General Lab Safety for Students

Good Science is Safe Science

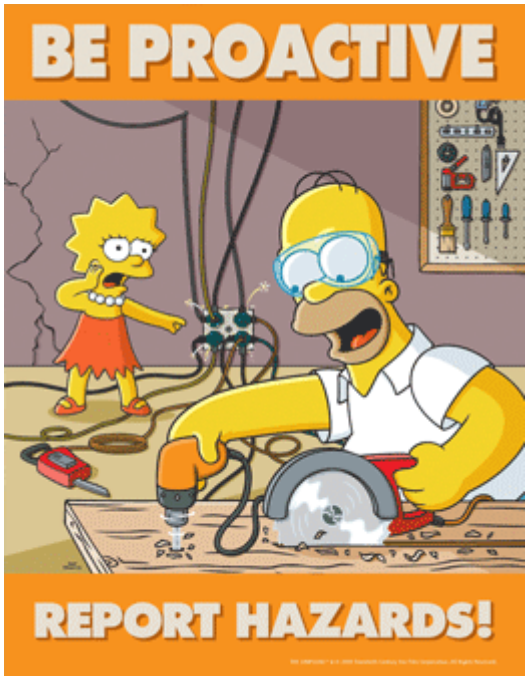
Safety and Risk Management

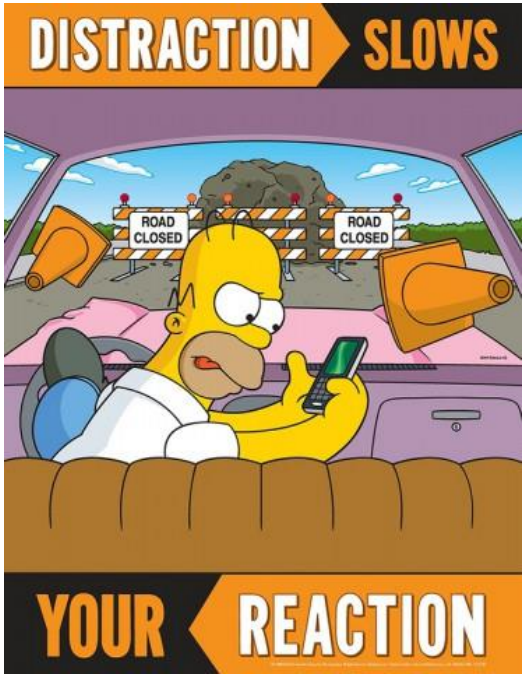
Disclaimer

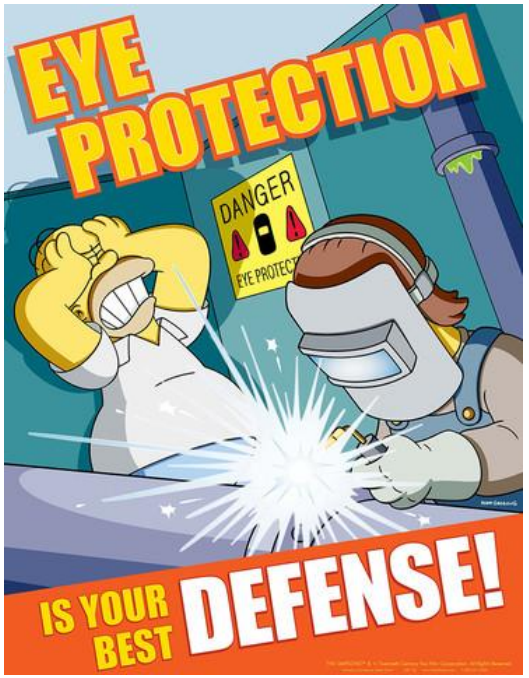
- This session is NOT intended to be a list of “do’s and do not’s”. While it will cover some common hazard this presentation is intended to help you develop your ability to identify hazards and reduce risks.

What is “Safety?

- Our definition is “The identification of hazards and the reduction of risk”.







