



College of Natural Sciences  
& Mathematics

# General Safety Training

Science Safety Office

Updated September 2022

[www.csulb.edu/cnsm/safety](http://www.csulb.edu/cnsm/safety)

# Please Note

Although this slide presentation addresses key safety issues that apply to all CNSM personnel, it only provides a general overview. Your supervisor provides detailed, task and material-specific training. Detailed information about each issue presented here is contained in the CNSM Safety Manual under the “Safety Guides” and supplementary procedures.

Please visit the [Science Safety Office website](#) often since it is frequently updated. For more detailed information, you are encouraged to follow this link to the Manual, and do a “key word search” to read detailed, current information on any given topic.

Thank you, and welcome to California State University, Long Beach and the College of Natural Sciences and Mathematics.

# Science Safety Office Information

## Office Location:

MICRO 207

## Phone:

On Campus      x55623

Off Campus     562.985.5623

## Office Hours:

*Monday through Friday*      8:00am - 5:00pm

*Closed for Lunch*              12:00pm - 1:00pm

# Science Safety Office Staff

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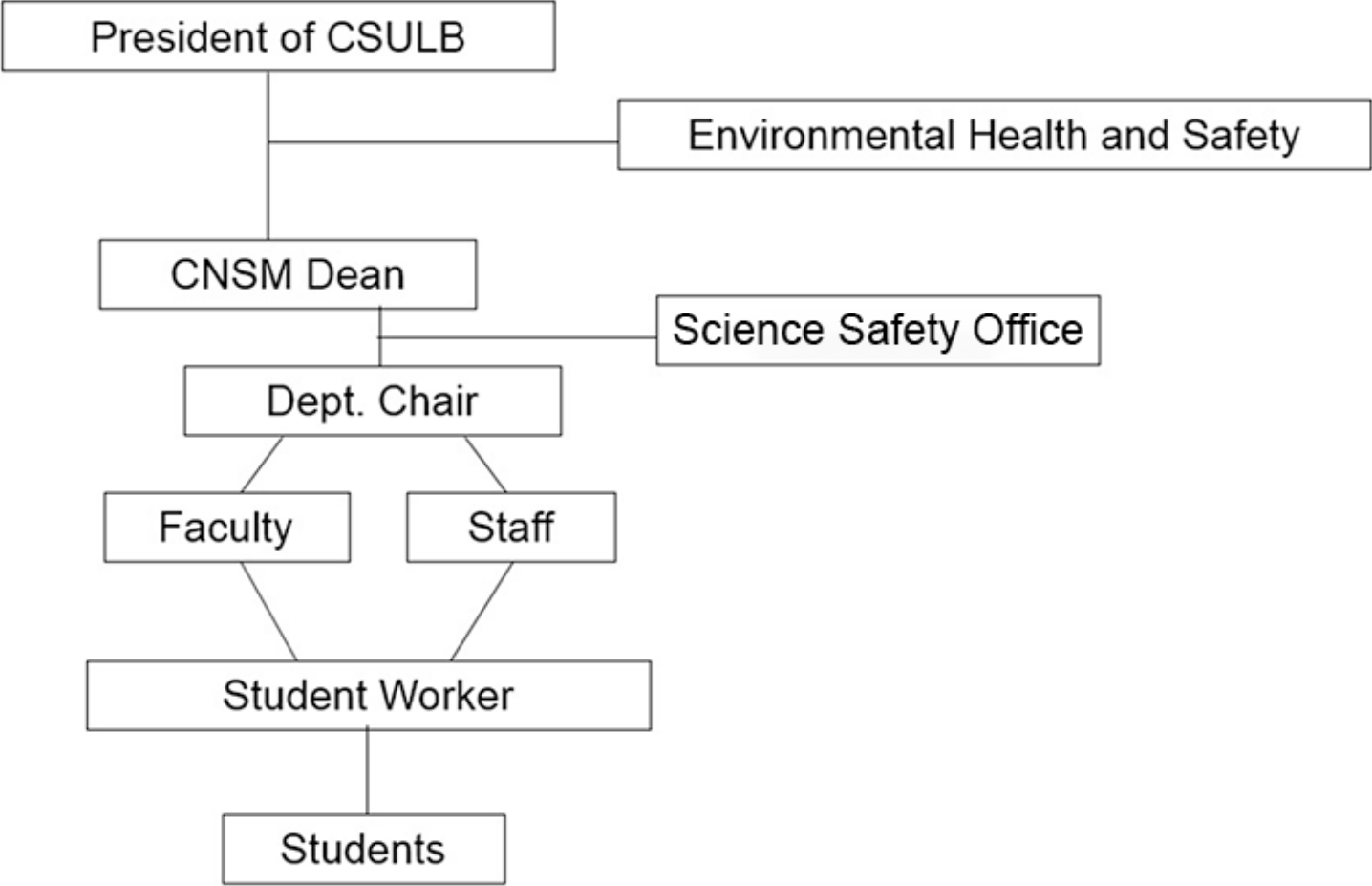
Cell Phone:

562.577.0504

Cell Phone:

310.869.3738

# Organizational Flowchart



# CNSM Employee Bulletin Board

- The CNSM Employee Bulletin Board is located adjacent to HSCI 160.
- Information about workplace safety, phone numbers, and annual injury reports can be found here.



# Training Outline

- **Part I**

- Campus Injury and Illness Protection Program (IIPP)
- CNSM Chemical Hygiene Plan
- Right-to-Know / Hazard Communication and Labeling
- Exposure Prevention
- Safety Data Sheets (SDS)

- **Part II**

- Hazards in Laboratories and Research
- Safety Equipment and Procedures
- Personal Protective Equipment (PPE)

- **Part III**

- No Food, Drink, or Smoking
- Conduct and Housekeeping
- Reporting Accidents / Incidents
- Medical Costs

# General Safety Training: Part I

- Campus Injury and Illness Protection Program (IIPP)
- CNSM Chemical Hygiene Plan
- Right-to-know / Hazard Communication and Labeling
- Exposure Prevention
- Safety Data Sheets (SDSs)



# Campus Injury and Illness Protection Program (IIPP)

- The CSULB IIPP is the cornerstone program which details the means and methods use for ensuring the safety and health of all CSULB employees and students.
- California regulation requires that an Employer develop and institute an IIPP.
- Deans, Department Chairs, Managers, Supervisors have the responsibility to implement the IIPP in their respective work areas. CNSM Safety Office personnel work with CNSM administration and departments to implement the IIPP.

# CNSM Chemical Hygiene Plan

- The CNSM Chemical Hygiene Plan (CHP) was prepared to fulfill the Cal/OSHA requirements pertaining to “Occupational Exposure to Hazardous Chemicals in Laboratories”, [California Code of Regulations Title 8, § 5191](#). The scope includes all personnel working in laboratories within the College of Natural Sciences and Mathematics.
- All personnel, especially supervisors, are encouraged to make themselves familiar with the Chemical Hygiene Plan.

# CNSM Chemical Hygiene Plan 2

- The regulations mandate that where hazardous chemicals are used in the workplace, the employer shall develop and carry out the provisions of a written CHP which is:
  1. Capable of protecting employees from the health hazards associated with hazardous chemicals present in the workplace.
  2. Capable of keeping exposures below Cal/OSHA-regulated limits.
  3. Readily accessible to employees via hard-copy at the CNSM Safety Office (MIC-207), select support labs and online: [CNSM Chemical Hygiene Plan](#).
  4. Reviewed annually and updated as appropriate.

