City University of New York
City Tech

2023
Laboratory Safety Training

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NESHTA Master Instructor

VEOLIA

Learning Objectives

Upon completion of this section, participants will be able to:

- State the requirements of the Laboratory Standard
- Implement laboratory specific training and written protocols that identify chemical and physical hazards
- Identify Components of the Chemical Hygiene Plan including Chemical Hygiene Practices & Procedures
- Explain the importance of, and how to do, a risk assessment for chemicals/hazardous substances.
- Explain the new GHS requirements of Hazard Communication (Classification, Pictograms, Label and SDS)
- Select and utilize appropriate engineering, work practice and PPE.
- Identify Hazardous Waste
- Utilize the facilities waste disposal procedures
- Define chemical storage and transportation requirements
- State emergency procedures
- Identify the location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory.

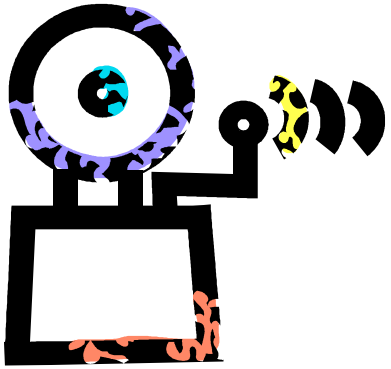
Brain Teaser

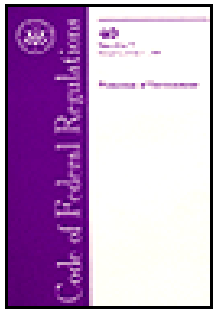
Wake up Challenge!
The classic slogan for what cereal?

"They're Gr-r-reat!"

Regulatory Requirements and Responsibility

- OSHA (29 CFR)
  - HAZWOPER
  - Laboratory Std.
  - Bloodborne Pathogen
  - PPE
- EPA (40 CFR)
  - RCRA
  - CERCLA
- DOT (49 CFR)
  - Hazardous Materials Transport





Regulatory Requirements and Responsibility

Laboratory Std. 29 CFR 1910.1450

- Laboratory Scale- work with substances in which the containers used for reactions, transfers and other handling can be easily and safely performed by one person.
- NYS PESH Program has adopted all federal OSHA standards and regulations in regards to laboratory safety with the exception of the Recordkeeping Rule, 29 CFR 1904.2
- Location of Standard:

https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450

The Culture of Laboratory Safety

- Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards: **http://www.ncbi.nlm.nih.gov/books/NBK55882/**
- Over the years, we have developed special techniques for handling chemicals safely.
- Institutions that sponsor chemical laboratories hold themselves accountable for providing safe working environments. Local, state, and federal regulations codify this accountability.
- Beyond regulation, employers and scientists also hold themselves responsible for the well-being of building occupants and the general public.

Injury, never mind martyrdom, is out of style!

Laboratory Standard –Safety Culture

- As a result of the promulgation of the OSHA Laboratory Standard, a culture of safety consciousness, accountability, organization, and education has developed in industrial, governmental, and academic laboratories.
- Safety and training programs, have been implemented to monitor the handling of chemicals from the moment they are ordered until their departure for ultimate disposal and to train laboratory personnel in safe practices.

Top 10 OSHA Citations of 2022: A Starting Point for Workplace Safety

1. Fall Protection - General Requirements (1926.501)
2. Hazard Communication (1910.1200)
3. Respiratory Protection (1910.134)
4. Ladders (1926.1053)
5. Scaffolding - General Requirements (1926.451)
6. Control of Hazardous Energy - Lockout/Tagout (1910.147)
7. Powered Industrial Trucks (1910.178)
8. Fall Protection – Training Requirements (1926.503)
9. Personal Protective and Lifesaving Equipment – Eye and Face Protection (1926.102)
10. Machine Guarding– General Requirement (1910.212)

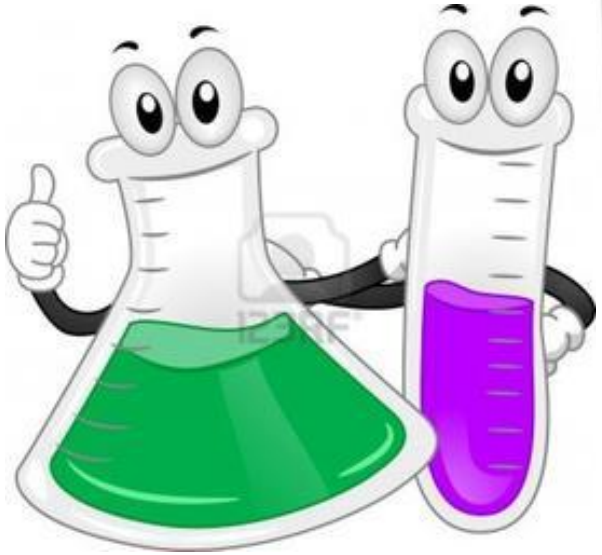
OSHA Civil Penalty Increase

OSHA penalties increased substantially and will continue to increase in the future. The 2015 Adjustment Act uniquely affects OSHA penalties because it removed OSHA's exemption from inflation-based increases. The following penalties were effective Jan. 17, 2023:

- Maximum civil penalties for "Serious," "Other-Than-Serious," "Posting Requirement," and "Failure to Abate" violations is $15,625 per violation.
- Maximum civil penalty for "Willful" or Repeated" violations is $156,259 per violation.

Preventing Lab Accidents

- The best way to prevent lab accidents is to be prepared and knowledgeable about what you are working with such as equipment, chemicals, or biological materials. Having a range of knowledge for each type or chemical/biological class of hazard you will work with is called a “working understanding” of your environment in the lab.
  - Hazard recognition and evaluation
  - Risk Assessment
  - Elimination and minimization of identified risks
  - Attention to tasks being performed



Preventing Lab Accidents

- Examples of lab accidents
  - Injuries- chemical or biological exposure, Thermal or Electrical Burns/Cuts/Other
  - Illness- Chemical or Biological exposure, chemical allergies or sensitization, repetitive trauma disorders
  - Damage/loss to equipment or facility- Fire/Explosion, work time lost to facility evacuation
  - Power failures
  - Ventilation failure/malfunction
  - Incidents/near miss situations
  - Other

University of Delaware- website incident Vacuum Flask Incident

- Researcher was performing tissue culture work. Had 4 liter vacuum flask set up on to aspirate the cell culture media off the samples.
- Flask contained a small quantity of cell culture waste and sodium hydroxide pellets had just been added to inhibit bacterial growth.
- Cotton from a pipette became lodged in the vacuum tubing. Water was aspirated in hopes of clearing the clog.
- Flask exploded sending shards of glass and liquid throughout the room. Researcher was splashed with the concentrated sodium hydroxide on the forehead just above the safety glasses. No one was cut.
- Public Safety and EHS notified

University of Delaware- website incident Vacuum Flask Incident

Upon investigation, it was determined that the water reacted with the sodium hydroxide causing an exothermic, or heat-producing, reaction. The flask being used was a standard flask; it was not designed to be used as a vacuum flask. Lessons to be learned:

- Safety glasses protect your eyes from hazardous material accidents that occur when you least expect them.
- Use a flask designated as a vacuum flask.
- Wrap a vacuum flask in tape or place it in a plastic secondary container to minimize the hazard of flying glass.
- Include pressure-relief valve in design of vacuum system to minimize the risk of pressure building too high.
- Use a disinfectant with a low hazard level. Bleach is effective for most tissue culture work. Always check the compatibility.
- Never work alone with hazardous materials. Researcher was fortunate to have someone with them to call for help.

ACS-Identifying and Evaluating Hazards in Research Laboratories

- The following factors were considered during the development of the guide:
  - To provide techniques to ensure hazard information is gathered and analyzed;
  - To aid researchers in recognizing the value of input from others with varying experiences;
  - To provide techniques that can be used for a variety of different types of activities (routine protocols, modifications to current research, or entirely new activities); and
  - To consider the variable nature of research tasks by providing tools that help researchers recognize and respond to change—both large and small.
- Guide was developed for researchers without deference to where they are in their careers.

https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/identifying-and-evaluating-hazards-in-research-laboratories.pdf

Sample Job Hazard Analysis Form

Job Title:	Job Location:	Analyst	Date
Task #	Description		
Hazard Type:	Hazard Description:		
Consequence:	Hazard Controls:		
Rational or Comment:			

- https://www.osha.gov/Publications/osha3071.pdf

CUNY
Chemical Hygiene Plan

CHO City Tech-

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Manager, Environmental, Health & Safety

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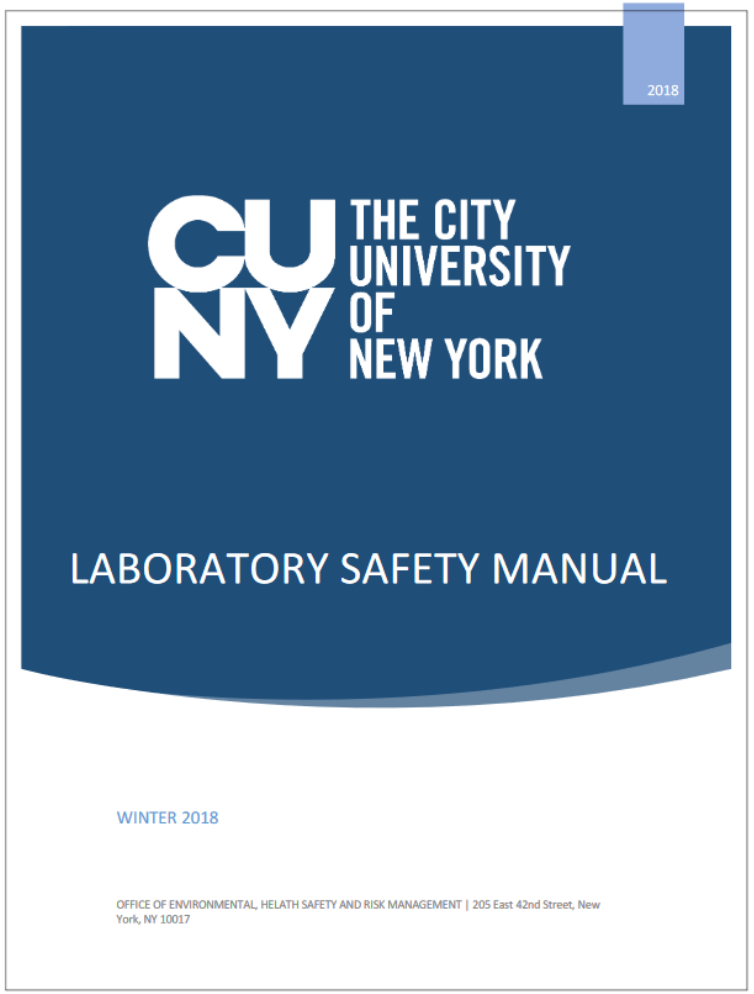
CHP located in the Laboratory Safety Manual

https://www.cuny.edu/wp-content/uploads/sites/4/page-assets/research/student-resources/laboratory-safety-manual/LAB-MANUAL-final-draft-for-committee_5-22-19.pdf