Questions

- What is a “hazard”?
- What is “risk”?
- How do we reduce risk?

A Hazard is…

- An untoward event
- An event which can cause loss, damage, injury, or death
- Something which can go wrong

Sources of Hazards

- The environment
  - Heights
  - Oxygen deficiency
- The things you use
  - Tools and equipment
  - Chemicals
- The things you do
  - Milling
  - Transporting chemicals
  - Trouble shooting equipment

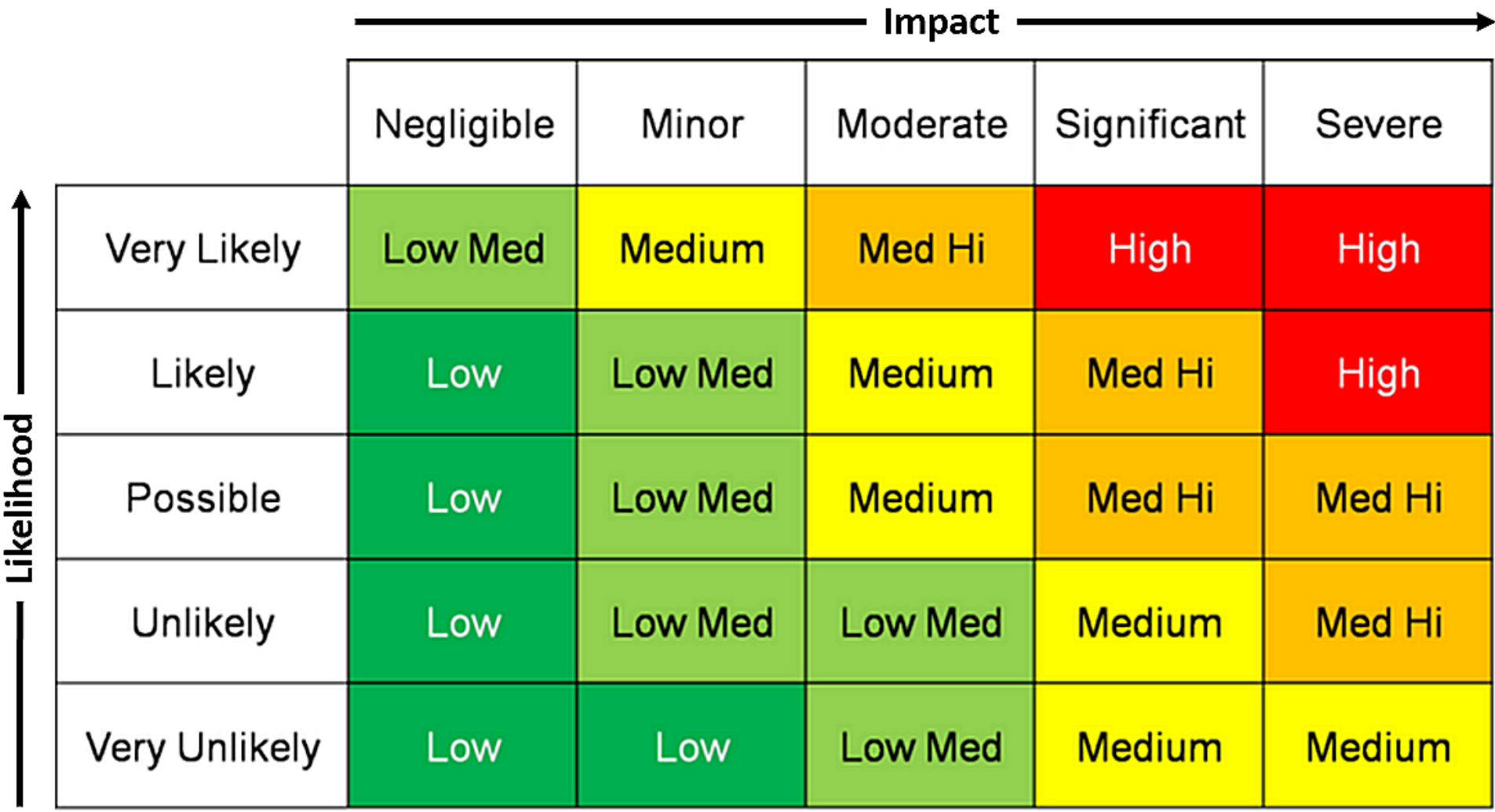
Risk is…

- The likelihood of an event multiplied by the severity of its occurrence.

