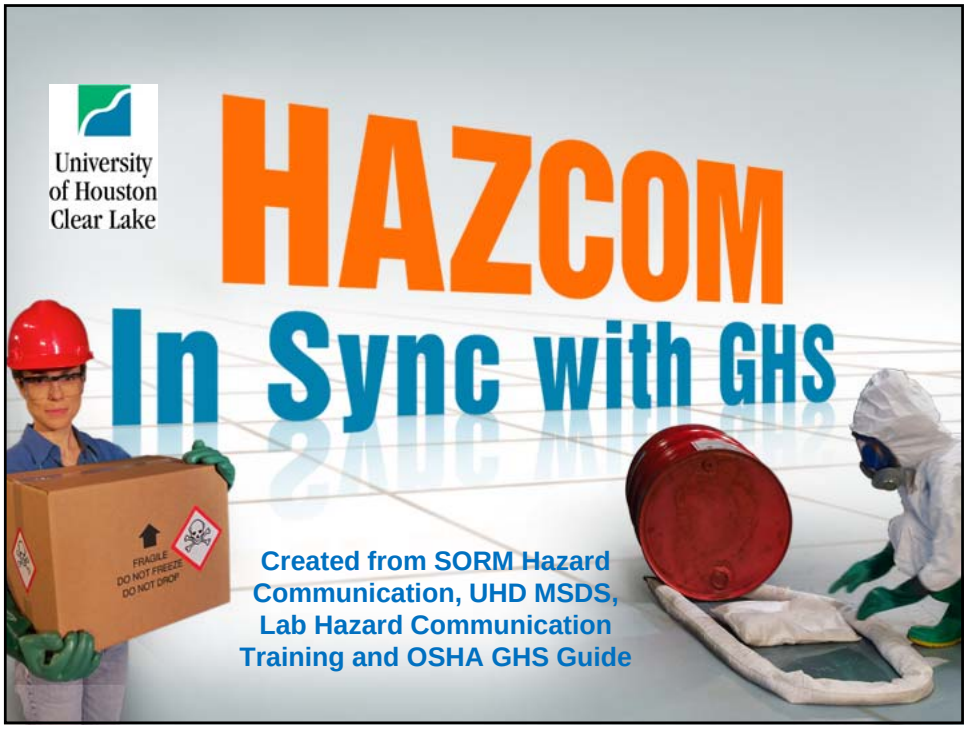


Training Overview

- Hazard Communication Act
- Global Harmonization Standard (GHS)
- Responsible Agencies
- Employer Requirements
- Your Responsibility
- MSDS / new SDS format
- Physical Hazards, Health Effects, Exposure Routes
- Labels
  - NFPA vs GHS format
- Spills, First Aid
- Personal Protection
- Chemical Product Safety

2

STATE AND FEDERAL LAW INFORMATION

- The Texas Hazard Communication Act is codified in Chapter 502 and 506 of the Texas Health and Safety Code. It is also known as the Public Employer Right-to-Know Act.
- Overseen by the Texas Department of State Health Services compatibly with the federal Emergency Planning and Community Right-To-Know Act (EPCRA), also known as the Superfund Amendments and Reauthorization Act of 1986 (SARA), Title III (42 USC §11001 et seq.), and related regulations (Title 40, Code of Federal Regulations (CFR), Parts 355-370), promulgated by the United States Environmental Protection Agency (EPA).

3

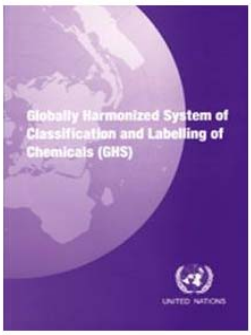
HAZARD COMMUNICATION

Hazard Communication Standard 29CFR1910.1200(a)(1)

"The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, ***material safety data sheets*** and employee training." **OSHA**

4

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS)



Link:
http://www.osha.gov/dsg/hazcom/ghs.html#1.1

"A globally harmonized hazard classification and compatible labelling system, including material safety data sheets and easily understandable symbols…" International mandate from United Nations Conference on Environment and Development

- Adopted by United Nations (UN) in 2003
- Includes criteria for the classification of: **health, physical and environmental hazards, as well as specifying what information should be included on labels of hazardous chemicals as well as safety data sheets.**
- Gears information more for users rather than emergency responders.

5

RESPONSIBLE AGENCIES

OSHA - Occupational Safe Health Administration. The primary federal agency that oversees workplace safety.

US Environmental Protection Agency

TCEQ – Texas Commission on Environmental Quality. The federal and state agencies that regulate pollution and waste disposal issues.

TDSHS – Texas Department of State Health Services oversees topics that overlap both occupational health & safety and environmental, such as Hazard Communication in Texas.

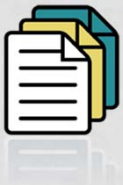
DOT – Department of Transportation oversees Hazardous Materials and Emergency Response on roadways.