CUNY
Laboratory Safety Manual - Table of Contents

CUNY
Laboratory Safety Manual - Appendices

APPENDIX A: CHEMICAL HYGENE PLAN REQUIREMENTS

APPENDIX B: CONTACT LIST

APPENDIX C: LABORATORY SAFETY RESPONSIBILITIES

APPENDIX D: STANDARD OPERATING PROCEDURES (SOPS) - RESOURCES

APPENDIX E: LABORATORY MOVE GUIDE

APPENDIX F: GLOVE SELECTION FOR SPECIFIC CHEMICALS

APPENDIX G: LABORATORY SELF-INSPECTION CHECKLIST

APPENDIX H: HOW TO UNDERSTAND AN SDS

APPENDIX I: HAZARDS OF FUNCTIONAL GROUPS

APPENDIX J: PEROXIDE FORMING CHEMICALS

APPENDIX K: INCOMPATIBLE CHEMICALS

APPENDIX L: CHEMICAL SEGRATION SCHEME AND LIMITS

APPENDIX M: SAMPLE PRIOR APPROVAL FORM

APPENDIX N: WASTE DETERMINATION/LABELING GUIDE

APPENDIX O: FUME HOODS

APPENDIX P: FIRE EXTINGUISHERS TESTING AND INSPECTIONS

APPENDIX Q: MACHINE SHOP GUIDANCE

APPENDIX R: LABORATORY SPECIFIC WORKING ALONE PROTOCOL APPROVAL

APPENDIX S: OVERVIEW OF HAZARDOUS WASTE DISPOSAL PROCEDURE

APPENDIX T: FIRE SAFETY IN LABS

APPENDIX U: GUIDELINES FOR CHEMICAL STORAGE

APPENDIX V: LABORATORY HAZARD ASSESSMENT TOOL

APPENDIX W: DRY ICE SHIPPING PROTOCOL

APPENDIX X: LABORATORY SAFETY REFERENCE LIBRARY

Responsibility

- **Chemical Hygiene Officer (CHO)-**Facilitate the implementation of the campus CHP and Laboratory Safety Manual across campus labs and facilities. Serves as a technical resource to the campus laboratory community.
- **Deans, Directors, and Department Chairpersons -** Responsible for maintaining compliance within Departments
- **Principal Investigators (P.I.s), Faculty, and Laboratory Supervisors-**overall responsibility for compliance in their laboratory. This includes appropriate oversite of laboratory operations.
- **Laboratory Employees**
- **Facilities Management**

Employee Information and Training

- **Responsibility of PI and laboratory supervisors to ensure that personnel working in laboratories under their control are familiar with the contents and location of the Chemical Hygiene Plan including**:
  - Laboratory specific standard operating procedures
  - Department or college level laboratory safety manuals, policies, and procedures
- **Employee Information and Training (Appendix A and Section 6)**
  - Employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area
  - Initial assignment and prior to assignments involving new exposure situations.
  - Frequency of refresher determined by the employer

Responsibility

Laboratory Workers

- Know and follow procedures in CHP
- Practice Safe Chemical Hygiene
  - PPE
  - Knowledge of hazardous materials and equipment
- Report unsafe conditions
- Report exposures & injuries promptly
- Emergency Procedures

HAZCOM

- A common, coherent approach to classifying and communicating chemical hazards.
  - Harmonized definitions of hazards
  - Specific criteria for labels
  - Harmonized format for safety data sheets

PHYSICAL HAZARDS

Hazard Class	Hazard Category						
Explosives	Unstable Explosives	Div 1.1	Div 1.2	Div 1.3	Div 1.4	Div 1.5	Div 1.6
Flammable Gases	1	2					
Flammable Aerosols	1	2					
Oxidizing Gases	1						
Gases under Pressure **Compressed Gases** **Liquefied Gases** **Refrigerated Liquefied Gases** **Dissolved Gases**	1						
Flammable Liquids	1	2	3	4			
Flammable Solids	1	2					
Self-Reactive Chemicals	Type A	Type B	Type C	Type D	Type E	Type F	Type G
Pyrophoric Liquids	1						
Pyrophoric Solid	1						
Pyrophoric Gases	Single category						
Self-heating Chemicals	1	2					
Chemicals, which in contact with water, emit flammable gases	1	2	3				
Oxidizing Liquids	1	2	3				
Oxidizing Solids	1	2	3				
Organic Peroxides	Type A	Type B	Type C	Type D	Type E	Type F	Type G
Corrosive to Metals	1						
Combustible Dusts	Single category						

HEALTH HAZARDS

Hazard Class	Hazard Category			
Acute Toxicity	1	2	3	4
Skin Corrosion/ Irritation	1A	1B	1C	2
Serious Eye Damage/ Eye Irritation	1	2A	2B	
Respiratory or Skin Sensitization	1			
Germ Cell Mutagenicity	1A	1B	2	
Carcinogenicity	1A	1B	2	
Reproductive Toxicity	1A	1B	2	Lactation
STOT – Single Exposure	1	2	3	
STOT – Repeated Exposure	1	2		
Aspiration	1			
Simple Asphyxiants	Single Category			

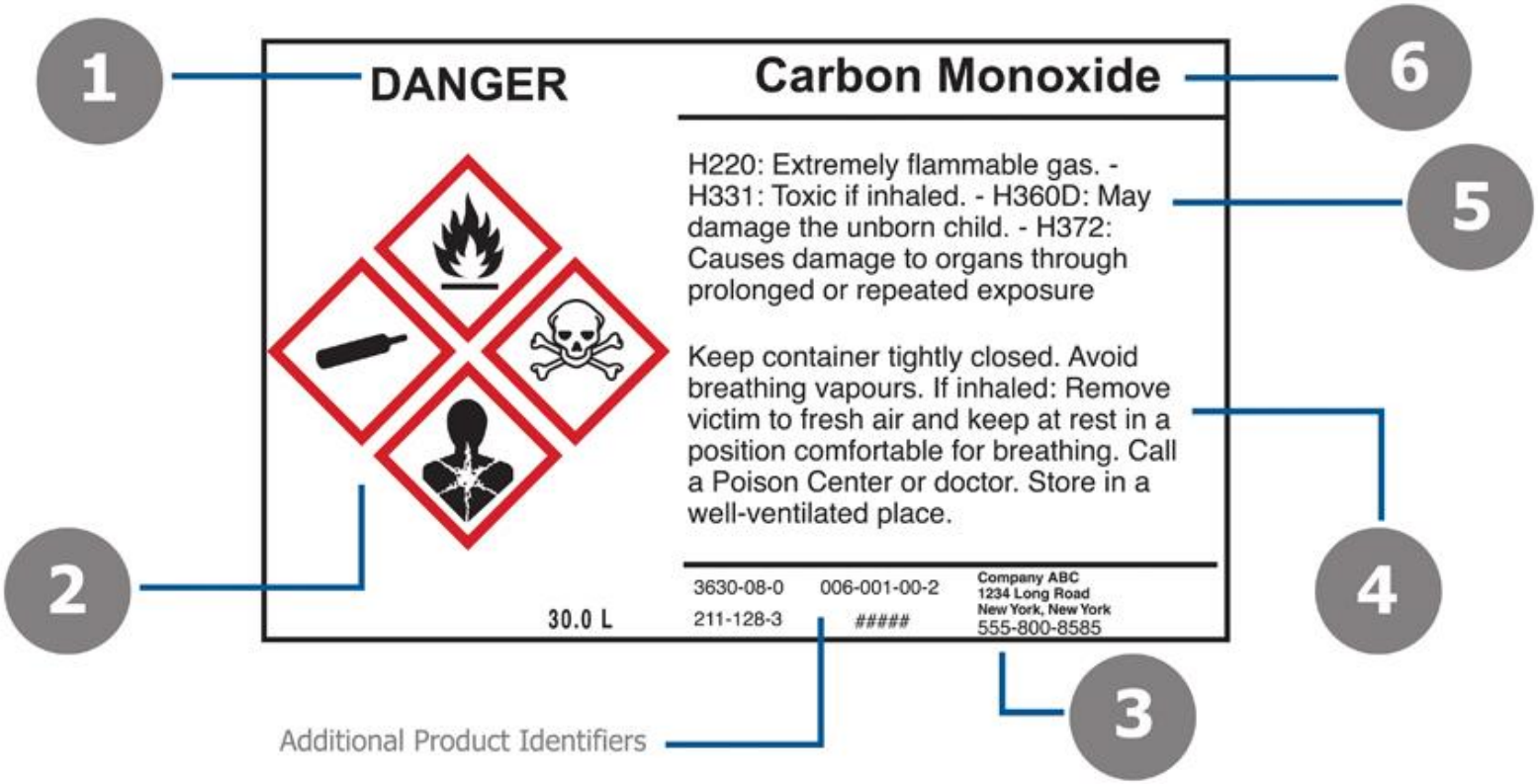
Question

Which pictogram represents an **acute toxicity (severe) hazard?**

PICTOGRAMS

Flame over circle	Flame	Exploding bomb
		
• Oxidizers	• Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self Reactives • Organic Peroxides	• Explosives • Self Reactives • Organic Peroxides
Skull and crossbones	**Corrosion**	**Gas cylinder**
		