High vs Low Likelihood

High vs Low Consequences

Risk Matrix


Impact
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Negligible
Minor
Moderate
Significant
Severe
Very Likely
Low Med
Medium
Med Hi
High
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Likely
Low
Low Med
Medium
Med Hi
High
Possible
Low
Low Med
Medium
Med Hi
Med Hi
Unlikely
Low
Low Med
Low Med
Medium
Med Hi
Very Unlikely
Low
Low
Low Med
Medium
Medium

What can we do about risk?

- Take steps to mitigate or reduce it
- Find a way to avoid it
- Transfer the risk to someone else
- Accept the risk

For Today

- Our focus for this class is on hazard mitigation
- We assume the project will go forward
- Other individuals are charged with transfer

Managing Risk

- A five step process
  1. Identify sources of hazards
  2. Identify your hazardous activities
  3. Develop a set of hazard statements
  4. Develop your work plan
  5. Choose control measures

1 - Identify sources of hazards

Source of hazard
Hazardous materials
Equipment/assemblies/parts
Processes (reactions, animals, growth, etc)
Environment (heights, water, confined space)
Samples / specimens
Energy release / energized equipment

2 - Identify Hazardous Activities

Hazardous activity
Mixing / blending/diluting
Transporting / moving
Milling/forming/building/heating
Testing
Collecting
Servicing
Disposing of
Storing
Observing / measuring

3 - Develop hazard statements (General Form)

A. What product, procedure will you use
B. What you are going to do with them
C. What can go wrong
D. What it will cause

3A – What are you going to use?

Source of hazard (Remember these from Step 1?)
Hazardous materials
Equipment/assemblies/parts
Processes (reactions, animals, growth, etc)
Environment (heights, water, confined space)
Samples / specimens
Energy release / energized equipment

3B – What are you going to do?

Hazardous activity (Remember these from Step 2?)
Mixing / blending/diluting
Transporting / moving
Milling/forming/building/heating
Testing
Collecting
Servicing
Disposing of
Storing
Observing / measuring

3C What Can Go Wrong?

Failure Mode
Improper handling (Dropped, broken, spilled)
Over pressurization
Launched, thrown, projected
Exposed to reactive substances (air, water, light, other chemicals)
Contact with moving parts (blades, pinch points, bits, rotating equipment)

3D What will it cause

Specific Outcome
Burns
Eye injuries
Fire
Explosion
Electrocution
Traumatic amputations
Penetrating injuries
Respiratory damage

Hazard Statement Elements

Hazardous activity	Source of hazard	Failure Mode	Specific Outcome
Mixing / blending/diluting	Hazardous materials	Improper handling (Dropped, broken, spilled)	Burns
Transporting / moving	Equipment/assemblies/parts	Over pressurization	Eye injuries
Milling/forming/building/ heating	Processes (reactions, animals, growth, etc)	Launched, thrown, projected	Fire
Testing	Environment (heights, water, confined space)	Exposed to reactive substances (air, water, light, other chemicals)	Explosion
Collecting	Samples / specimens	Contact with moving parts (blades, pinch points, bits, rotating equipment)	Electrocution
Servicing	Energy release / energized equipment		Traumatic amputations
Disposing of			Penetrating injuries
Storing			Respiratory damage
Observing / measuring			

A complete hazard statement

- We will be diluting 98% sulfuric acid to make testing samples at concentrations of 1% 2.5% and 5%. During the mixing process it is possible that the concentrated acid can be spilled on expose skin. If this happens serious burns may result.

