
- Label and dispose of hazardous waste appropriately
- Know the specific hazards and the proper first aid procedures of the chemicals you will be working with
- Know where your safety equipment is located
Questions?
ehsd.tamu.edu

labsafety@tamu.edu

979-845-2132