• Acute toxicity (severe)	• Corrosives	• Gases under pressure
Health Hazard	**Environment**	**Exclamation mark**
		
• Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	• Aquatic Toxicity	• Irritant • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic effects • Respiratory Tract Irritation • Hazardous to Ozone Layer

GHS LABEL


1
DANGER
Carbon Monoxide
6
H220: Extremely flammable gas. - H331: Toxic if inhaled. - H360D: May damage the unborn child. - H372: Causes damage to organs through prolonged or repeated exposure
5
Keep container tightly closed. Avoid breathing vapours. If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a Poison Center or doctor. Store in a well-ventilated place.
4
2
30.0 L
3630-08-0
211-128-3
006-001-00-2
#####
Company ABC
1234 Long Road
New York, New York
555-800-8585
3
Additional Product Identifiers

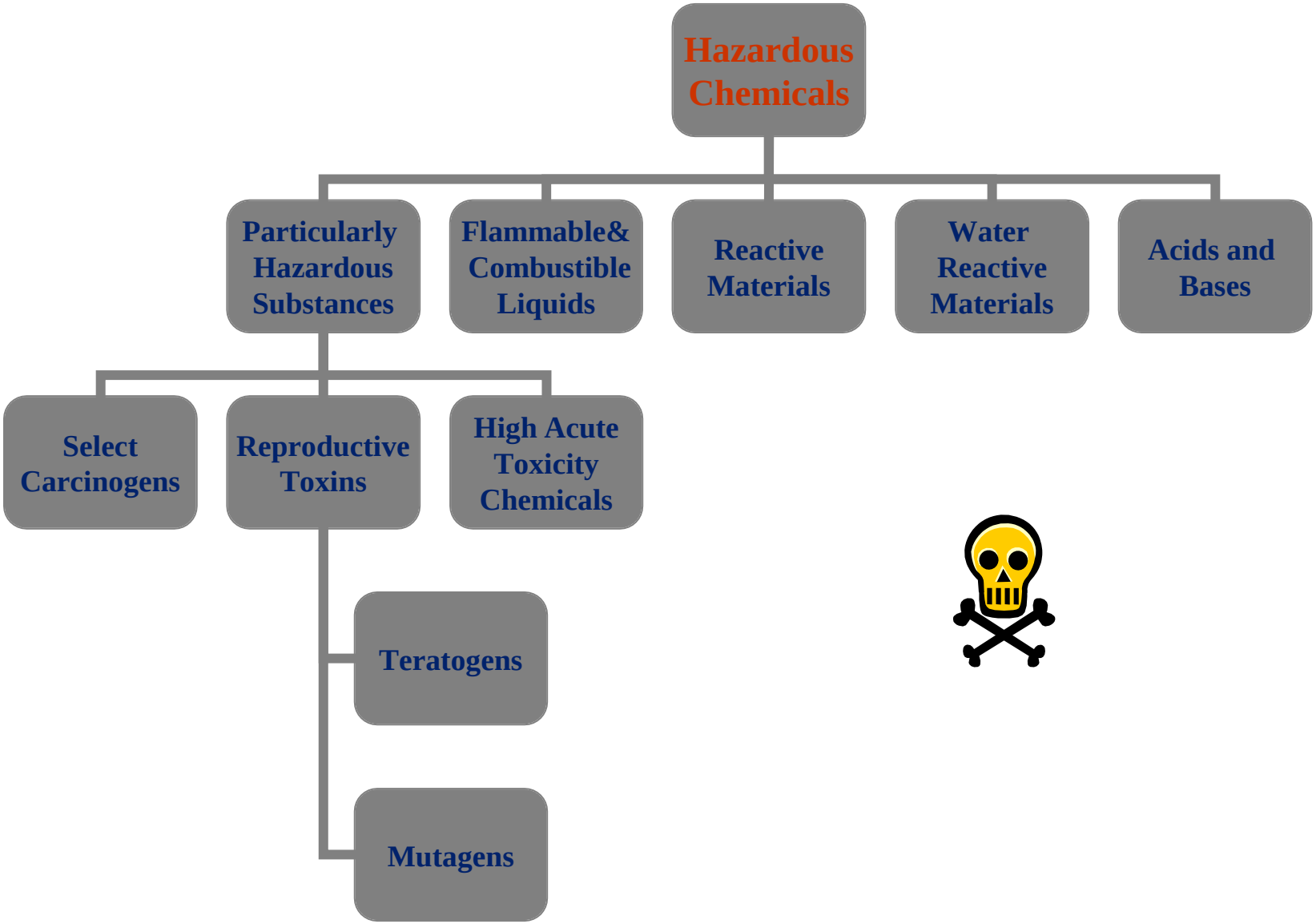
16-Section Safety Data Sheet

1. Identification of the substance or mixture and of the supplier
2. Hazards identification
3. Composition/information on ingredients Substance/Mixture
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological
12. *Ecological information (non mandatory)*
13. *Disposal considerations (non mandatory)*
14. *Transport information (non mandatory)*
15. *Regulatory information (non mandatory)*
16. Other information including information on preparation and revision of the SDS

Hazard Identification
Safety Data Sheets (SDS)

- Section 7 – CUNY Lab Safety Manual
- Chemical shipment received should have SDS
- Check the chemical manufacturer's website first, call the manufacturer directly, or contact your EHSO.
- Questions regarding how to read an SDS, or questions about the terminology or data used, contact your EHS Office. See Appendix H
- SDSs accessible at all times. Produce within 5 min.
- Strongly encouraged to keep paper copies of SDSs in the laboratory.
- Bookmarking SDS websites acceptable as long as all employees are trained to use the computers and know where to find the SDSs.

Hazardous Chemicals Flow Chart



Reactive Substances

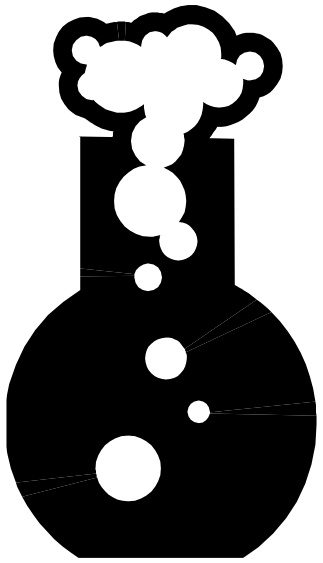
Solids, liquids or gases that will vigorously:

- Polymerize,
- Decompose,
- Combine, or
- Become self-reactive under conditions of shock, pressure or temperature.

These include peroxide forming, water reactive and pyrophoric materials.

Key Controls for Peroxide Forming/Time-Sensitive Substances

- Substitute whenever possible.
- Purchase minimum amounts.
- **Date stamp upon receipt and upon opening**.
- Monitor and dispose within the recommended time limits.
- Use engineering controls.
- Use appropriate PPE.
- Separate incompatible chemicals.
- CUNY Lab Safety Manual -Appendix J



Key Controls for Peroxide Forming Substances

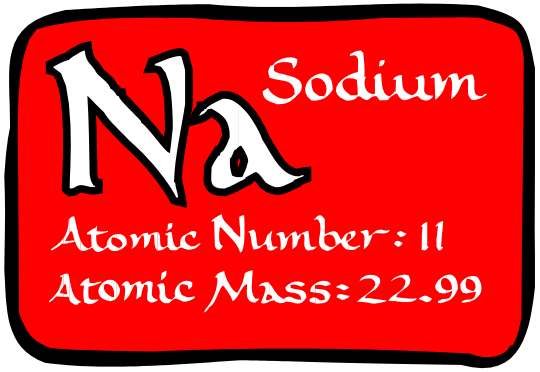
- **Never <u>open</u> or move a container with evidence of visible peroxide formation** (e.g., crystal formation around the lid or in the liquid, visible discoloration, liquid separation, cloudiness).
- **Peroxides/crystals can also concentrate in the cap threads of the container. Do Not open.**

Key Controls for Pyrophoric Substances

- Review the hazards of the material and assess the conditions under which it will be used.
- Identify and use safer chemical alternatives if possible.
- Limit the amount purchased.
- Track the use
- Keep working quantities to a minimum. Store properly and use the minimum for the operation. Then dispose of the excess.
- Do not stockpile pyrophoric chemicals.
- Conduct periodic cleanouts to prevent accumulating unneeded pyrophoric chemicals.

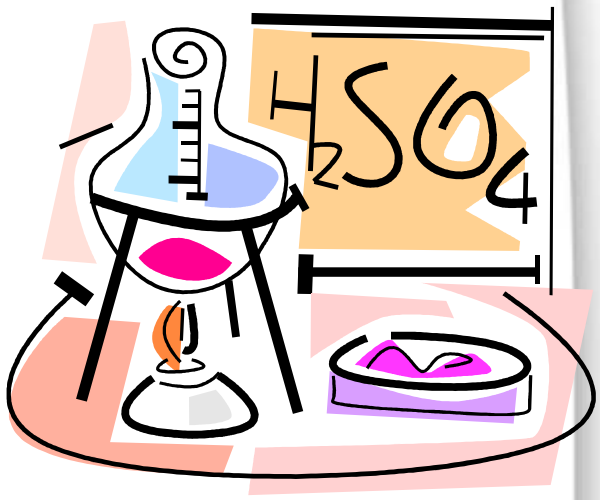
Key Controls for Water Reactive Substances

- Substitute if possible.
- Handle in an inert, dry atmosphere or under mineral oil (alkali metals).
- Expect a hydrogen build-up in storage containers.
- Separate from incompatible chemicals.
- PPE and Extinguisher, Class D metal fire extinguisher available when working with alkali metals.