# Right-to-Know / Hazard Communication and Labeling

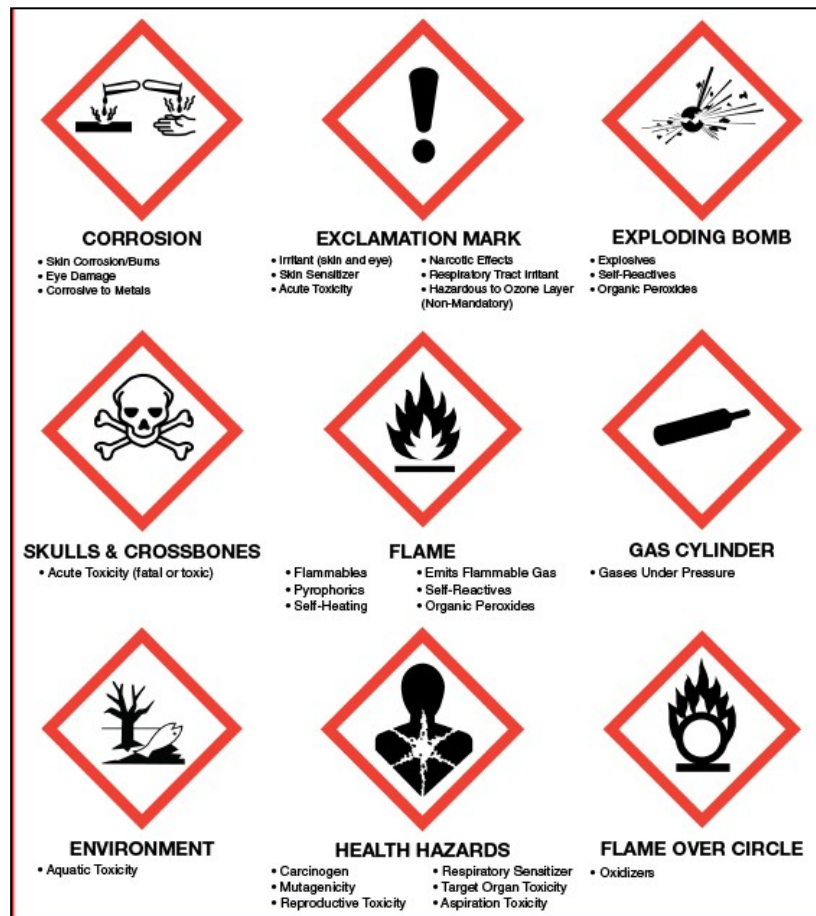
- You have the right to know (and are expected to know) about all chemicals used in the workplace. This includes household chemicals.
- Any unattended container must be labeled as follows:
  - Name of the material (no abbreviations)
  - Hazard (e.g. flammable, corrosive, poison)

# Labeling of Chemicals: Globally Harmonized System (GHS)

- Beginning in 2013 manufacturer labels were to be standardized and required to have:
  - Pictograms
  - Signal Words
  - Hazard Statement
  - Precautionary Statements
  - Product Identifier
  - Supplier Identification
  - Supplemental Information (as required)

# GHS Pictograms

- Nine pictograms utilized in identifying ALL chemical and physical hazards.
- Each chemical will have AT LEAST one pictogram, often multiple pictograms, to visually convey the hazards associated with it.



# Labels: Signal Words and Hazard Statements

- Signal words describe the severity of a hazard:
  - **Danger** - reserved for the more severe hazards
  - **Warning** - used on less severe hazards
  - Note: If there is no significant hazard, a signal word won't be used
- Phrases that describe the nature of a hazard. Examples:
  - Highly flammable liquid and vapor
  - May cause liver and kidney damage
  - Fatal if swallowed

# Labels: Precautionary Statements

- Recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to the hazardous chemical.
- There are four types of precautionary statements:
  1. Prevention (to minimize exposure)
  2. Response (in case of accidental spillage or exposure)
  3. Storage
  4. Disposal



# GHS Label Example

**Components Of A GHS-Compliant Label**

<b>product identifier</b>	<b>AMMONIA</b>		<b>pictograms</b>
<b>signal word</b>	<b>DANGER</b>		
<b>hazard statement</b>	<b>TOXIC IF INGESTED</b>		
<b>precautionary statements</b>	<p>Wash hands thoroughly after handling. Keep container tightly closed when not in use. Keep away from heat, sparks and open flames - may explode when exposed to high heat. Use in an open area that is well-ventilated. Breathing in ammonia is irritating and corrosive. Wear protective gloves and safety goggles to prevent burns and irritation.</p> <p>If swallowed: Immediately call Poison Control or doctor/physician. Drink water or milk to dilute ammonia.</p>	<p>See Safety Data Sheet (SDS) for further details regarding safe use of this product.</p>	
<b>supplier information</b>	<b>ABC Chemicals - 123 Main Street - Cincinnati, OH - <a href="http://www.abcchem.com">www.abcchem.com</a> - 800-733-5252</b>		

# Secondary Labels

- Whenever a chemical is taken from its original container, **the container it is transferred into must have a secondary label affixed to identify its contents.**
- CNSM uses Department of Transportation (DOT) based container labels interchangeably with GHS pictograms. DOT labels for secondary containers are being phased out.

# CNSM Label Policy

- Label any *unattended* container of material as follows:
  - **Full Name** - do not only use abbreviations or formulas such as H<sub>2</sub>O, HCl, ETOH
  - **Hazard(s)** - write the word or use a sticker that says that hazard(s)

Examples of Stickers:

**Flammable**



**Corrosive**



**Poison**



**Oxidizer**



**Carcinogen**



**Biohazard**



# CNSM Label Policy 2

- Make sure any old, inappropriate labels are completely unreadable (you may erase, deface, or remove labels).
- Permanently-labeled bottles may NOT be used for a different material, as your label may fall off or your ink may wash off to show the old wrong label.
- Note: DOT and GHS labels are used to communicate similar information but have their differences.

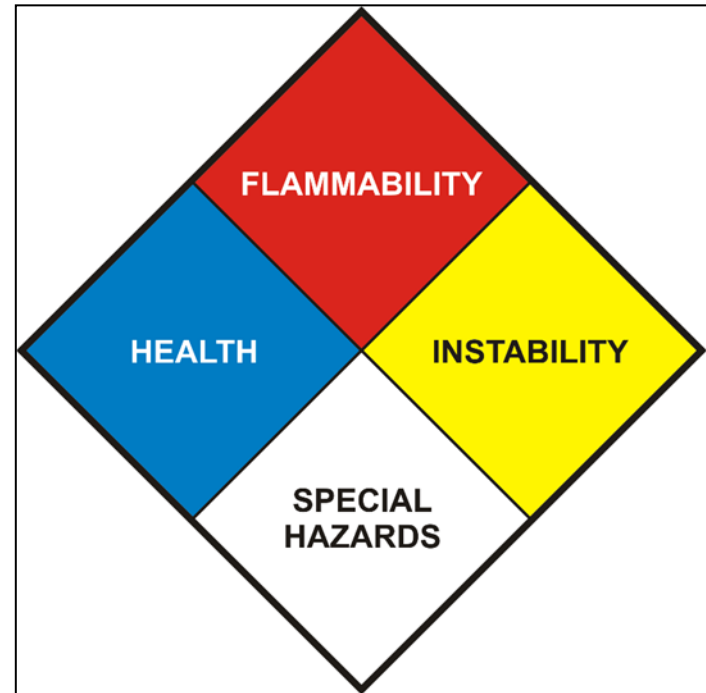
# CNSM Label Example

- Include full name and hazard of any chemical you leave unattended.



# NFPA Symbols on CNSM Doors

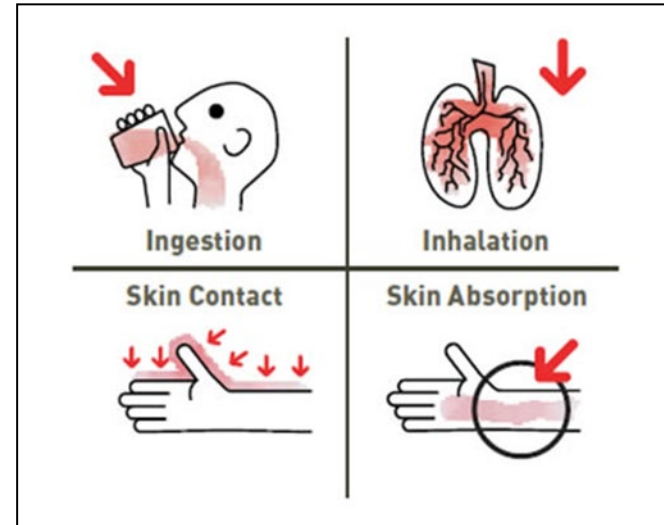
- Diamond shaped symbols that have been placed on doors to all CNSM laboratories or other chemical storage areas.
- Purpose is to communicate area hazard information to first responders such as fire or police.
- Comprised of four quadrants, each providing specific information.
- GHS system of hazard classification used inside of laboratories, not NFPA.