What you will be using

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What you will be doing

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What can go wrong

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What it can cause

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Example

Activity and source of hazard (Steps 1, 2, & 3)	Work Plan (Step 4)	PPE and Protection (Step 5)
Dilute 98% sulfuric acid to render 1%, 2.5% and 5% working samples. Sulfuric acid is extremely corrosive. During handling it can come in contact with human tissue (skin, eyes, etc). If it does serious burns can result.		

4 Developing a work plan

A. Who is going to do the work
B. What the work will be done with
C. What is going to be done
D. Where the work will be done.

A Completed Work Plan

Each team of students will need a set of three, 10 liter containers, a 1 liter container of 98% sulfuric acid and a glass stir rod. The containers will be filled with 9500 ml, 9750, ml, and 9900, ml of water. Enough acid will be added to each container to make 10 liters. All work will be done in the fume hoods.

4A - Who will do the work

Each team of students will need a set of three, 10 liter containers, a 1 liter container of 98% sulfuric acid and a glass stir rod. The containers will be filled with 9500 ml, 9750, ml, and 9900, ml of water. Enough acid will be added to each container to make 10 liters. All work will be done in the fume hoods.

4B- What the work will be done with

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4C - What will be done

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4D - Where it will be done

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Choose Control Measures

- Administrative
  - Work rules, labels, policy requirements, training
- Engineering
  - ventilation, fire extinguishers, shields, machine guarding
- Work Practice
  - PPE (eye, face, hand, body, foot, and respiratory)
  - General safety practices (confined space, lock out/tag out, or arc flash protection)

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Information You Can Use

- Lab Specific Emergency Posters
- Safety Equipment
- Open Lab Policy
- Lab Safety Manual
- Chemical Hygiene Plan

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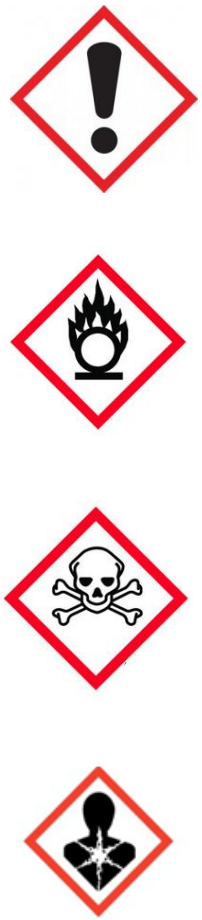

General Shop Safety Rules

- Only fully trained and competent personnel are permitted to utilize machine shop equipment and tools. The following general machine shop safety guidelines apply to general shop duties and do not serve as adequate replacement of specific shop equipment training. These guidelines must be implemented to ensure safety and health in machine shops; failure to do so may result in serious injury or death.
- Eye protection (i.e., safety glasses, goggles or face shields) is required in all shop areas, whether working or not.
- Open toed shoes, or sandals, are prohibited within machine shops. Closed toed shoes are required when in any shop area. Steel toed shoes may be required if working with heavy materials, such as metal.
- Adequate hand protection must be worn depending on the materials being handled.
- Wear appropriate clothing for the shop and task being completed
- Operation of any piece of shop equipment is not permitted unless the user is fully trained on the specific piece of equipment.
- At least two people should be present in machine shops when equipment and/or tools are in use.
- The use of compressed air to clean equipment should be minimized and only used at pressures less than 30 pounds per square inch (psi). Compressed air should never be used for cleaning clothing, hair or aimed at other persons.

Shop Equipment

- Equipment use is permitted in designated area of the shop or other pre-approved location.
- Please use adequate hand and body protection when using any piece of equipment.
- Equipment should be clean after use.

Pinch Point Hazards

- This laboratory contains mechanical equipment. While operating any piece of equipment or other moving devices tie hair back and secure loose jewelry and clothing.

General PPE

- Closed-toe shoes and lab glasses or goggles are required for all activities in this laboratory.

Emergency Information

- **If life or health is in danger, dial 911.**
- To report an accident, call Ben Swords at 423-425-2154, Karl Fletcher at 423-425-4306 , Susan at 423-425-2256, or UTC Office of Safety & Risk Management 423-425-5741.

