

Laboratory Safety & Chemical Waste Management



Chemical Health & Safety
Division of Environmental Health & Safety
University of Connecticut

Why does the University require this training?

- ◎ To protect people- it's a moral responsibility
- ◎ To comply with the law- government regulations
- ◎ Good safety is good business
- ◎ Safety is a catalyst for organizational excellence
- ◎ To incorporate a culture of safety at the University

Regulatory Agencies

- ◎ **Environmental Protection Agency (EPA):** To protect human health and the environment
- ◎ **Occupational Safety & Health Administration (OSHA):** To assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance.



 OSHA

The logo for the Occupational Safety and Health Administration (OSHA) consists of a stylized circular emblem on the left, followed by the letters "OSHA" in a large, bold, serif font.

OSHA Laboratory Standard

(29 CFR 1910.1450)

- ◎ Addresses “**Occupational exposure to hazardous chemicals in laboratories**”
- ◎ Provides guidelines to ALL laboratory workers using hazardous chemicals in an “investigative” application (29 CFR 1910, subpart Z)
- ◎ Does not apply to laboratory uses of hazardous chemicals which provide no potential for employee exposure
 - Impregnated Test Media (e.g. dip-and-read tests)
 - Commercially prepared kits (e.g. pregnancy test kits)

OSHA Lab Standard–Chemical Hygiene Plan

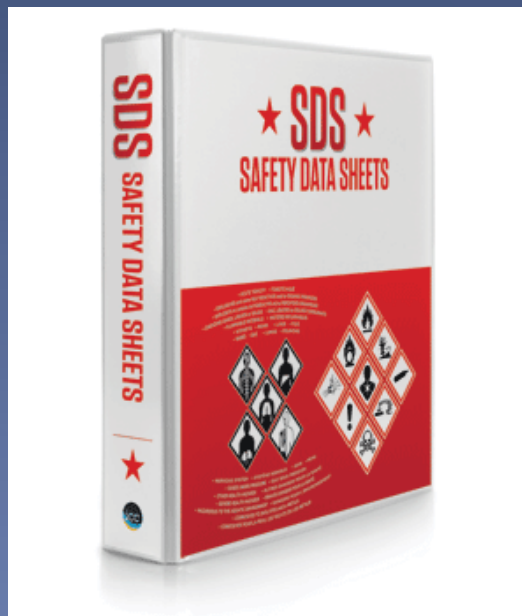
- ◎ The primary elements in the Chemical Hygiene Plan include:
 - Minimizing exposure to chemicals by establishing standard operating procedures, requirements for personal protective equipment, engineering controls (e.g., chemical fume hoods, air handlers, etc.) and waste disposal procedures.
 - For some chemicals, the work environment must be monitored for levels that require action or medical attention.
 - Procedures to obtain free medical care for work-related exposures must be stated.
 - The means to administer the plan must be specified.
 - Responsible persons must be designated for procurement and handling of Safety Data Sheets, organizing training sessions, monitoring employee work practices, and annual revision of the CHP.

- ◎ The University Chemical Hygiene Plan is located at <http://www.ehs.uconn.edu/Chemical/chemplan.php>

OSHA Lab Standard– Chemical Hygiene Officer

- ◎ Each lab shall designate its own Chemical Hygiene Officer (CHO).
- ◎ The CHO is responsible for implementing the policies and procedures in the Chemical Hygiene Plan.
- ◎ Ultimately **EVERY LAB WORKER** is responsible for following the safe work practices in the CHP.

Safety Documentation



**Hazard
Assessment**



Chemical Inventory

- ◎ **Chemical Inventory**- a list of every chemical (including gas cylinders) present in a laboratory
- ◎ Required in all labs with hazardous chemicals
- ◎ Can be an electronic or hard copy
- ◎ Should contain at a minimum:
 - Name of the chemical
 - Location of the chemical in the lab (e.g. left storage cabinet)
 - Approximate amount of the chemical (e.g. 5-gallons)
- ◎ Document changes to inventory as needed

Safety Data Sheets (SDSs)

- ◎ SDS- a written or electronic document that contains details of the hazards associated with a chemical and gives information on its safe use.
- ◎ Most important tool in hazard(s) identification
- ◎ Employers must ensure that SDSs are readily accessible to employees.
- ◎ Standard format/Must be written in English
- ◎ Required for EVERY chemical in the lab
 - Hard copy and/or
 - Link to an electronic form