National Fire Protection Agency  
(NFPA) 704 Diamond

# Exposure Prevention

- Primary routes of exposure to hazardous materials include:
  - Inhalation
  - Ingestion
  - Skin Contact
  - Skin Absorption
- Also of Concern: Injection
- Exposure to chemicals or other hazardous materials is to be prevented at all costs.



# Exposure Prevention 2

- Symptoms of chemical exposure vary depending on the material and amount.
- Common symptoms include:
  - Irritation, redness or burning of the skin, eyes, nose or throat
  - Nausea
  - Headaches
  - Blurry vision
  - Difficulty breathing or standing
  - Abdominal pain
  - Numbness, loss of muscle control
  - Others



# Safety Data Sheet (SDS)

- These documents are a source for information including but not limited to the hazards, safe handling, accidental release measures, and disposal method for chemicals/products used in the workplace.
- Must be readily accessible to all personnel when they are in their work areas:
  - Hard copies in a binder
  - Electronically available via MSDSOnline database
  - As files on a computer with unrestricted access
- Key health information found on initial page(s) including chemical specific exposure symptoms.

# SDS Example

**Material Name** →

*Very Important  
to Understand:*

**Hazards with  
Category** →

**Signal Word** →

**Hazard  
Statements** →



**Fisher Scientific**

Part of Thermo Fisher Scientific

## SAFETY DATA SHEET

Creation Date 12-Mar-2009

Revision Date 12-Feb-2015

Revision Number 2

### 1. Identification

**Product Name** Nitric acid (65 - 70%)

**Cat No. :** A198C-212, A200-212, A200-212LC, A200-500, A200-500LC, A200-612GAL, A200C-212, A200S-212, A200S-212LC, A200S-500, A200SI-212, A467-1, A467-2, A467-250, A467-500, A483-212; S719721

**Synonyms** Azotic acid; Engraver's acid; Aqua fortis

**Recommended Use** Laboratory chemicals.

**Uses advised against** No information available  
*Details of the supplier of the safety data sheet.*

**Company** Fisher Scientific  
One Reagent Lane  
Fair Lawn, NJ 07410  
Tel: (201) 796-7100

**Emergency Telephone Number**  
CHEMTRECS, Inside the USA: 800-424-9300  
CHEMTRECS, Outside the USA: 001-703-527-3887

### 2. Hazard(s) identification

**Classification**  
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Oxidizing liquids	Category 3
Corrosive to metals	Category 1
Skin Corrosion/Irritation	Category 1 A
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system,	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney.	

#### Label Elements

**Signal Word**  
Danger

**Hazard Statements**  
May intensify fire; oxidizer  
May be corrosive to metals  
Causes severe skin burns and eye damage  
May cause respiratory irritation  
May cause damage to organs through prolonged or repeated exposure

# General Safety Training: Part II

- Hazards in Laboratories and Research
- Personal Protective Equipment (PPE)
- Safety Equipment and Procedures

# Hazards Specified by GHS

- When using chemicals that have potential health hazards, it is imperative that everyone in the lab/workplace strive to avoid exposure to the chemicals.
- Some low-level exposures may be unavoidable.
- Anyone with concerns about chemical exposures at CSULB can take the list of workplace chemicals to their medical doctor to consider the best course of action.
- Always take the time to read and understand the SDS for any materials you work with. Bring any questions or concerns to your supervisor or the Science Safety Office.
- Most of the reagents used in the lab have hazardous characteristics, many have more than one.
- Under GHS these characteristics fall into three categories: health hazards, environmental hazards, and physical hazards.

# GHS Hazard Categories

## 1. Health Hazards

- acute toxicity
- skin corrosion/irritation
- serious eye damage/irritation
- respiratory or skin sensitization
- germ cell mutagenicity
- carcinogenicity
- reproductive toxicology
- target organ system toxicity - single exposure
- target organ system toxicity - repeated exposure
- aspiration toxicity

## 2. Environmental Hazards

- hazardous to the aquatic environment
  - acute aquatic toxicity
  - chronic aquatic toxicity
    - bioaccumulation potential
    - rapid degradability

## 3. Physical Hazards

- explosives
- flammable gases
- flammable aerosols
- oxidizing gases
- gases under pressure
- flammable liquids
- flammable solids
- self-reactive substances
- pyrophoric liquids
- pyrophoric solids
- self-heating substances
- substances which, in contact with water, emit flammable gases
- oxidizing liquids
- oxidizing solids
- organic peroxides
- corrosive to metals

# Health Hazards: Acute Toxicity



GHS Pictogram

- Many of the reagents used in the lab are toxic poisons.
- Ingestion, inhalation, and skin contact (main exposure routes) must be avoided.
  - Exposure can cause a person to become ill and even be fatal
  - The  $LD_{50}$  is a measure of toxicity. The lower the  $LD_{50}$ , the higher the toxicity
- Instructors or supervisors will provide specific safety and handling warnings as these materials are introduced into the lab.

# Health Hazards: Acute Toxicity 2



GHS Pictogram

- 5 Categories under GHS.
- Categories 1 and 2 considered to have high (severe) acute toxicity.
  - Single exposure (even short duration) may be fatal or cause serious organ damage.

Acute toxicity	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Category 5
Oral (mg/kg)	≤ 5	> 5 ≤ 50	> 50 ≤ 300	> 300 ≤ 2000	Criteria: • Anticipated oral LD50 between 2000 and 5000 mg/kg; • Indication of significant effect in humans;* • Any mortality at class 4.* • Significant clinical signs at class 4.* • Indications from other studies.* *If assignment to a more hazardous class is not warranted.
Dermal (mg/kg)	≤ 50	> 50 ≤ 200	> 200 ≤ 1000	> 1000 ≤ 2000	
Gases (ppm)	≤ 100	> 100 ≤ 500	> 500 ≤ 2500	> 2500 ≤ 5000	
Vapors (mg/l)	≤ 0.5	> 0.5 ≤ 2.0	> 2.0 ≤ 10	> 10 ≤ 20	
Dust & mists (mg/l)	≤ 0.05	> 0.05 ≤ 0.5	> 0.5 ≤ 1.0	> 1.0 ≤ 5	

ACUTE ORAL TOXICITY – Annex 1					
	Category 1	Category 2	Category 3	Category 4	Category 5
LD <sub>50</sub>	≤ 5 mg/kg	> 5 < 50 mg/kg	≥ 50 < 300 mg/kg	≥ 300 < 2000 mg/kg	≥ 2000 < 5000 mg/kg
Pictogram					No symbol
Signal word	Danger	Danger	Danger	Warning	Warning
Hazard statement	Fatal if swallowed	Fatal if swallowed	Toxic if swallowed	Harmful if swallowed	May be harmful if swallowed

# Health Hazards: Corrosion/Irritation



GHS Pictogram

- Watch out for corrosive materials as they can cause severe burns and blindness.
- One typical characteristic of corrosive materials is extreme pH (2 or below or 11.5 and above).
- Never mix acids and bases. A violent reaction may occur.
- Use caution when adding concentrated acids or bases to a solution.
  - "Do what you ought'er, add acid to water"
- Neutralize tiny acid spills/drips (NOT injuries) with bicarbonate solution.



# Health Hazards: Skin Corrosion/Irritation



GHS Pictogram

- Skin irritation considered to be reversible, corrosion is not.
- Divided into 3 categories, category 1 being most severe.

Skin Corrosion Category 1			Skin Irritation Category 2	Mild Skin Irritation Category 3
Destruction of dermal tissue: visible necrosis in at least one animal			Reversible adverse effects in dermal tissue	Reversible adverse effects in dermal tissue
Subcategory 1A Exposure < 3 min. Observation < 1 hr,	Subcategory 1B Exposure < 1 hr. Observation < 14 days	Subcategory 1C Exposure < 4 hrs. Observation < 14 days	Draize score: $\geq 2.3 < 4.0$ or persistent inflammation	Draize score: $\geq 1.5 < 2.3$

# Health Hazards: Eye Corrosion/Irritation



GHS Pictogram

- Eye irritation considered to be reversible, corrosion is not.
- Divided into 2 categories, category 1 being most severe.