SDS are available in notebook to left of the entrance of this laboratory. All students must undergo safety training before using this laboratory.

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GHS Labels

Oxidizers - Can burn without air, or can intensify fire in combustible materials.

Explosives - May explode if exposed to fire, heat, shock, friction.

Corrosives - May cause skin burns and permanent eye damage.

Gasses Under Pressure - Gas released may be very cold. Gas container may explode if heated.

Flammable if exposed to ignition sources, sparks, heat. Some substances may give off flammable gases.

Toxic to aquatic organisms and may cause long lasting effects in the environment.

Toxic material which may cause life threatening effects even in small amounts and with short exposure.

May cause serious and prolonged health effects on short or long term exposure.

Irritant - May cause irritation (redness, rash) or less serious toxicity

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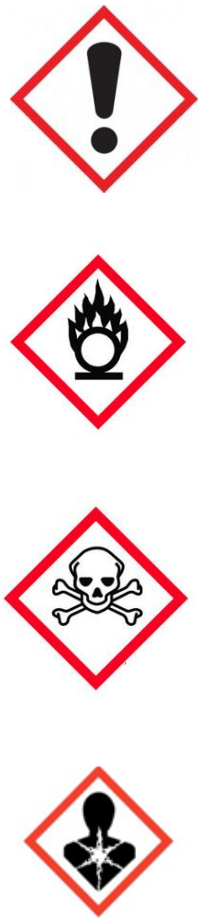

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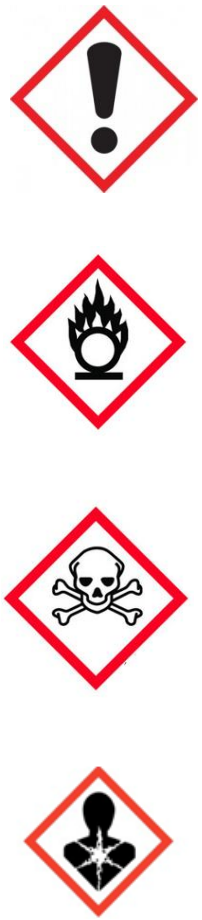

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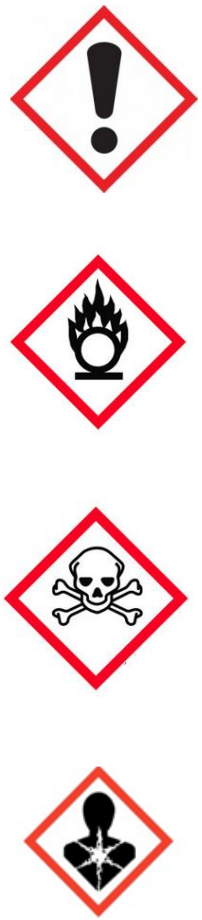

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Know Your Safety Equipment

Know Your Safety Equipment

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Open Lab Policy

- Currently enrolled students of this program ONLY
- Specific access requirements and instructions for all after hours lab work
- Minimum two persons in the lab at all times
- No unauthorized hazardous materials of any type
- If you didn’t bring it in, don’t take it out

Open Lab Policy

- Everyone MUST use their Mocs Card AND sign the log
- Keep your doors secured
- NO unauthorized persons access the lab.
- Do not conduct any activity that might be considered dangerous or in violation of university policy
- **No food, drinks or tobacco products are allowed in the labs.**
- Leave the labs neat and orderly, the University is not responsible for personal items left in the labs or classrooms.

Chemical Hygiene Plan

- Don’t bring it in if not approved
- All chemicals must be
  - In proper containers
  - Properly marked
  - Always closed unless in use
- Disposal procedures must be followed
- Additional training will be provided if needed

In class

- You may be asked to perform a risk analysis and develop a safety plan for your projects.
- The information contained here is a guideline, listen to your professor’s instructions
- Good science is safe science