Safety Data Sheets– Standard Format

Section	Section Title	Description
1	Identification	Product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
2	Hazard(s) identification	All hazards regarding the chemical; required label elements
3	Composition/ information on ingredients	Information on chemical ingredients; trade secret claims
4	First-aid measures	Important symptoms/ effects, acute, delayed; required treatment
5	Fire-fighting measures	Suitable extinguishing techniques, equipment; chemical hazards from fire
6	Accidental release measures	Emergency procedures; protective equipment; proper methods of containment and cleanup
7	Handling and storage	Lists precautions for safe handling and storage, including incompatibilities
8	Exposure controls/personal protection	Includes OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE)

Safety Data Sheets– Standard Format

(continued)

Section	Section Title	Description
9	Physical and chemical properties	Lists the chemical's characteristics
10	Stability and reactivity	Chemical stability and possibility of hazardous reactions
11	Toxicological information	Routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity
12	Ecological information	Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 .
13	Disposal considerations	Since other Agencies regulate this information, OSHA will not be enforcing Sections 13.
14	Transport information	Since other Agencies regulate this information, OSHA will not be enforcing Sections 14.
15	Regulatory information	Since other Agencies regulate this information, OSHA will not be enforcing Sections 15.
16	Other information	Includes the date of preparation or last revision

Workplace Hazard Assessments

- ⊙ Required by the Occupational Safety & Health Administration
- ⊙ Used to identify the **Personal Protective Equipment (PPE)** required within each laboratory
- ⊙ PPE can be determined through safety data sheets, manufacturer recommendations, knowledge of process, etc.
- ⊙ Required to be updated whenever operations in the lab change to warrant the use of new PPE.
- ⊙ One copy of each WHA should be kept in the lab and another should be mailed/emailed to EHS.
- ⊙ Workplace hazard assessments (WHAs) can be completed online at <http://ehs.uconn.edu/forms/WHA.php>.

Personal Protective Equipment (PPE)

◎ At a minimum, all employees and students working labs where hazardous chemicals are used or stored must wear:

1. ANSI-approved safety glasses/safety goggles
2. Closed-toed footwear



◎ Other PPE (e.g. gloves, lab coats, face shields, etc.) must be used when the eyes, face, hands, extremities, or other parts of the body are exposed to workplace hazards that cannot be controlled by other means.

Safety Information Cards

- ⦿ A “**UCONN Emergency Information Card**” must be completed and present on the exterior door of the lab.
 - Faculty
 - Key Personnel
 - Emergency Phone Numbers
- ⦿ A “**Laboratory Safety Information Card**” must be present on the interior of the lab by the entry door.
 - Chemical Hygiene Officer
 - Chemical Hygiene Plan
 - Safety Data Sheets
 - Chemical Inventory
 - Workplace Hazard Assessment Form
- ⦿ The cards can be completed online at: <http://www.ehs.uconn.edu/forms/index.php>

Hazard Identification



Types of Hazards

- **Health Hazard-** means a chemical which is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard.

- **Physical Hazard-** means a chemical that is classified as posing one of the following hazardous effects: explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid or gas); self-reactive; pyrophoric (liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; or in contact with water emits flammable gas.



Health Hazards

- Acute Toxicity
- Skin Corrosion/Irritation
- Serious Eye Damage/Eye Irritation
- Respiratory or Skin Sensitization
- Germ Cell Mutagenicity
- Carcinogenicity
- Reproductive Toxicity
- Specific Target Organ Toxicity- Single Exposure
- Specific Target Organ Toxicity- Repeated or Prolonged Exposure
- Aspiration Hazard



Physical Hazards



- Explosives
- Flammable Solids
- Flammable Liquids (FP $\leq 93^{\circ}\text{C}$ (199.4 $^{\circ}\text{F}$))
- Flammable Gases
- Flammable Aerosols
- Oxidizing Solids
- Oxidizing Liquids
- Oxidizing Gases
- Gases Under Pressure (*e.g. compressed gases, liquefied gases, dissolved gases and refrigerated liquefied gases*)
- Self-Reactive Chemicals
- Pyrophoric Liquids
- Pyrophoric Solids
- Self-Heating Chemicals
- Chemicals which react with water to emit flammable gases
- Organic Peroxides
- Corrosive to Metals