Category 1 Serious eye damage	Category 2 Eye Irritation	
Irreversible damage 21 days after exposure  Draize score: Corneal opacity $\geq 3$ Iritis $> 1.5$	Reversible adverse effects on cornea, iris, conjunctiva  Draize score: Corneal opacity $\geq 1$ Iritis $\geq 1$ Redness $\geq 2$ Chemosis $\geq 2$	
	<b>Irritant</b> Subcategory 2A Reversible in 21 days	<b>Mild Irritant</b> Subcategory 2B Reversible in 7 days

# Health Hazards: Sensitizers

- Two categories:
  - **Respiratory sensitizers** induce hypersensitivity of the airways following inhalation of a substance.
  - **Skin sensitizers** (equivalent to contact sensitizers) induce an allergic response following skin contact.



Respiratory Sensitizer  
GHS Pictogram



Skin Sensitizer  
GHS Pictogram

# Health Hazards: Germ Cell Mutagenicity



GHS Pictogram

- A mutation is a change in the DNA sequence of a gene and a mutagen is a chemical or other agent that can cause an increased occurrence of mutations.
- Germ cells pass heredity to the next generation.
- Category 1 mutagens are known or presumed to cause mutation with exposure.

Category 1 Known / Presumed		Category 2 Suspected / Possible
Known to produce heritable mutations in human germ cells		<ul style="list-style-type: none"> <li>• May induce heritable mutations in human germ cells</li> <li>• Positive evidence from tests in mammals and somatic cell tests</li> <li>• <i>In vivo</i> somatic genotoxicity supported by <i>in vitro</i> mutagenicity</li> </ul>
Subcategory 1A Positive evidence from epidemiological studies	Subcategory 1B Positive results in: <ul style="list-style-type: none"> <li>• <i>In vivo</i> heritable germ cell tests in mammals</li> <li>• Human germ cell tests</li> <li>• <i>In vivo</i> somatic mutagenicity tests, combined with some evidence of germ cell mutagenicity</li> </ul>	

# Health Hazards: Carcinogens



GHS Pictogram

- Some chemicals may be classified as carcinogenic (capable of causing cancer) in addition to the other hazardous properties .
  - e.g., Benzene is a flammable liquid, is toxic, but also can induce leukemia with extended exposure.
- CAL/OSHA designates which chemicals must be labeled as Carcinogen. See the CNSM Chemical Hygiene Plan for more information.

# Health Hazards: Carcinogens 2



GHS Pictogram

- Substances in this hazard class are assigned to one of two hazard categories.
- Category 1 carcinogens are known or presumed to cause cancer with exposure.
- Use of category 1 carcinogens requires special training and procedures.

Category 1 Known or Presumed Carcinogen		Category 2 Suspected Carcinogen
Subcategory 1A Known Human Carcinogen Based on human evidence	Subcategory 1B Presumed Human Carcinogen Based on demonstrated animal carcinogenicity	Limited evidence of human or animal carcinogenicity



GHS Pictogram

# Health Hazards: Reproductive Toxicity

- Some chemicals (once in the body) target male and/or female reproductive systems or developing fetuses.
- Category 1 reproductive toxins are known to have reproductive effects.

Category 1		Category 2 Suspected	Additional Category
Known or presumed to cause effects on human reproduction or on development		Human or animal evidence possibly with other information	Effects on or via lactation
Category 1A Known Based on human evidence	Category 1B Presumed Based on experimental animals		

# Particularly Hazardous Substances

- CCR Title 8 §5191 defines Particularly Hazardous Substances (PHSs) as any of the following:
  - Select carcinogens (known, presumed or suspected)
  - Reproductive toxins (known, presumed or suspected)
  - Highly acute toxins (Category 1 or 2 acute toxicity)
- PHSs are found in many CNSM labs and common examples include methanol, cadmium compounds, acrylamide, benzene, chloroform, toluene, cyanide compounds, ***many others.***
- Review the SDS or contact the Science Safety Office to determine if a material is a PHS.



# Particularly Hazardous Substances 2

- PHSs require special provisions including:
  - Establishment of a designated area (may be a lab)
  - Use of containment devices (such as fume hoods)
  - Procedures for safe removal of contaminated waste
  - Decontamination procedures
- Talk to your supervisor to find out what PHSs may be in your assigned area.
- Work with PHSs will require specialized training by your supervisor or the Science Safety Office and the use of a material or category specific SOP.

# Other Health and Environmental Hazards



GHS Pictogram

- Other GHS health hazards include aspiration (entry of material into your airways) and target organ systemic toxicity (any effect not otherwise included in GHS such as narcotic effects).
- Some chemicals can be particularly damaging to the environment or to aquatic life if released. Under GHS there are multiple categories for acute and chronic aquatic toxicity.

# Physical Hazards: Flammables

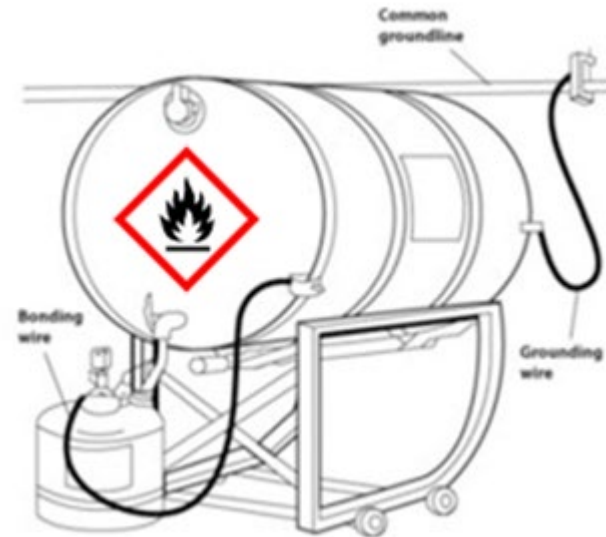


GHS Pictogram

- Flammable materials ignite easily and burn quickly and may be in the form of liquids, solids, gases or aerosols (fine mists).
- There are several hazard categories under GHS:
  - Flammable liquids – four categories based on flashpoint (the temperature at which a vapor above a solution will ignite in air if with ignition source), category 1 being most dangerous (example: diethyl ether).
  - Flammable solids – readily combustible and may cause a fire if heated or through friction. Two categories, category 1 being most dangerous.

# Physical Hazards: Flammables 2

- Bulk (large) quantities of flammable liquids requires that their containers be bonded and grounded.
- Bonding and grounding provides an electrically conductive pathway between a dispensing container, the receiving container and an earth ground.
- This prevents the buildup of static electricity which could cause sparks and lead to a fire.
- Contact the Science Safety Office for more specific information.



# Physical Hazards: Oxidizers



GHS Pictogram  
(flame over circle)

- Oxidizing materials (“oxidizers”) promote or accelerate combustion and may be in the form of liquids, solids or gases.
- Oxidizers such as hydrogen peroxide, potassium nitrate and many chemicals whose names start with “per”, end in “ate” or end in “ite” are especially dangerous.
- Supervisors must communicate special instruction if oxidizers are to be handled.

# Physical Hazards: Oxidizers 2



GHS Pictogram  
(flame over circle)

- There are several hazard categories under GHS based on measured increases in ignition time or pressure compared to control mixtures.
- Oxidizers may ignite or form explosive compounds on contact with organic solvents, materials such as flammables, combustibles, or other reducing materials, or reducing agents such as metals, etc.
- Oxidizers may not be mixed with or stored beside these materials.
  - Concentrated nitric acid is a strong oxidizer and will react violently with flammable organic solvents or acetic acid.

# Physical Hazards: Pyrophorics and Water Reactives

- Pyrophoric substances (liquids or solids) will ignite within 5 minutes after coming in contact with air.
- Water reactive substances will release flammable gases or will become spontaneously flammable upon contact with water.
- Pyrophorics and water reactives are separated into several categories depending on level of reactivity.
- GHS *Flammables* pictogram used.
- Work with pyrophorics and water reactives is especially hazardous and requires specialized training.

# Physical Hazards: Gases Under Pressure



GHS Pictogram

- Gases that are contained in a pressurized receptacle or as a refrigerated liquid.



compressed gases  
in cylinders



liquid nitrogen in  
storage dewars



# Physical Hazards: Gases Under Pressure 2



GHS Pictogram

- CNSM Gas Cylinder Safety Training includes training on the safe use of cryogenic materials.
- Only personnel who have completed CNSM Gas Cylinder Safety Training may:
  - Move gas cylinders
  - Work with Liquid Nitrogen
  - Install gas regulators
  - Work with Dry Ice
- GHS categories are based on the state of the gas under pressure.