Key Controls for Acids and Bases

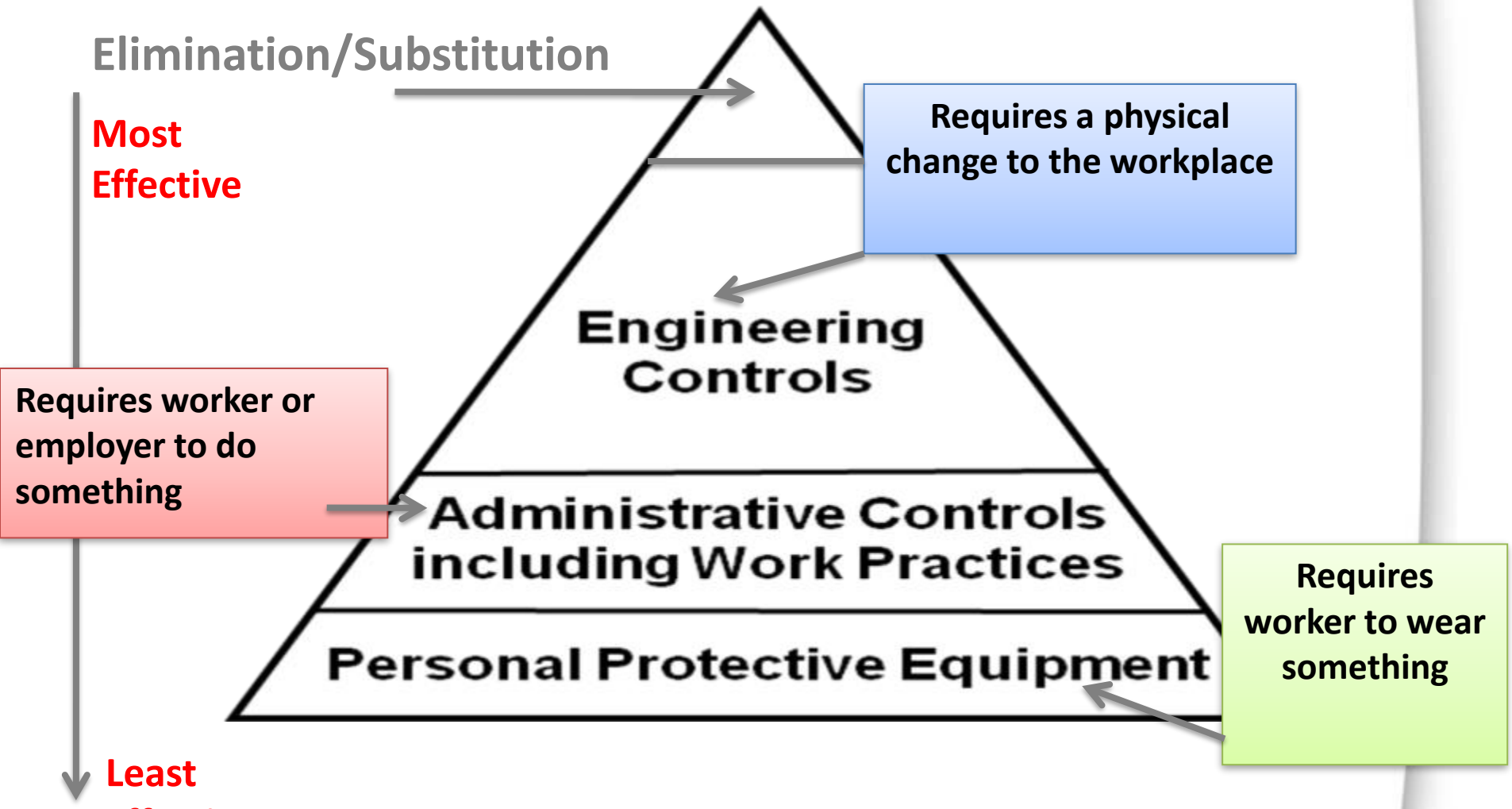
- Use less toxic or non-oxidizing acid when possible.
- Use safety carriers to transport.
- Use appropriate ventilation to remove vapors and liberated toxic or flammable gases.
- Perchloric acid vapors may generate explosive perchlorates.
- Use additional PPE, including goggles, face shield, acid resistant gloves and apron.
- Awareness of special precautions for some corrosives like Hydrofluoric Acid (has not been used at SJU University City campus for years)



General Principles

- Prudent to minimize all chemical exposures
- Avoid underestimation of risk
- Provide adequate ventilation
- Institute chemical hygiene program
- Observe PEL and TLV

Hierarchy of Controls



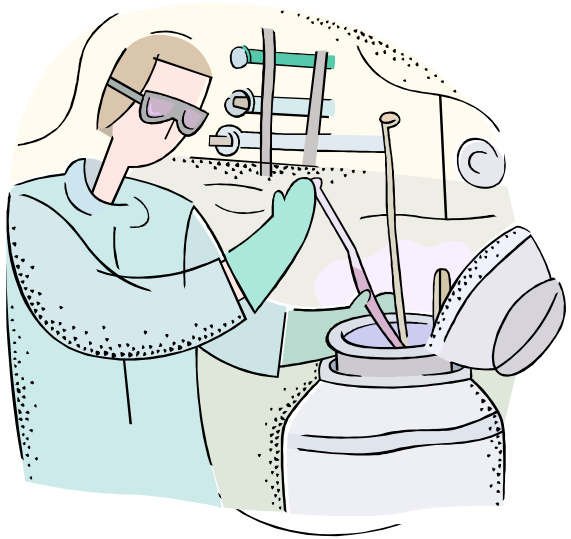
Question

Removing flammable material from an area with ignition sources would be an example of what control measure?

1. Elimination
2. Substitution
3. Administrative
4. Engineering

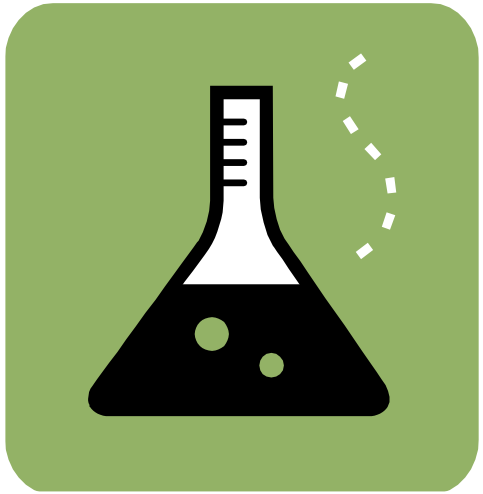
Safe Chemical Use

- Know physical and health hazards
- Read the label, SDS and other appropriate sources before using a chemical
- Review the appropriate Standard Operating Procedure from CHP & laboratory
- After the potential hazards associated with the substances and the experimental processes are evaluated, you can modify work procedures so that laboratory hazards are minimized or eliminated.



CUNY Section 7-Safe Chemical Use

- Safe chemical use includes minimizing exposure to chemicals and proper training understanding chemical hazards.
- Encompasses proper labeling, storage and segregation, transport and disposal



CUNY Section 7-Safe Chemical Use

To minimize chemical exposure the following guidelines should be implemented where applicable:

- Do not underestimate the risk of exposure to chemicals, even for substances of no known significant hazard.
- Substitute less hazardous chemicals in experiments
- Always use the smallest possible quantity of chemical for all experiments and consider microscale experiments
- Minimize chemical exposures for all potential routes of entry (inhalation, ingestion, skin and eye absorption, and injection) through proper use of engineering controls and personal protective equipment

CUNY Section 7-Safe Chemical Use

- Be sure to select the proper PPE and regularly inspect it
- Do not pipette or apply suction by mouth
- Do not smell or taste chemicals. When it is necessary to identify a chemical's odor, hold the chemical container away from the face and gently waft a hand over the container without inhaling large quantities of chemical vapor.

CUNY Section 7-Safe Chemical Use

- To identify potential hazards, laboratory personnel should plan experiments in advance. These plans should include specific measures that will be taken to minimize exposure, proper positioning of equipment, and organization of dry runs.
- Chemicals that are particularly hazardous substances require prior approval from your supervisor and special precautions must be taken.
- When working with mixtures of chemicals, laboratory personnel should assume the mixture is more toxic than the most toxic component in the mixture.
- Consider all substances of unknown toxicity to be toxic until proven otherwise.
- Request exposure monitoring to ensure that the Permissible Exposure Limits (PELs) of OSHA and the current Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists are not exceeded.

CUNY Section 7-Safe Chemical Use

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Housekeeping

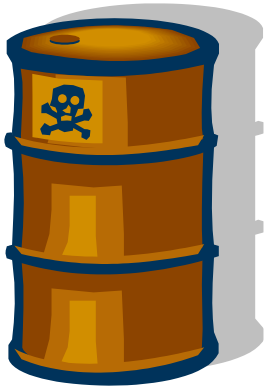
- Housekeeping
  - Lab benches keep clear except for necessary to work.
  - Clean at end of shift
  - Unobstructed: aisles, safety equipment, electrical disconnects.
  - Chemical labeling and storage requirements
- Equipment Maintenance
  - good working order
  - calibrated

Engineering Controls

- General ventilation
  - Design
    - →(air change 4-12 times per hour)
    - →Lab Negative air pressure
  - Maintenance
    - →Quality
    - →Once through air
    - →Inspection schedule
- Local exhaust ventilation-opening close as possible to source

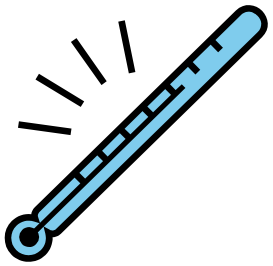
Engineering Controls

- Laboratory Exhaust Hood
- Point source ventilation
- Flammable Storage Cabinets-NFPA approved, keep closed properly, compatibility
- Isolators



Engineering Controls

- Laboratory Equipment
  - Use for intended purpose
  - Glassware handle to minimize breakage
  - Inspected & Maintained
- Systems under pressure
- Cold Room
- Thermometers
- Electrical



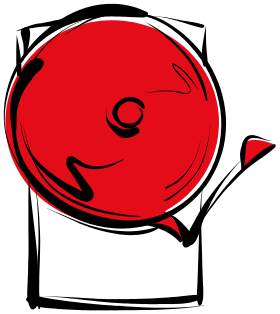
- Heating Devices-do not leave open heat sources unattended,

  safer controls with safety shut offs.
- Centrifuges-physical and hazardous material hazard
  - Tubes
  - Carrier Cups and rotors
  - Ultracentrifuge

Hot Plate Malfunctions and Misuse
Penn EHRS

- Several incidents and near misses involving hot plates have been reported at Penn and at other research institutions.
- Cause of each incident was either electronic malfunction or user error.
- **January 2021:** A post-doc used a combination heat-stir plate to stir a western blot transfer in a cold room overnight. A few hours later, the reservoir melted and caught fire because of an electronic failure or because the researcher did not notice that the heating function was turned on.