Toxicity– Routes of Entry

◎ Inhalation



◎ Absorption



◎ Ingestion



◎ Injection



Factors Influencing Toxicity

Route of entry	Excretion
Physical condition	Combined effects
Dose	Presence of other chemicals
Frequency	Stress
Ability to be absorbed	Sensitivity
Metabolism	Sex
Distribution within body	Individual variation

Signs & Symptoms of a Chemical Exposure

- Behavior change
- Breathing difficulty
- Change in complexion
- Coughing
- Drooling
- Fatigue/weakness
- Irritation of eyes/nose/throat
- Headache
- Nausea/vomiting
- Sweating
- Tightness of chest
- Coordination difficulty
- Dizziness
- Diarrhea
- Irritability
- Light-headedness
- Sneezing
- Dermatitis

Laboratory Practices

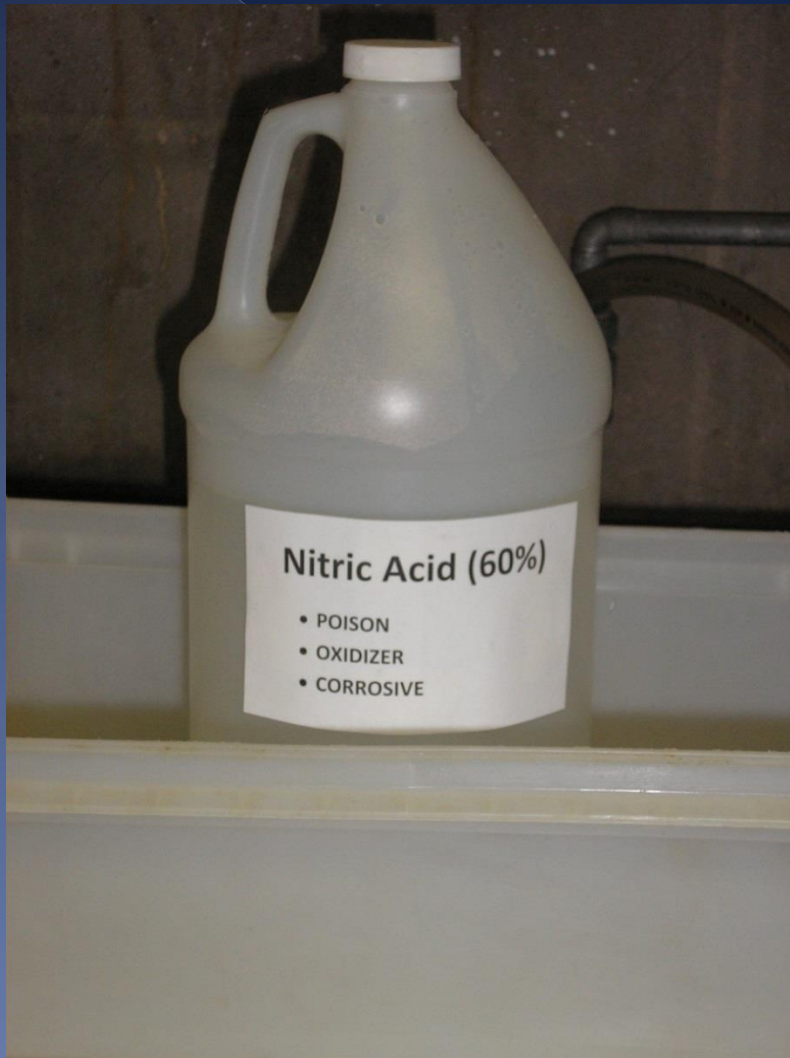


Permanent Container Labels

- ◎ Labels from suppliers are required to contain:
 - Product identifier
 - Supplier identification information
 - Precautionary statements
 - Hazard pictograms
 - Signal words:
 - **Danger** = *more severe hazard*
 - **Warning** = *less severe hazard*
 - Hazard statement
 - Supplemental information
- ◎ Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.