Group	Criteria
Compressed gas	Entirely gaseous at $-50^{\circ}\text{C}$
Liquefied gas	Partially liquid at temperatures $> -50^{\circ}\text{C}$
Refrigerated liquefied gas	Partially liquid because of its low temperature
Dissolved gas	Dissolved in a liquid phase solvent

# Other Physical Hazards

- Other GHS physical hazards:
  - Explosives - materials capable by chemical reaction of gas with temperature, speed and pressure enough to damage surroundings
  - Self-Reactive Substances - thermally unstable materials able to undergo exothermic decomposition
  - Organic Peroxides - reactive, shock sensitive
- Work with these materials is especially hazardous and is generally not permitted.



# Other Physical Hazards 2

- Other GHS physical hazards:

- **Corrosive to Metal** - materials that by chemical action will damage or destroy metals



Corrosive to Metal  
GHS Pictogram

- **Self-Heating Substances** - a substance which by reaction with air, without energy supply can self-heat. Large amounts of material and long time periods are needed



Self-Heating Substances  
GHS Pictogram

# Other Potential Hazards

- Chemical Storage and Incompatibilities
- Chemical Wastes
- Ionizing Radiation
- Non-Ionizing Radiation
- Biohazards
- Chemical Spills
- Scientific Glassware
- Broken Glass and Other Sharp Items
- Equipment Hazards (including hot surfaces)
- Slips, Trips and Falls
- Heat Stress
- Fieldwork and Travel

# Chemical Storage and Incompatibilities

- Always return chemicals to their proper place and store them compatibly.
- Chemical hazard and compatibility information can be obtained from the container's label, the Safety Data Sheet (SDS), your supervisor or CNSM Safety personnel.
- Always use a “bottle carrier” or other secondary containment carrier when transporting any chemicals to or from the lab.

# Chemical Storage and Incompatibilities 2

- Hazardous liquids must be stored in secondary containers such as bins or buckets.
  - Remember to store incompatibles in separate trays.
  - Separate acids from bases, oxidizers from organic materials such as combustibles/flammables/reducing agents, etc.
    - **It is CRITICAL that you remember nitric acid will react violently with organic materials including acetic acid.**
  - The hazardous waste compatibility chart can be used to determine what chemicals are incompatible.

# Chemical Storage and Incompatibilities 3

- Watch out for flammable materials such as alcohols, acetone, ethers etc. and keep them away from ignition sources.
- NEVER store them in standard refrigerator/freezers!
  - Regular refrigerators contain ignition sources (interior lights, defrost cycles) that can ignite flammable vapors.
  - If you must keep your flammables cold, store them ONLY in special “Flame-rated” refrigerators. Read the labels on the refrigerator so you know what kind it is.



Placard indicating unit is designed for storage of flammable materials

# Double Containment

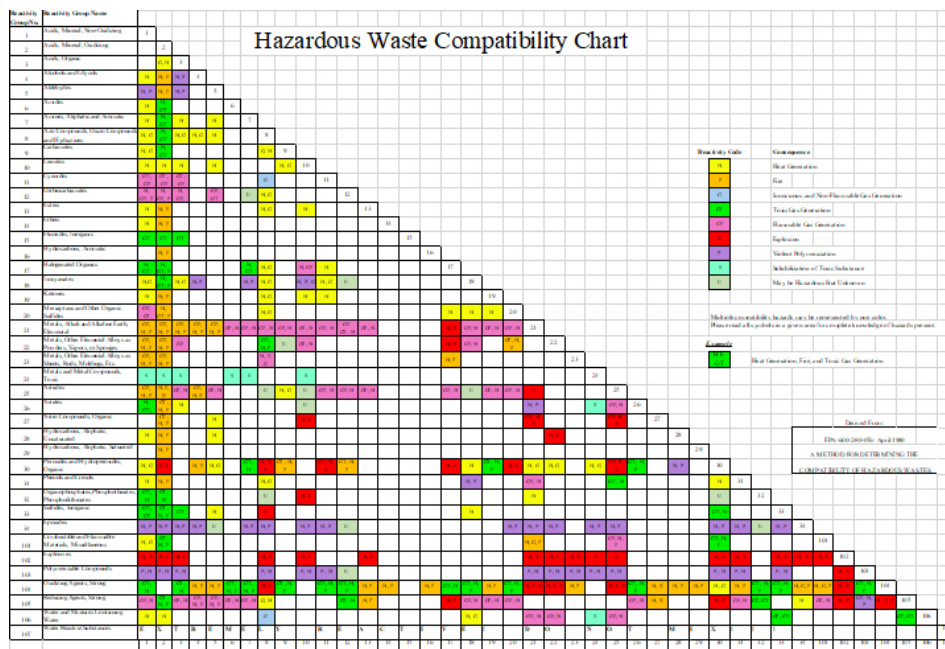
- Use for transport of chemicals and storage of hazardous liquids.





# Chemical Waste Compatibility Chart (US EPA)

- May be used as a guide when storing hazardous materials.
- Look for this chart in your lab, or contact the Science Safety Office for a copy.



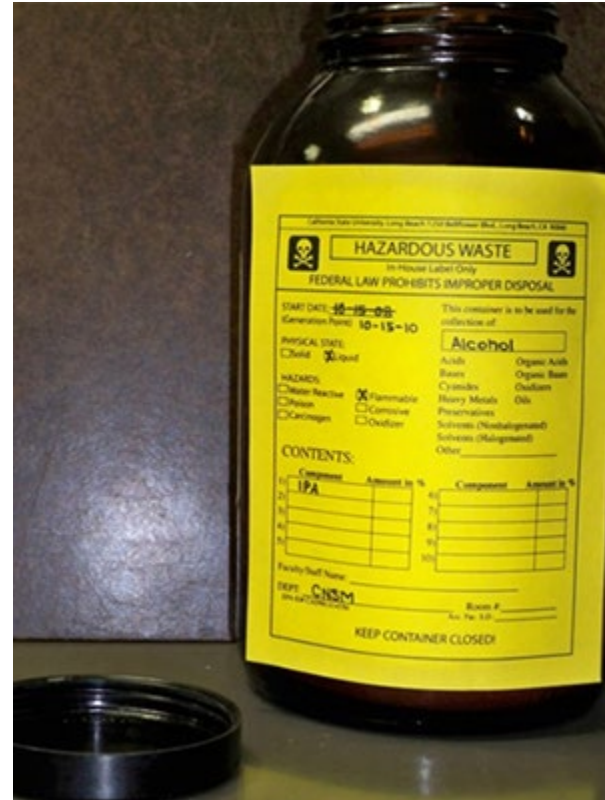
# Chemical Wastes

- Most labs have several DIFFERENT waste containers.
- **MUST** make sure you know which container is the correct one for your waste! Otherwise you could cause a fire, explosion, or some other unwanted chemical reaction.
- Containers must not be overfilled.
- Waste containers must be kept closed when not in use.
- **Do not fill a waste jug more than  $\frac{3}{4}$  full!!**
- It is *everyone's responsibility* to **notify the Science Safety Office or Chem Issue when a container is  $\frac{3}{4}$  or when approaching six months since the start of collection.**
  - Yellow labeled waste containers cannot remain in use longer than 6 months.
  - A replacement waste container may be available through Science Safety Office.