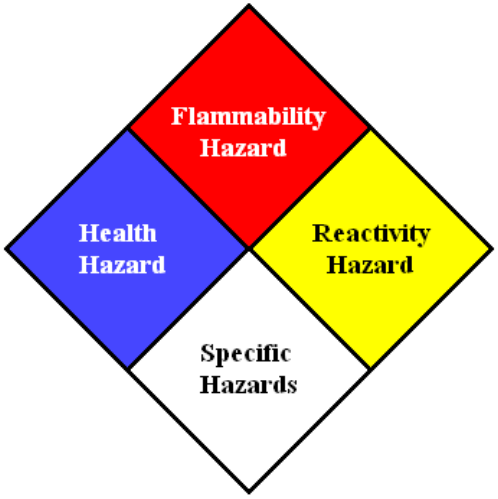
Hazard Identification

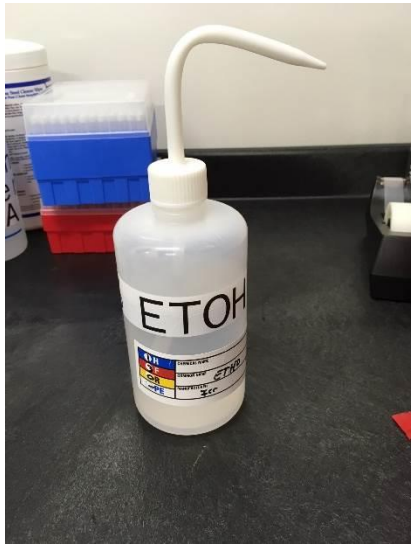


- Emergency telephone numbers
- Identity labels-contents of containers, hazard warnings, including waste receptacles.
- Location signs-safety equipment, exits, first aid equipment
- Warnings at areas or equipment where special or unusual hazards exist

Hazard Identification - Labeling

- Chemical manufacturer, importer or distributor shipped chemicals
  - GHS
- Employer
  - Identity
  - Hazard warning (words, symbols, pictures)
- Examples
  - GHS
  - NFPA
  - DOT
  - HMIS

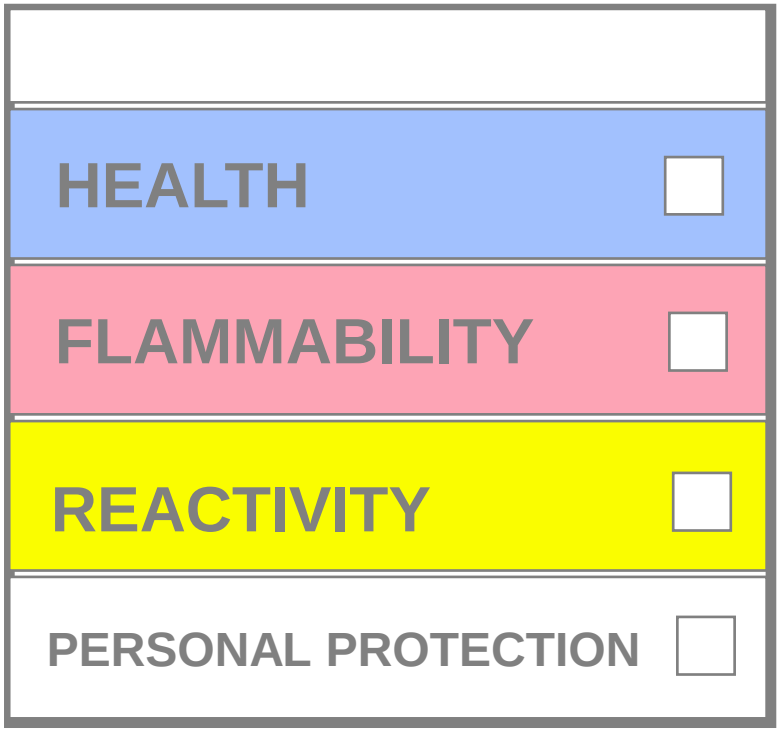




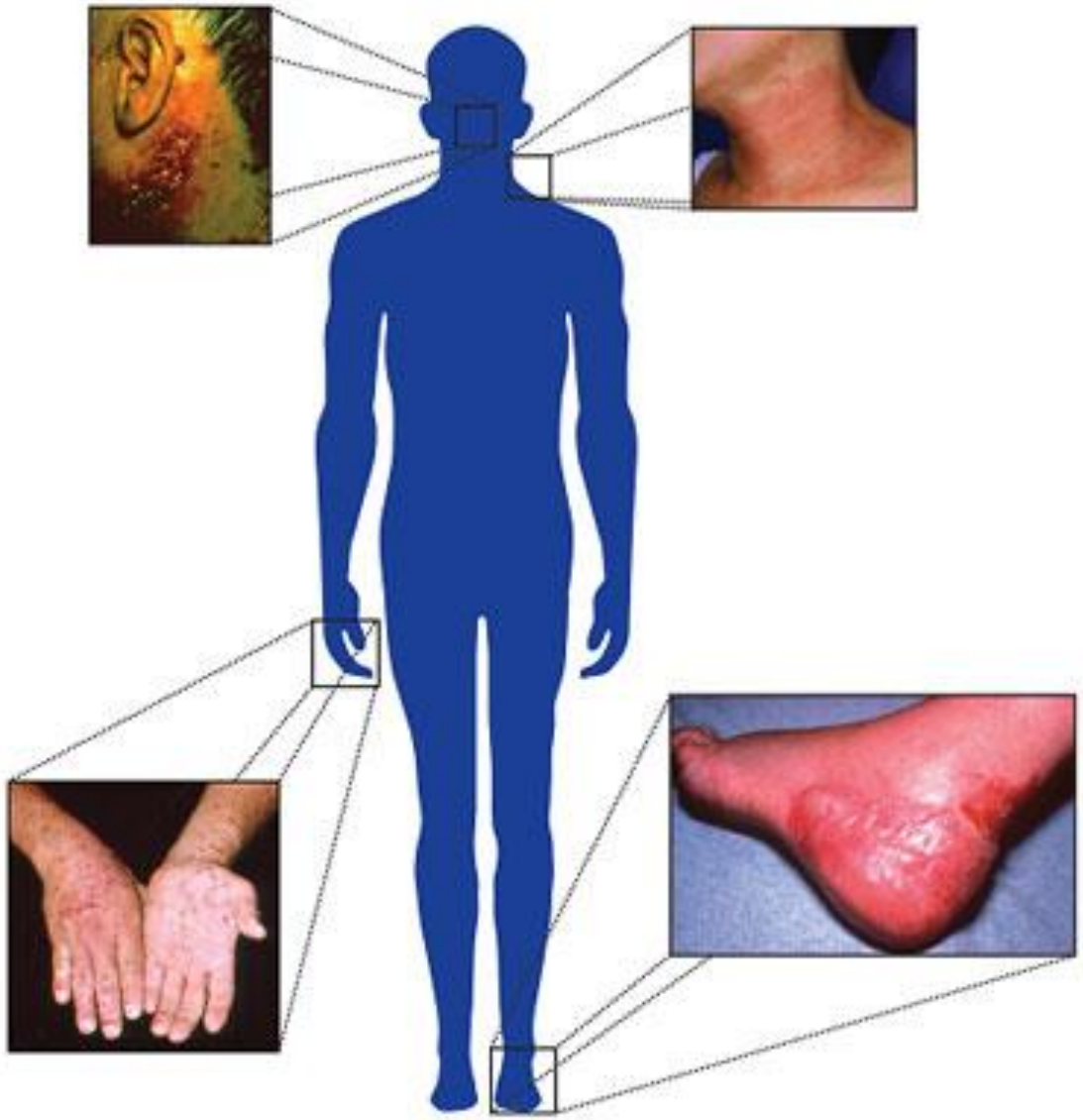
HMIS LABEL

FIVE HMIS HAZARD LEVELS

- ☑ - 4 SEVERE
- ☑ - 3 SERIOUS
- ☑ - 2 MODERATE
- ☑ - 1 SLIGHT
- ☑ - 0 MINIMAL



Chemical Exposure



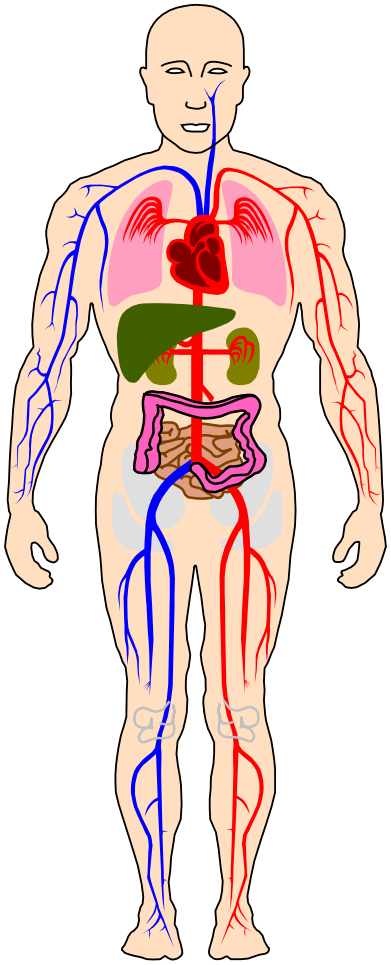
ROUTES OF EXPOSURE

?