Portable (Secondary) Container Labeling



- ◎ The employer shall ensure that **secondary** containers have labels that contain:
 - Identity of the hazardous chemical(s)
 - **Appropriate physical and/or health hazard warnings**

- ◎ Employer shall also ensure that that labels or other forms of warning are:
 - Legible
 - Written in English
 - Prominently displayed on the container

Chemical Segregation

- ⦿ Incompatible chemicals should not be stored together.
- ⦿ Chemicals should be segregated into distinct groups based on their chemical properties:

INORGANIC ACIDS	FLAMMABLES
ORGANIC ACIDS	OXIDIZERS
INORGANIC BASES	POISONS/TOXICS
ORGANIC BASES	WATER-REACTIVE
EXPLOSIVES	NONHAZARDOUS

- ⦿ Safety Data Sheets must be consulted for manufacturer storage and incompatibility guidelines.
- ⦿ Segregating chemicals by alphabetical order often times does not minimize hazards

Fume Hoods– Safe Use

- ⦿ Conduct all operations that may generate irritating and/or hazardous air contaminants inside a fume hood
- ⦿ Keep all apparatus and chemicals at least **6 inches** back from the face of the hood
- ⦿ Keep the hood sash closed as much as possible
- ⦿ Do not store chemicals or apparatus in the hood
- ⦿ Do not use the hood to volatilize chemicals
- ⦿ Keep the slots in the hood baffles free of obstruction
- ⦿ Contact EHS (486-3613) if you suspect your hood is not working properly

Compressed Gases– Hazards

- ◎ **Compressed Gas-** a gas which when packaged under pressure is entirely gaseous at $-50\text{ }^{\circ}\text{C}$; including all gases with a critical temperature $\leq -50^{\circ}\text{C}$.
- ◎ Chemical hazards
 - Explosive
 - Corrosive
 - Flammable
 - Reactive
 - Toxic
- ◎ Other Hazards
 - Asphyxiation
 - Potential energy of cylinder
 - Compatibility between valve and regulator fittings



Compressed Gas Safety– Storage



- ⦿ Contents of the cylinder should be clearly marked
- ⦿ Store all cylinders upright
- ⦿ Secure with a chain, strap or cable to a wall or lab bench that can fully support the weight of the cylinder
- ⦿ A cylinder cap or regulator valve should always be in place
- ⦿ Store in cool, well-ventilated areas (no cold rooms), free from sources of ignition
- ⦿ Separate and secure full and empty cylinders

Housekeeping

- ⦿ Work areas should be kept clean and free from obstruction.
- ⦿ Hands should be washed after every experiment, before touching any non-contaminated area or object and before leaving the laboratory area.
- ⦿ Access to exits, emergency exits, aisles and controls should never be blocked.
- ⦿ Work areas should be cleaned at the end of the experiment and at the end of the day.
- ⦿ Food or drink is not allowed in active lab areas.

Hazardous Waste Management



Hazardous Waste

- ◎ **Hazardous Waste**- a waste with properties that make it dangerous or potentially harmful to human health or the environment
- ◎ Includes materials that are:
 - Abandoned
 - Unknown
 - Inherently waste-like
- ◎ EPA (40 CFR 262.11) requires that any person who produces or generates a waste must determine if that waste is hazardous (i.e., Ignitable, Corrosive, Reactive, Toxic)



Hazardous Waste Management

- ◎ Every hazardous waste container must:
 - Contain the words “**Hazardous Waste**”
 - List the specific name for each chemical in the container **(NO SYMBOLS OR ABBREVIATIONS)**
 - Have a tight-fitting cap or lid. Waste containers should be closed (e.g. no funnels) when not actively adding waste.
 - Be stored with compatible chemicals
 - Be stored at or near a green “**Satellite Accumulation Area**” sign
 - Be stored in a secure location
 - Store liquid waste in secondary containment tubs

Broken Glass/Sharps Management

- ◎ All broken glass should be disposed of in suitable glass waste receptacles in the labs
- ◎ Sharps (e.g. syringes (with or without needles), hypodermic needles, scalpel blades, etc.) should be disposed of in approved sharps containers
- ◎ Sharps containers are available through the Biological Health & Safety website.