# Chemical Wastes 2



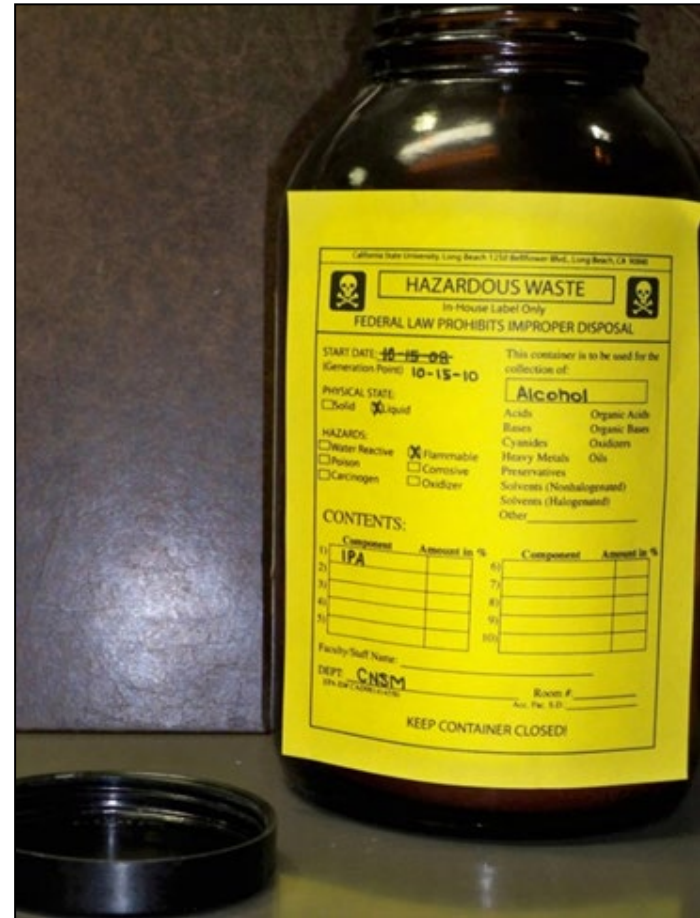
Correct Application



Incorrect Application  
*What's wrong with picture?*

# Chemical Wastes 3

- What's wrong:
  - Lid not affixed to container
  - Hazardous liquid without secondary containment
  - Original start date crossed out
  - Chemical name abbreviated, percentage not indicated
  - General description not complete
  - Generator information not complete



# Ionizing Radiation



radioactivity symbol

- Some atoms release energy in several forms of radiation in order to become more stable.
- Ionizing Radiation is radiation having enough energy to break chemical bonds.
- Can be from materials or can be generated by certain devices in the form of x-rays (high energy photons).
- Use of Radioactive Materials and certain x-ray generating devices requires special permission and training through the Radiation Safety Office.

# Ionizing Radiation 2

- Labs that generate radioactive wastes will place them in specially marked containers.
- Entry doors will be labeled and work areas within labs will be marked off with yellow tape and labeled.



radioactive waste can



labeled work area

# Non-Ionizing Radiation

- Some lab classes use sources of non-ionizing radiation.
- Non-Ionizing Radiation does not have enough energy to break chemical bonds but can still be dangerous.
- Sources include lasers, microwaves and ultraviolet (UV) light sources.
- Use of most non-ionizing sources requires training by CNSM Safety or by your supervisor depending on the source.

# Biohazards



biohazard symbol

- Some labs including classes use pathogenic agents (capable of spreading disease) and thus generate Biohazardous Waste.
- Special training and materials handling required for use of such materials.
- Items contaminated with human blood or other potentially infectious materials (OPIM) must be collected in specific RED waste containers. Examples of OPIM include human cell lines or tissue samples.



# Biohazardous Waste Containers



biohazardous  
sharps container



biohazardous  
waste barrel



biohazardous  
waste can

# Handling and Reporting of Chemical Spills

- In the event of a spill, review the CNSM Chemical Spill Response Procedures posted.
- Small spills (less than 1L or 0.5kg) of known materials that DO NOT pose an inhalation hazard can be cleaned up following the posted procedure by individuals having completed this training.
- Call the Science Safety Office before cleaning up significant spills or spills you do not feel capable of addressing safely.

# Handling and Reporting of Chemical Spills 2

- Be sure to wear all necessary PPE during cleanup and contact your supervisor or the Science Safety Office if needed.
- Once remediated, report the spill on the CNSM Incident Form.
- Call 911 and/or pull the fire alarm if necessary to address a spill that may impact others in the building.

# Scientific Glassware

- If glass tubing or a thermometer must be inserted in a rubber stopper or cork, LUBRICATE IT so it goes in easily.
  - If you don't lubricate it, it may break off and cut you.
- Use caution when washing glassware.
  - Glassware that gets broken can cut you.

# Broken Glass and Other Sharp Items

- Broken glass must be cleaned up promptly, but NEVER put sharp items in regular trash cans.
- Put them in special “Broken Glass” box.
- When full, tape shut and place directly in dumpster.
- Do not overfill and do not let the box get wet or too heavy.
- If the broken glass is contaminated with a hazardous material, package and label it as hazardous waste.
- Needles, razor blades, jagged metal or other sharps must be discarded into approved sharps containers.

# Sharps Receptacles

- For all non-biohazardous sharps waste



broken glass box



sharps container,  
small



sharps container,  
large

# Equipment Hazards

- Some equipment is dangerous if improperly used (lasers, centrifuges, etc.).
- Furnaces, stir plates with heating function, ovens, or other devices with heating elements may have hot surfaces.
- If you don't know how to use the equipment properly, ask before using the equipment.
- Supervisors shall ensure that appropriate training and supervision is provided.
- If you must lift items as part of your job, be sure to lift safely. Specialized training available through EHS is required before moving loads 50 pounds or greater. Contact your supervisor or the Science Safety Office for more information or to request this training.

# Equipment Hazards: Autoclaves

- Autoclaves pressurize steam and operate at high temperatures.
- Specialized training is required prior to use.
- Training for CNSM common use autoclaves is provided by the Biological Sciences Department.





# Work Area Hazard: Slips, Trips, and Falls

- Slips, trips, and falls account for a large proportion of workplace injuries and fatalities.
- Most are caused by hurried or careless work habits, damaged or slippery (often wet) surfaces, obstructions in walkways, poor visibility, or unsafe use of stairs or ladders.
- Report any potential slips, trips or fall hazards to your supervisor or Science Safety Office immediately.

# Work Area Hazard: Slips, Trips, and Falls 2

- Good practices to avoid slips, trips, and falls include:
  - proper planning of work activities
  - promptly cleaning up water or other spills
  - maintain tidy, well kept work areas
  - avoid leaving tools or other materials on floors
  - promptly reporting lighting outages to Beach Building Services (x54357) for repair
  - not carrying loads large enough to obstruct vision up or down stairs
  - only using ladders in good condition; during use folding them out completely; facing the ladder when climbing; keeping weight centered; and keeping 3 out of 4 limbs on ladder at all times. Specialized training available through EHS is required prior to the use of portable ladders. Contact your supervisor or Science Safety Office to request this training
  - when using temporary extension cords, position equipment to avoid crossing walkways or use cord protectors

# Laboratory Security Regulation

- All laboratories in the CNSM are bound by the [College Lab Security Regulation \(PDF\)](#).
- Make sure you are familiar with the regulation and that your name is added to the Authorized Personnel list as appropriate.

# Heat Stress and Heat Illness

- CSULB has a Heat Illness Prevention Program.
- Workers who are exposed to extreme heat or work in hot environments may be at risk of heat illnesses brought on by heat stress including heat cramps, heat exhaustion, and heat stroke.
- Supervisors must ensure that work taking place outdoors or in hot environments is carefully planned to avoid the possibility of heat illness. This planning includes providing proper shade, water and training.
- Training for employees is available regarding heat stress recognition and prevention. Contact the Science Safety Office to request this training or for more information.
- It is critical that illness symptoms be recognized and immediate appropriate action be taken.

# Motor Vehicle Driver Requirements

- Anyone using a personal vehicle more than once per month on University business must fill out a State form in the Department Office.
- Anyone using a University vehicle, or a personal vehicle for more than 4 hours/month on University business, must also complete the Driver Training Class conducted by University Police.



Driving is dangerous. CSULB has strict rules for those who drive as part of their job.

# Field Trip Procedures and Forms

- In accordance with Executive Order 1062, a field trip is defined as a university course-related off campus activity led by a faculty or staff member and designated to serve educational purposes.
- A fieldtrip would include the gathering of data for research, museum visit, participation in a conference or competition, or visits to an event or place of interest lasting a class period or longer.
- Review the [field trip/project procedures](#) linked on the Science Safety Office website. CSU policies and required forms are available there.

# Safety Equipment and Procedures

- The next several slides will cover these topics:
  - Administrative Controls
    - Standard Operating Procedures (SOPs)
  - Risk and Safety Solutions (RSS)
  - Engineering Controls
    - Chemical Fume Hoods and Biological Safety Cabinets
  - Safety Shower / Eyewash
  - Emergency Contacts and Phone Boxes
  - Emergency Evacuation Procedure
  - Fire Extinguishers
  - CNSM Safety Supply Cabinets

# Administrative Controls

- Administrative controls (also known as work practice controls) are practices or procedures such as written safety policies put in place with the goal of reducing or eliminating workplace risks such as chemical exposure.
- Standard Operating Procedures (SOPs) are a form of administrative control that provide instructions safety information on the use of equipment or for a certain procedure.