Ingestion

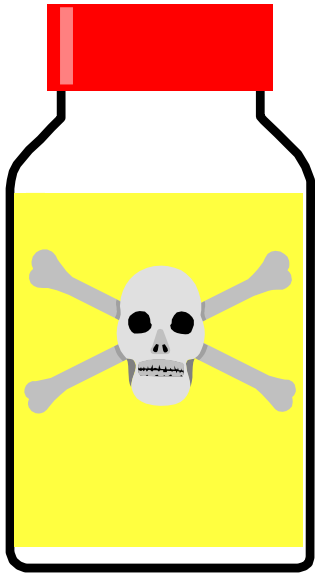
absorption

Injection



TOXIC EFFECT =

- Dose +
- Length of Exposure +
- Individual Susceptibility



Question

Results after repeated low exposures over a typically long period of time.

1. Systemic effect
2. Acute effect
3. Chronic effect

Effects of Overexposure

- Acute Effect
  - occurs almost immediately
- Chronic Effect
  - results after repeated exposures over a typically long period of time
- Local Effect
  - felt at or near the point of contact
- Systemic Effect
  - requires the intake and distribution of the chemical within the body, felt in a system or part of the body away from the point of contact.

PPE
CUNY Lab Safety Manual –Section 3

- Compatible with the required degree of protection for substances being handled
- Appropriate PPE will be provided to employees and visitors
- Hazard Assessment
  - Check SDS
  - Other Reference material glove guides and charts
  - Check with Supervisor/CHO

What are some of the causes of eye injuries?

- Dust and other flying particles, such as metal shavings or sawdust
- Molten metal that might splash
- Acids and other caustic liquid chemicals that might splash
- Blood and other potentially infectious body fluids that might splash, spray, or splatter
- Intense light such as that created by welding and lasers

Types of PPE

- Eye and face protection – must comply with
  - ANSI Z87.1-2003, or
  - ANSI Z87.1-1989 (R-1998)
- Used to protect against moderate impacts from particles

Source: OSHA

Types of PPE

- Goggles
  - Protect eyes, and the facial area immediately surrounding the eyes from impact, dust, splashes.
  - Some can be used over corrective lenses, if they fit them.

Source: OSHA

Types of PPE

- Face shields
  - Protect face from nuisance dusts and potential splashes or sprays of hazardous liquids
  - Shields do not protect from impact hazards unless so rated
  - Shields are for face protection, not eye protection. To protect the eyes, wear safety glasses with side shields, or goggles under the face shield.

Source: OSHA

Types of PPE

- Laser safety goggles
  - Provide protection from hazards:
    - → physical contact such as flying particles
    - → ultraviolet light, laser, and welding

Source: OSHA

Types of PPE

Hearing Protection:

Exposure to excessive noise depends upon several factors:

- How loud is the noise as measured in decibels (dBA)?
- What is the duration of each employee's exposure to noise?
- Do employees move between separate work areas with different noise levels?
- Is noise generated from one source or multiple sources?

Generally, the louder the noise, the shorter the exposure time before you must provide hearing protection.

What are some of the hand injuries you need to guard against?

- Burns
- Bruises
- Abrasions
- Cuts
- Punctures
- Fractures
- Amputations
- Chemical Exposures
- CUNY Lab Safety Manual – Appendix F

Types of PPE

- Types of gloves

Anti-vibration

Chemical-resistant

Leather Palm

Permeation-resistant

Heat-resistant

Cut-resistant

Source of photos: OSHA

Question

Amount of time from the initial chemical contact with the material of glove until the chemical Is detected inside of the glove?

1. Flow Time
2. Permeation Time
3. Breakthrough Time

Types of PPE

Foot and leg protection:

Source: OSHA

- Causes of foot injuries:
  - Falling or rolling of heavy objects
  - Crushing or penetrating materials
  - Sharp objects that can penetrate the sole
  - Exposure to molten metal
  - Working on, or around, hot, wet, or slippery surfaces
  - Working when electrical hazards are present.

Respirators

- Employer Respiratory Protection Program
- When respirator use is required, a program must be followed that includes:
  - Medical Clearance,
  - Respirator use training,
  - Respirator fit testing,
- Respirators *DO NOT* eliminate the need for good work practices and engineering controls (ventilation, fume hoods).

SIGNS AND SYMPTOMS

- Hazardous Materials Spill/Release Signs & Symptoms
  - Eye Irritation
  - Odors
  - Persistent Illness
  - Visible Dust
  - Chemical Spills
  - Noise
  - Sight
  - Sounds

Incidental Release

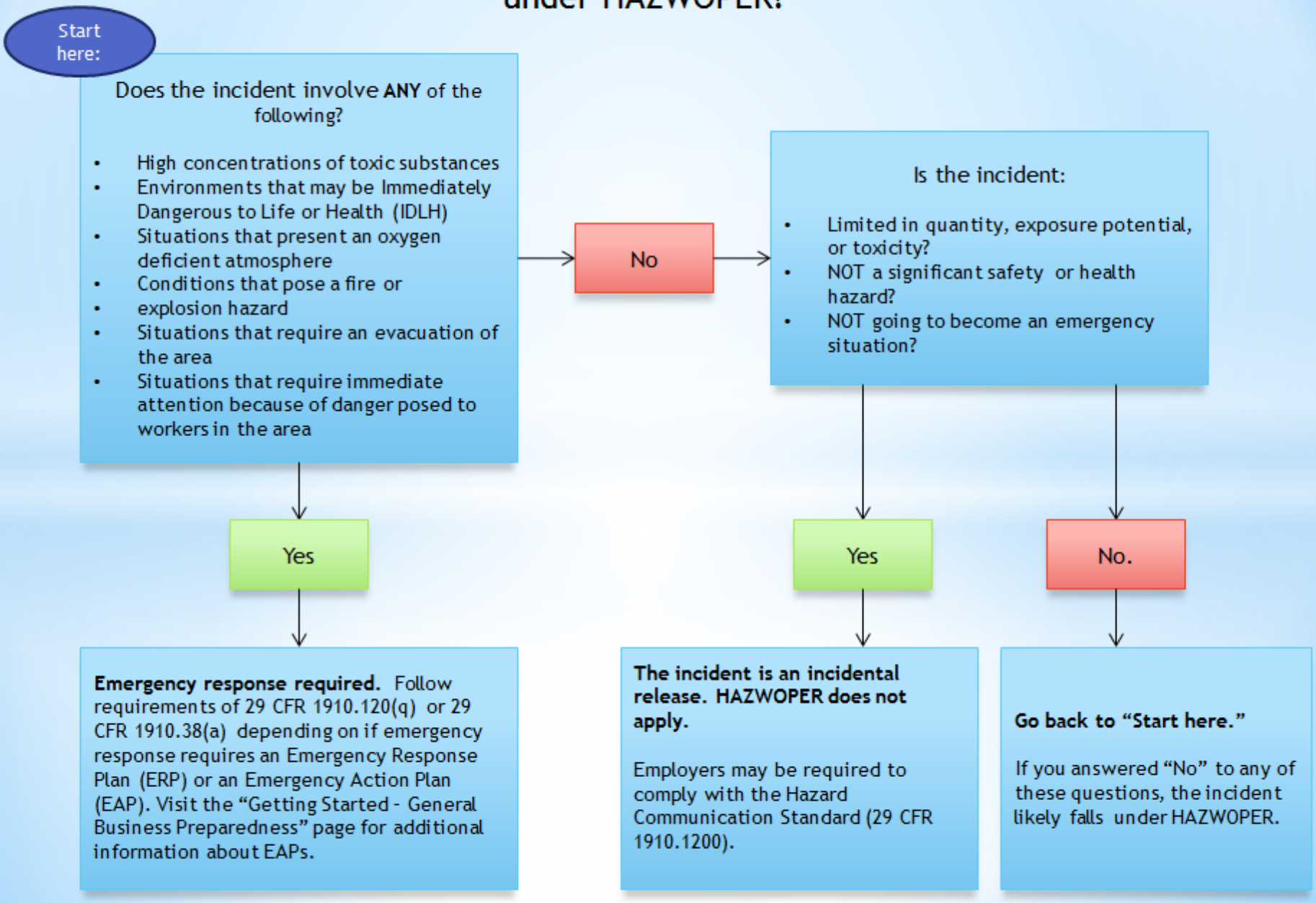
- Hazardous substances that are in the work area and stored in very small quantities the risks of having a release that escalates into an emergency are minimal.
  - Laboratory which handles amounts in pint sizes down to test tubes, and the hazardous substances do not pose a significant safety and health threat at that volume
  - Incidental releases will generally be the norm and employees will be trained to protect themselves in handling incidental releases per the training requirements of the Hazard Communication standard (29 CFR 1910.1200).

Incidental Release Response

Clean-up Procedures

1. Limit access to the spill so that unsuspecting persons do not inadvertently encounter spilled material and contaminate themselves or spread the spilled material beyond the immediate spill area.
2. Don the appropriate personal protective equipment
3. Control further release and spread of material. Right containers and placing absorbent or other diking material around the spill to prevent the spread of the spill.
4. Absorb any free liquid. The appropriate absorbent will vary with the different chemicals.
5. Neutralize the spill or suppress flammable vapors to reduce the hazard whenever possible.
6. Be careful not to get cut by broken glass during the clean-up process. Use tongs to pick-up the broken glass.
7. Neutralize any remaining residues and decontaminate the area.
8. The final step is to inspect the area for spill residue, hidden contamination, or other unsafe conditions.
9. Waste Management Procedures

Is an incident an emergency response or incidental release under HAZWOPER?