Emergency Response



Emergency Response

- ◎ **R**elocate- If it is safe to do so, relocate people in immediate danger.
- ◎ **A**lert- Call **911** or pull the building fire alarm to alert others. Move to a safe location..
- ◎ **C**onfine- If it can be done safely, close all doors, windows and other openings to confine the fire. As you evacuate, shut off fuel sources such as piped gases and compressed gas cylinders.
- ◎ **E**vacuate- Evacuate the building. Do not use elevators. Report to your designated meeting site. Notify emergency response personnel if others are trapped or left behind in the building.

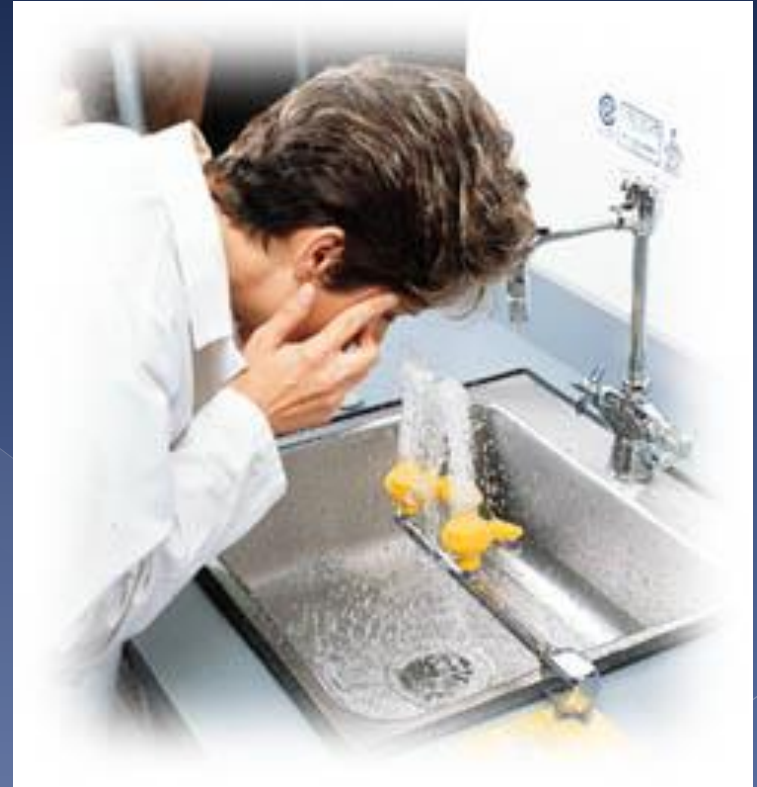
Major Chemical Spills

1. Close door(s) to lab.
2. Post “**NO ENTRY**” sign(s) on the door(s)
3. Relocate to a safe location
4. Call **911**
5. Do not re-enter area until instructed to do so by the fire department or other emergency personnel



First Aid- Eyes

- ⦿ Wash eyes thoroughly with water using an emergency eyewash.
- ⦿ If you are wearing contact lenses, remove while rinsing.
- ⦿ Forcibly hold eyes open to ensure effective wash behind both eyelids for at least **15 minutes**.
- ⦿ Obtain medical attention if still experiencing burning, inflammation or any other discomfort after 15 minutes.
- ⦿ If eyes are exposed to dust, metal, paint or wood chips, do not use an emergency eyewash. Cover or close eye(s) and contact emergency personnel for evaluation.
- ⦿ Report the injury to your supervisor



First Aid- Skin



- ⦿ Wash skin thoroughly with water using a faucet or emergency shower
- ⦿ Remove contaminated clothing while rinsing
- ⦿ Take care not to break the skin
- ⦿ For chemical and thermal burns, flush with **cold water**, if indicated in SDS
- ⦿ For biological, blood or radiological exposure, use **soap & lukewarm water**
- ⦿ Obtain medical attention if still experiencing burning, inflammation or any discomfort after flushing the affected area for 15 minutes
- ⦿ Report the injury to your supervisor

First Aid– Inhalation

◎ Symptoms

- Skin that has become dried, reddened, and itchy or exhibits a rash
- Tearing or burning of the eyes
- Burning sensations of the skin, nose or throat.
- Headache, dizziness, cough

◎ Course of Action

- Move to fresh air
- Get immediate help (**911**)



Consultation

◎ Chemical Health & Safety

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