# Standard Operating Procedures

- Standard Operation Procedures (SOPs) are required for any use of equipment or operation that if done improperly could result in injury to personnel or result in costly damages.
- The Science Safety Office has numerous template SOPs available for use and many for individual hazardous chemicals or chemical categories.
- Some form of training documentation should accompany each SOP.
- The Science Safety Office recommends labs keep their SOPs in a Laboratory Safety Notebook.
- Job Safety Analyses (JSAs) are similar to SOPs but are for “shop” type equipment such as mechanical saws or a drill press.

# Risk & Safety Solutions

- Risk & Safety Solutions (RSS) is a software package having several integrated modules.
  - Assessment Tool – used by lab or operation supervisor to create a custom hazard assessment
    - Includes PPE requirements and other safety information
    - Those working for Faculty or Staff supervisor will be contacted by email to review and “acknowledge” assessment
  - Inventory Tool – used by lab or operation supervisor to create and manage an inventory of all hazardous materials
    - Utilizes barcoded stickers affixed to each chemical container



# Engineering Controls

- Engineering controls are physical barriers or devices designed to protect workers from hazardous conditions by placing a barrier between them and the hazard or by removing a substance through air ventilation.
- Examples include chemical fume hoods, biosafety cabinets, guards or shields, sharps containers, and others.

# Chemical Fume Hoods

- Chemical fume hoods are used to protect people when lab work may produce harmful, bad-smelling or smoky emissions.
- Individuals may wear dust masks to reduce exposure to nuisance levels of dust but gas masks, respirators or other personal filtration devices require fit testing and approval by campus EHS before use..
- A detailed [guidance on the use of fume hoods \(PDF\)](#) is available online or from the Science Safety Office.

# Chemical Fume Hoods 2

- When using a fume hood for protection, keep in mind the following:
  - Never put your head inside the fume hood when chemicals are present.
  - Do not use if air flow velocity is below 100 linear feet/min.
  - Cluttered hoods with excess equipment and bottles should not be used due to impeded air flow.
  - Sash (movable glass front) **MUST** be at or below the sash “stop” catch.
  - If arrow stickers are in place, sash **MUST** be at or below those markers.
  - Promptly report defective/alarming hoods to the Science Safety Office. **DO NOT USE!**

# Chemical Fume Hood Examples

- Note the yellow sash height indicator stickers.



# Biological Safety Cabinets

- Biological safety cabinets (biosafety cabinets or BSCs) are open fronted cabinets that protect users from potentially infectious (disease causing) aerosols by holding a negative pressure and use filters to filter air.
- Proper use of BSCs is described in the CNSM Biohazardous Materials training.
  - Use of chemically hazardous materials in CNSM BSCs is restricted; the filters trap aerosols not chemicals.
  - Hazardous chemicals used in a BSC may pass through cabinet filters and escape into the lab.

# Biological Safety Cabinet

## Example

- Note that it looks similar to a chemical fume hood but is not to be used when handling hazardous chemicals.





# Safety Shower / Eyewash

- Must be “ten seconds” away when working with hazardous materials that can injure the eyes and skin, know the location in your place of work.
- The immediate area surrounding a shower/eyewash (typically marked by yellow and black tape) must be clear as well as the path to the shower/eyewash.
- Shower turns ON when handle is pulled.
  - Will not turn off until handle is pushed UP.
- The injured/exposed person must stay in the shower for a minimum of 15 minutes.
- Contaminated clothes should be removed during shower.
- MOST SHOWERS DO NOT HAVE A DRAIN.
  - Don't worry about the flooding, health of person is more important.
- Eyewashes in HSCI are equipped with drain. Those in MLSC and Micro are not. Use “bucket brigade” if possible.

# Safety Shower / Eyewash 2

- Flush with water only, NEVER apply sodium bicarbonate or medicine to the injury; leave treatment to medical professionals.
- When using the eyewash, follow same rules as safety shower.
- During the 15 minute flushing, the injured person should use his/her fingers to hold eyelids open.
- Science Safety Office should be called when an eyewash or safety shower is used.
- Call 911 as necessary.
- Inert absorbent is available in the Safety Cabinet to put on the wet floor.
- Need longer flush for some chemicals! **Check SDS.**

# Safety Shower / Eyewash Examples



shower and  
eyewash  
handles



eyewash in  
use, pull  
handle  
down to  
activate

# Portable Eyewash Units

- Portable units are in several CNSM locations where plumbed units are not available.
- Two types, see photos below for operational instructions.
- Once activated, 15 minutes of continuous flow will be provided.
- Area supervisor must visually check water level and quality each month. then sign the inspection tag. Report issues to Science Safety Office.



YELLOW: pull all the way down on black basin



GREEN: grasp black strap and pull to remove covers

# Personal Eyewash Units

- Personal eyewash units are to be used during field operations where a unit capable of providing 15 minutes of continuous flow is not immediately available.
- Follow instructions for use on bottle and information sheet (inside carry case).
- Not to be used as an alternative to a 15 minute flushing station.
- Personal eyewash units are available in CNSM vehicles or can be checked out from the Science Safety Office.



single use personal eyewash and carry case

# Emergency Contacts

DIAL 911

FOR POLICE, FIRE  
OR  
MEDICAL EMERGENCIES

Please add the Science Safety Office phone number to your address book:

**562.985.5623**

# Emergency Phone Boxes

- Are located on the walls in the science building hallways and in elevators.
- Use them to speak directly to CSULB police.
- Dial 911 from any phone to reach emergency responders.



in an elevator

# Emergency Evacuation Procedure

- Be aware of the fastest/safest exit.
- If alarm sounds, or authorities order an evacuation, leave promptly.
  - Take personal items and turn off Bunsen burners, other ignition sources and equipment (if possible).
- STAY 200 FEET away from the building upon evacuation.
- If safe, proceed to designated “rally points” upon evacuation.
  - For MLSC, HSCI and MICRO, rally points are in the open area adjacent to the campus bookstore.
  - For LA5 and FO3, rally point is in open area adjacent to the Student Success Center (SCC).
- [Evacuation Plans](#) are available on the University Police website.



# Fire Extinguishers

- MLSC fire extinguishers are in the hallways.
- HSCI and MICRO fire extinguishers are in laboratories and in the hallway.
- Fire extinguishers should only be used by trained people. Specialized training is available; contact your supervisor or the Science Safety Office for more information or to request this training.
- DON'T BE A HERO, extinguishers are to be used in a defensive manner only.
- Evacuate the building and pull the fire alarm as appropriate.

# Fire Extinguishers Examples

- This is what fire extinguishers may look like:



# CNSM Safety Supply Cabinets

- There are three Safety Cabinets:
  1. HSCI Room 385; door opened by HSCI building key
  2. MLSC 300 level Lobby; lock opened by any CNSM building or lab key
  3. MICRO 100 level between restroom and elevator; lock opened by any CNSM building key
- Safety supplies are stocked for use in laboratory work areas including a first aid kit and spill cleanup materials.
- Notify the Science Safety Office if you use the cabinet so they can keep it stocked.

# CNSM Safety Supply Cabinets 2



Safety Cabinet in  
HSCI 385



Safety Cabinet in  
MLSC 300 level



Safety Cabinet in  
MICRO 100

# Personal Protective Equipment

- Personal protective equipment (PPE) is designed and used to shield users from harmful exposure to chemicals or from hazardous operations.
  - Engineering controls and other safety measures come first, PPE can sometimes be thought of as a last line of defense.
- The types of and amount of PPE is selected based on an individual's need for protection.
- In CNSM laboratories minimum PPE generally consists of closed-toed shoes, eye protection, a lab coat, and gloves.
- Some operations require additional specialized PPE. Using improper PPE may result in inadequate protection. Contact your supervisor or the Science Safety Office for more information.