Emergency Preparedness
CUNY Lab Safety Manual – Section 5

- **Written Emergency Plan established and communicated**
- **Alarm system**
- **Spill control policy- prevention, containment, cleanup, and reporting**
- **All accidents or near accidents should be carefully analyzed with the results distributed to all who may benefit**

Emergency Response

- General Actions for all emergencies:
  - Protect Yourself
  - Communicate
  - Respond

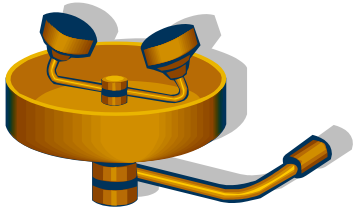
CUNY City Tech
What to do in case of emergency?

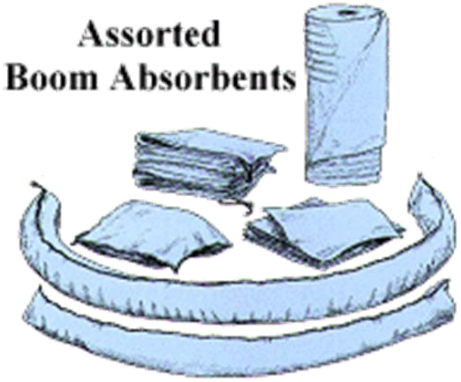
- To reach the Department of Public Safety Dispatcher **Dial 5555** from any on-campus telephone. Otherwise, dial **718-260-5555**.
- To reach a New York City Police/Fire Department Operator: From a campus telephone, dial 9-911. Otherwise, dial **9-1-1**.
- https://www.citytech.cuny.edu/public-safety/emergency.aspx

CUNY City Tech
What to do in case of emergency?

- Notify the Public Safety or Police/Fire Dispatcher that you are reporting an emergency by saying: **"This is an emergency."**
  - State the nature of emergency.
  - Provide the number from which you are calling.
  - Provide the location of the emergency.
  - Unless there is an immediate threat to you, do not hang up until instructed to do so.
- It is important to know how you should react in an active shooter situation active shooter video.

Emergency Equipment
KEEP AREA CLEAR



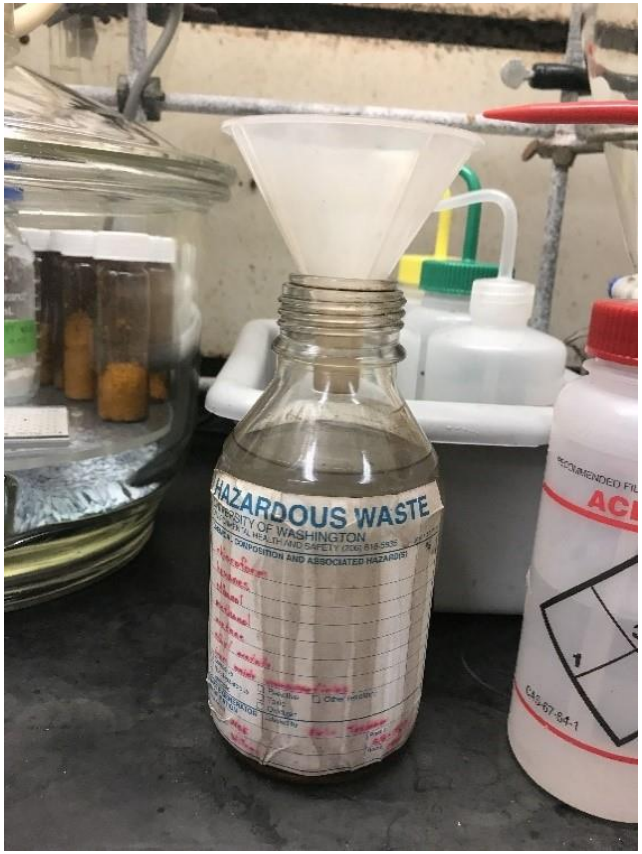


- Fire Extinguishers
- Emergency Showers
- Emergency Eyewash Stations
- First Aid Kit
- Things to Know (Lets Discuss):

1. **Location**
2. **Access**
3. **Use**
4. **Inspection**

Chemical Waste Container Explosion

- August 2017
- EHS staff were notified of a chemical spill on during which a waste bottle ruptured in secondary containment bin, spilling about 3 liters of liquid.
- Lab was evacuated and a hazardous material team cleaned up the chemicals and shattered glass.
- 4 liter glass bottle reportedly contained a mixture of organic solvents.
- Waste label was incomplete and the actual contents were unknown.



https://www.ehs.washington.edu/about/latest-news/chemical-waste-container-explosion-lessons-learned

80

Chemical Waste Container Explosion

Event highlights some key guidelines to follow for hazardous waste accumulation:

- Don’t place incompatible chemicals together in a waste bottle.
- Use appropriate containers that are compatible with the contents.
- Properly Label your waste containers before you begin accumulating in them
- Waste containers should remain closed at all times except when adding waste.
- Don’t overfill waste containers. Bottles should be no more than ¾ full to allow for vapor headspace and prevent over-pressurization accidents.
- Use secondary containment bins for waste containers, and especially if they are stored on the floor or near a drain.

81

Waste Disposal - Categories

- Solid Waste/trash (Municipal)
- Recyclable
- Biohazardous
- Hazardous
- Radioactive

All employees generating wastes shall properly segregate, package and identify wastes

Waste Disposal
Hazardous Waste

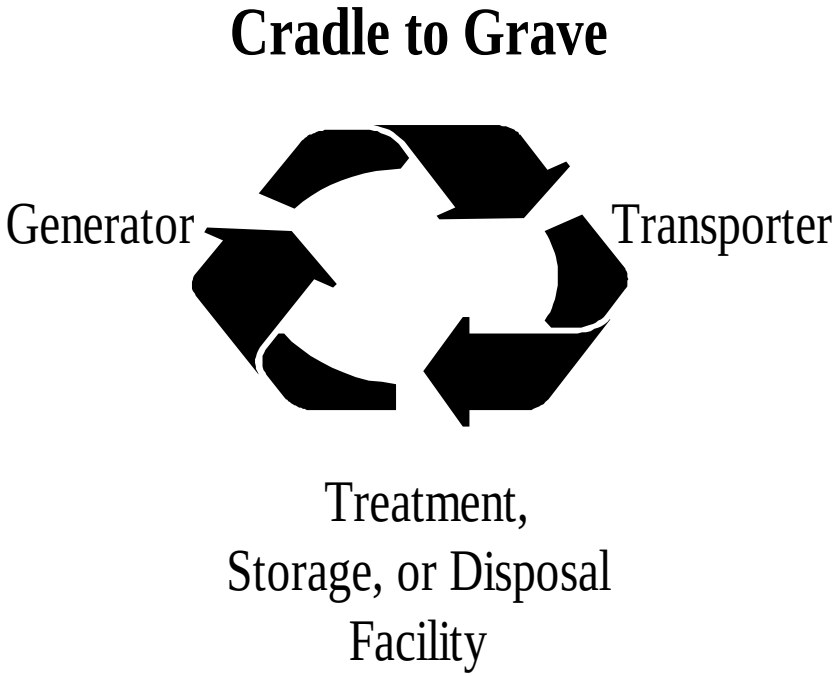
- Environmental Protection Agency (EPA) 40CFR 260-272
- 1976 Resource Conservation and Recovery Act (RCRA) - Cradle to Grave “system of governing hazardous waste
- 1984 Hazardous and Solid Waste Amendments (HSWA) -waste minimization and landfill bans
- New York State (NYS) Environmental Conservation Law passed in 1978 and is enforced by the NYS Department of Environmental Conservation (DEC)
- NYC Department of Environmental Protection (DEP) is responsible for enforcing the sewer regulations

Waste Disposal
Hazardous Waste

Generators

Any person by site whose act or process produces hazardous waste …or whose act first causes a hazardous waste to become subject to regulation.

- Liability
- Manifest-For LQG and SQG



NYS Generator Requirements
Conditionally Exempt Small Quantity Generator (CESQG)

- CESQG if, generate no more than in a calendar month:
  - 220 pounds of hazardous waste, and
  - 2.2 pounds of acute hazardous waste, and
  - 220 pounds of material from the cleanup of a spillage of acute hazardous waste
- AND, at anytime store no more than :
  - 2,200 pounds of hazardous waste, and
  - 2.2 pounds of acute hazardous waste.

NYS Generator Requirements
Conditionally Exempt Small Quantity Generator (CESQG)

- A Generator that is a CESQG does not need to:
  - Acquire an EPA RCRA ID Number,
  - Use a Hazardous Waste Manifest form, and
  - Submit an Annual Report.
- Keep waste shipments frequent enough to avoid accidentally becoming a more regulated status, due to the amount of hazardous waste stored onsite. A CESQG that stores more than 2,200 pounds of hazardous waste is now a Small Quantity Generator which requires the use of an EPA RCRA ID Number and Hazardous Waste Manifest form.
- The CUNY City Tech site has pickups every 3 to 4 months with waste vendor. Hazardous Waste will be picked up from the lab by Luis Venegas. Waste vendor prepares and transports off site to TSDF.

Waste Disposal
Hazardous Waste Accumulation in Lab

- Lab worker responsible for marking the container:
  - The words "Hazardous Waste"
  - Other words to identify the Contents
  - indication of the Hazard of the contents (Pictograms)
- Container:
  - Good condition-if leaking must immediately transfer to a container in good condition
  - Compatible to the container
  - Closed except when adding/removing
  - Do not be mixed or placed in a container with other hazardous waste that are incompatible.