# Eye Protection

- Chemical splash **goggles** with indirect vents must be worn by EVERYONE as soon as *anyone* in a lab class or handles hazardous materials.
- Goggles must be worn by any individuals within 10 feet of someone handling hazardous materials.
- Upon approval from your supervisor, safety glasses (with side shields) may be worn when working with small volumes (less than 25ml) or to protect from impact hazards.
- Face shields are used when additional protection is necessary.
- Always used with either goggles or safety glasses depending on the operation.

# Eye Protection 2

- Wear appropriate eye protection when working with ***anything*** that can injure the eyes, e.g.:
  - flying particles
  - laser light
  - UV light
  - electric arc
  - etc.
- ONLY those with proper eye protection will be allowed in the lab/workplace.

# Eye Protection Examples



## **Chemical Splash Goggles:**

Note the indirect vents (no holes); good for protection from liquids and solids (any amount)



## **Safety Glasses:**

Note the side shields; may be used for physical hazards or small volume work. Limitation: may not fully protect user from splashes while working with large volumes



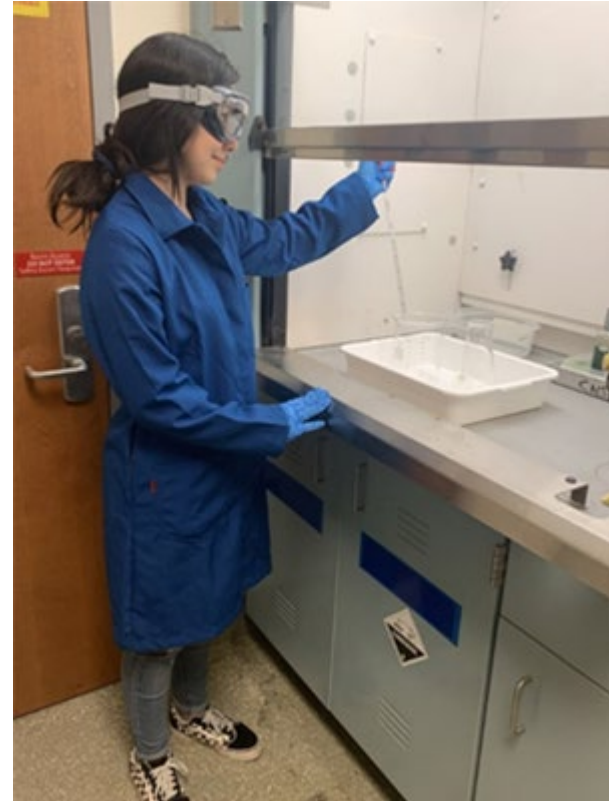
# Laboratory / Workplace Attire

- Closed-toe shoes must be worn at all times in any class or research lab that will EVER use hazardous chemicals at any point. Closed-toe shoes are also required wherever heavy items are stored or transported.
- Gloves (even if clean) should not be worn outside the laboratory.
- Must also wear a lab coat if hazardous materials are used or upon direction of the supervisor.
  - Flame resistant lab coats may be required if the chemicals being used are flammable or pose a fire danger.

# Laboratory / Workplace Attire 2



standard lab coat



fire-resistant lab coat

# General Safety Training: Part III

- No Food, Drink, or Smoking
- Housekeeping and Conduct
- Reporting Accidents / Incidents
- Medical Costs

# No Food, Drink, or Smoking

- No food or drink is allowed in laboratories or any other location where toxic materials could be present.
- Food and beverage items cannot be brought into labs (this includes personal water bottles).
- Labs where food is allowed will have special postings on walls/doors.
  - If no postings are present, no food or beverages are allowed.

# Housekeeping and Conduct

- Promptly clean up broken glass, trash and chemical spills when safe to do so.
- Never throw chemicals in trash or into broken glass box.
- Never pour chemicals down the drain.
- If water is spilled on the floor, clean up immediately to prevent slip/fall injuries.
- Inappropriate behavior will not be tolerated.

# Poor Housekeeping Examples



Not OK: metal to wire lamp on wet concrete



Not OK: extension cord

*Temporary use (less than 90 days) is OK*



Not OK: daisy chain with 2 power strips

# Reporting Accidents / Incidents

- Please report all injuries, dangerous failures, chemical spills, noxious odors, floods, etc., to the Science Safety Office or your lab instructor.
- The CNSM Incident Report Form is available from the Science Safety Office and online.
- Injured students should go to the Student Health Center for medical evaluation.
- Do not clean up any human blood or OPIM, the Science Safety Office will perform this task once notified.

# Incident Report Form Example

<b>CNSM OFFICE USE ONLY</b>		<b>Safety Office</b>	
INCIDENT NUMBER: _____ - _____		College of Natural Sciences and Mathematics	
<small>year                      number</small>		<a href="http://www.csulb.edu/cnsm/safety">www.csulb.edu/cnsm/safety</a>	
DATE RECEIVED BY CNSM SAFETY: _____			

### INCIDENT REPORT FORM

DATE OF INCIDENT: \_\_\_\_\_ TIME: \_\_\_\_\_

LOCATION: \_\_\_\_\_

INCIDENT DESCRIPTION: \_\_\_\_\_

NAME(S) OF IMPACTED PERSONNEL: \_\_\_\_\_  
*"(E)" For Employee or "(S)" for student must follow name(s)*

NAME(S) OF RELEVANT WITNESSES: \_\_\_\_\_

INDIVIDUAL(S) IN CHARGE OF AREA/OPERATION: \_\_\_\_\_

RESPONSIBLE DEPARTMENT: \_\_\_\_\_

DATE FORM INITIATED: \_\_\_\_\_

INCIDENT FORM INITIATED BY: \_\_\_\_\_

### INVESTIGATION

The section below to be completed by administrative and/or CNSM Safety personnel ONLY.

INVESTIGATED BY: \_\_\_\_\_

INVESTIGATION DATE(S): \_\_\_\_\_

APPARENT CAUSE OF INCIDENT: \_\_\_\_\_

APPROPRIATE PPE/ENGINEERING CONTROLS EMPLOYED?     YES     NO

LIST: \_\_\_\_\_

CORRECTIVE MEASURES TAKEN: \_\_\_\_\_

SENT TO APPROPRIATE ADMINISTRATOR: \_\_\_\_\_    \_\_\_\_\_  
name                      date



# Medical Costs

- **WARNING:** The University does not reimburse students for treatment sought for injuries or illnesses (even if the student is injured in class).
- Treatment for students is available at the Student Health Center but may be limited and subject to reduced hours of operation.
- Notify your instructor or supervisor if you think your health might be adversely impacted by any class or workplace activity.
- Employees are covered by Worker's Compensation Insurance. Go to the Science Safety Office for authorization forms and instructions.

# Safety Quiz

- After completing the General Safety Quiz, you will be directed to print a Safety Program Form.
- You will take this form to your supervisor and your supervisor will mark any of the items you will be working with.
- You and your supervisor will sign the form and you will take the form to the Science Safety Office.
- The Science Safety Office will review your form and provide you with information on any additional training(s) you will need.

# Supplemental Training

- Supplemental training is available on the second Wednesday of every month at 1:00pm.
- The Science Safety Office offers Supplemental General Safety Training on a walk-in basis.
- Topics presented in this training are discussed in person and you are given the opportunity to ask any question you have.
- Supplemental training is optional but recommended.
- Location will be in the Science Safety Office unless otherwise stated.

# Specialized Trainings

- Science Safety Office offers the following specialized trainings:
  - Compressed Gases/Cryogenic Materials Training
  - Biohazardous Materials (includes Bloodborne Pathogen Training)
  - X-Ray Generating Device Training
  - Radioactive Materials Training
  - Laser Safety Training
  - Organic Peroxide Forming Materials Training
  - Hazardous Materials Procurement Training

# Conclusions

- The topics covered in this training must be kept in mind during all CNSM activities including field work, research, and teaching lab activities as well as lab or classroom demonstrations.
- Demonstrations should be discussed with the Science Safety Office prior to taking place whenever there are potential hazards involved.

# Conclusions 2

- Before beginning your assigned work each day, always ask yourself the following questions:
  - Do I have the proper training and comfort level to do what I am about to do?
  - Does this work need to be done inside a chemical fume hood or biosafety cabinet?
  - Am I wearing all of the necessary PPE?
  - Is there a safety shower and eyewash nearby?
  - Will this work generate wastes that are hazardous and must be collected for proper disposal?
- Unsure of the answers? Contact your supervisor or the Science Safety Office any time.