CUNY Laboratory Safety Manual

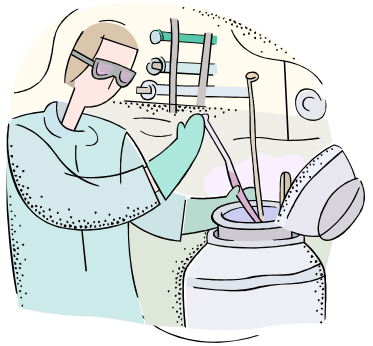
APPENDIX K: INCOMPATIBLE CHEMICALS

Generator Requirements

Hazardous Waste Determination

- Hazardous Waste determination for each waste container in the lab must be accurate and made at the point of generation by the lab staff/supervisor before any dilution, mixing or alteration, and at any time during the course of management for wastes potentially exhibiting a hazardous characteristic.
- Generators can use generator knowledge and tests in making hazardous waste determinations
- CUNY Laboratory Safety Manual

APPENDIX N: WASTE DETERMINATION/LABELING GUIDE



Waste Identification and Classification

According to RCRA, any material (solid, liquid, or gaseous) that is discarded is considered a:

SOLID WASTE

Distinguishes between waste and all other materials such as products

Hazardous Waste

The solid waste must:

- Not be excluded from regulation as a hazardous waste by EPA (household, plant or animal waste, discharges regulated under the Clean Water Act, etc. found in 261.4(b))
- Be included on a list of hazardous waste (LISTED)
- Contain a hazardous characteristic

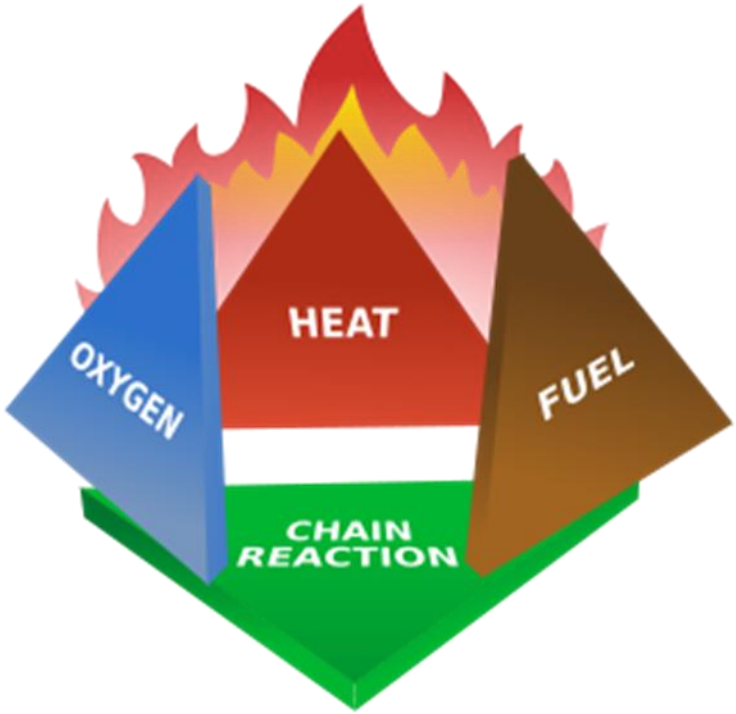
Waste Identification and Classification

Ignitability 40 CFR 261.21

- Liquid with a Flash Point < 60^0C (140^0F)
- Other than liquid is capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes
- Ignitable compressed gas
- Oxidizer
- EPA HW No. D001
- Examples

https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-261/subpart-C?toc=1

The Fire Tetrahedron



- What is the hazard?
- What do we need to keep in mind when handling?
  - Grounding & Bonding flammable/combustible liquids.
  - Drum Handling
- What can happen if I don't handle properly?

Waste Identification and Classification

Corrosivity 40 CFR 261.22

- Aqueous (water-based) solutions pH ≤ 2 or pH ≥ 12.5
- Liquids that can corrode steel at specified rates
- EPA HW No. D002
- Examples

- **What is the hazard?**
- **What do we need to keep in mind when handling?**
- **What can happen if I don't handle properly?**

Waste Identification and Classification

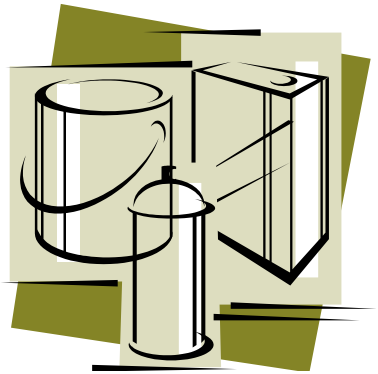
Reactivity 40 CFR 261.23

- Normally unstable and readily undergoes violent change without detonating
- In the presence of water
  - Reacts violently
  - forms potentially explosive mixtures
  - generates toxic gases, fumes, or vapors
- Cyanide or sulfide bearing waste that generates toxic gases when exposed to pH conditions between 2 and 12.5
- Capable of detonation or explosion
- Class A, Class B, or Forbidden explosive by DOT
- EPA HW No. D003

Waste Identification and Classification

DOO3

- **What is the hazard?**
- **What do we need to keep in mind when handling?**
- **What can happen if I don't handle properly?**



Waste Identification and Classification

Toxicity Characteristic

40 CFR 261.24

- Could leach toxic contaminates Determined by TCLP
- EPA HW No. D004-D043
- EXAMPLES

- **What is the hazard?**
- **What do we need to keep in mind when handling?**
- **What can happen if I don't handle properly?**

Question

The flashpoint for liquids that fall under the characteristic of Ignitability is _____.

a) < 40 °C

b) < 50 °C

c) < 60 °C

Waste Identification and Classification

Hazards and Hazard Code of Hazardous Waste

1. Ignitable = I
2. Corrosive = C
3. Reactive = R
4. Toxic Characteristic = E
5. Acutely Hazardous = H
6. Toxic = T

Waste Identification and Classification

Listed Wastes

EPA has studied and listed as hazardous hundreds of industrial wastestreams

- Non-specific source waste (F List)- 40CFR 261.31
  - Halogenated and non-halogenated spent solvent waste
- Specific source waste (K list)- 40CFR 261.32
  - Currently not found at the site
- Commercial chemicals (P and U List)- 40CFR 261.33
  - Discarded commercial chemical products, off-specification species, container residues and spill residues.

https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-261/subpart-D

Mixture and Derived from Rules 40 CFR 261.3

- The mixture and derived-from rules function differently for listed waste and characteristic wastes.
- Mixing of hazardous waste with solid wastes for generators 40 CFR 262.13(f)
- Dilution is prohibited as a substitute for treating a restricted waste: *40 CFR 268.3*

DILUTION IS NOT THE ANSWER TO POLLUTION

Sewer Prohibition

- Hazardous waste pharmaceuticals may not be sewered (e.g., no disposal down the drain and no flushing)
- The sewer prohibition applies to:
  - All healthcare facilities, including healthcare facilities that are VSQGs
  - All reverse distributors
- Hazardous wastes that are DEA controlled substances are also subject to the sewer prohibition
- Strongly discourage sewering of any pharmaceuticals by any entity
- The effective date of the sewer prohibition will be August 21, 2019 for ALL states

Department of Transportation (DOT)

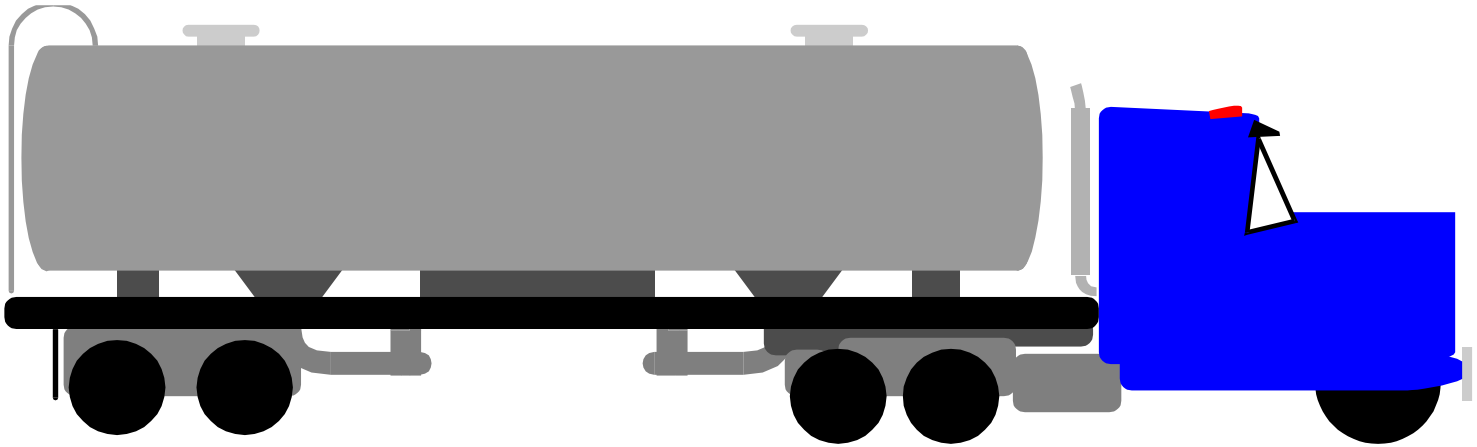
The Hazardous Materials Regulations (HMR) are located in the Code of Federal Regulations (CFR)

- **Title 49-Transportation**
- **Subtitle B- Other Regulations Pertaining to Transportation**
- **Chapter I- PHMTA (**Pipeline and Hazardous Materials Safety Administration**)**
- **Subchapter C-Hazardous Material regulations, Parts 171-180.**

CUNY must comply with US Department of Transportation (DOT) and International Air Transportation Association (IATA) regulations for shipping hazardous materials

Hazardous Materials Definition

- A substance or material in a quantity and form which may pose an unreasonable risk to health and safety or property when transported in commerce.



CUNY
If You Need To Transport Hazardous Materials:

- Contact the EHS Office for guidance
- Departments shipping hazardous materials or dangerous goods on a frequent basis, the EHS Office can provide the appropriate training to any additional designated personnel required.
  - Responsibility of the P.I.s or laboratory supervisors to ensure that any employee working under their supervision who ships or prepares shipments of hazardous materials has received the proper initial training. Retraining is required every 3 year