6

EMPLOYER RESPONSIBILITY

Your workplace must provide you with:

- A written hazard communication program
- A list of the hazardous chemicals onsite
- SDSs for those chemicals
- Training:
  - How to recognize, understand, and use labels and SDSs
  - How to use safe procedures that protect you against exposure
  - Inform you how to detect presence or release of hazardous chemicals (HazWOpER training soon)



7

YOUR RESPONSIBILITY

You and the University are both responsible for your own safety. You are expected to:

- Follow all safety instructions given by your Supervisors, EH&S, and training materials.
- Read product labels and Material Safety Data Sheets (SDS) to be aware of material hazards, and adhere to the Personal Protective Equipment (PPE), handling and storage requirements.
- Report any unsafe working condition so it may be corrected as soon as possible

8

SAFETY DATA SHEETS
(SDS)

WHAT YOU NEED TO KNOW

9

SDS OVERVIEW

- SDS Format and information
- Physical Hazards
- Toxicity hazards and terms
- Health Effects
- Exposure terms
- Routes of Exposure

10

SAFETY DATA SHEETS (SDS)

ARE MULTI-PAGE DOCUMENTS PROVIDED BY THE CHEMICAL OR PRODUCT MANUFACTURER THAT CONTAIN:

1. **Identification of Chemical** Product, Company and Emergency Contact Information
2. **Hazard(s)** identification (Toxicological information, route of entry, carcinogenicity, exposure limits etc.)
3. **Composition**/information on ingredients
4. **First-aid** measures
5. **Fire-fighting** measures
6. **Spill** / Accidental release measures
7. **Handling and storage**
8. Exposure control/Personal Protective Equipment (**PPE**) Recommendations
9. Physical and chemical **properties**
10. **Stability and reactivity**
11. **Toxic**ological information
12. **Ecological** information
13. **Disposal** considerations
14. **Transport** information
15. Regulatory information
16. Other information

11

SDS

An SDS can be intimidating, but please be aware:

- It contains important information you may need to reference for safe handling precautions or in the event of a spill or accident.
- You should read and know how to access the SDS for each chemical you work with, before beginning work.
- Some hazards are always present with chemical products, but with appropriate facilities and equipment, and proper use of PPE you should be able to work safely

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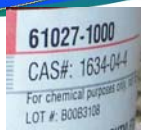
Compound Identification
CAS Number



Often a chemical will have more than one appropriate name or will have a common short name. A chemical may also have different names in other languages.

To avoid confusion, the Chemical Abstracts Service (CAS) assigns a unique number, the CAS Number, to each compound. You will find this universal number in the SDS along with the names.

This number allows an easy computer search for information about a compound, and will be located on the SDS. Emergency personnel can readily access safety information with this number, and chemists can use it to find literature articles or to order the chemical.

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Basic Chemical Hazards

- **Flammable**- chemicals that will ignite and burn easily, sometimes vaporizing to form flammable or explosive mixture with air. Caution must be taken with these materials to separate from flame and heat sources.
  - ✓ Volatile compounds- readily evaporate (form a vapor) when left in an open container. The vapor could be flammable or toxic
  - ✓ **Auto-ignition Temperature-** the lowest temperature upon which a material will ignite without an external source of ignition. Heating to this point may result in explosion.
- **Oxidizers**- may cause a fire when they come in contact with other chemicals and are extremely reactive
- **Corrosive**- chemicals that will damage (burn) your skin:
  - Corrosive: usually applies to acids
  - Caustic: usually applies to bases

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Special Hazards

- **Peroxidizable**- materials that can form peroxides during storage, generally after contact with the air. Special precautions must be taken to test for peroxides and routinely discard. **Commonly used compounds can explode upon heating or distilling, but some may also be sensitive to shock or opening the container.** *Do not open or use* any that do not have the date opened written on the container or any test data within a year of opening.
- **Pyrophoric**-a substance that reacts or *ignites upon contact with air* at temperatures below 45C, or sometimes the moisture in air, *or water* itself
- **Spontaneously combustible-** material that can ignite without an external source of heat, perhaps by reaction with oxygen in the air, by absorption of moisture, or from heat generated during processing.

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TOXICITY

- ***Toxicity relates to the adverse effects of a chemical on a living system***
- There are two timeframes to toxic effects:

Acute Toxicity: the chemical's adverse effects occur within a short time after exposure, sometimes after a single exposure. Acute effects may be severe.

Chronic Toxicity: the chemical's effects occur much later (days, months, years), and may be because of repeated exposure, possibly smaller doses. Chronic effects are often the hardest to diagnose because of the delay in response and lack of supporting evidence.

The SDS gives information about toxicity which should help guide you to the proper PPE and handling safeguards to prevent exposure.

Manufacturer's are required to study toxicity of new chemicals and report new adverse effects. However, toxicity of chemicals is not always known and chemicals should always be handled with caution.

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Special SDS Toxicity Terms

Toxic compounds may list specific actions:

- **Carcinogen**: known to cause Cancer
- **Teratogen**: causes Birth Defects or Fetal Death
- **Hepatotoxic**: cause Liver damage
- **Nephrotoxic**: cause Kidney damage

- **Neurotoxic**: damages the Nervous system
- **Hematopoietic**: damages Blood cells and/or Bone marrow

- **Clastogen:** causes chromosomal breaks in cells, which causes mutated cells possibly leading to cancer. Example: Benzene, Arsenic

- **Systemic poison:** can cause *severe poisoning or even death by remote exposure* such as a small amount onto the skin. Phenol, hydrofluoric acid, and Methyl Mercury are examples of systemic poisons. Extreme care and special protective equipment and procedures are required for the use of these materials.

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SDS: Effects that may be listed

Asphyxiant-displaces air and/or reduces the level of oxygen in the body to dangerous levels. No pain is felt, the only indication may be light-headed or sleepiness.

- **Sensitizer**-causes reaction, often to the skin, possibly after repeated exposure

Irritant-causes inflammation of the skin, mucous membranes, or lungs

Hygroscopic-a material which attracts moisture. Some dry forms may create a solution upon contact with air, and some may dry out the skin

Vessicant- causes severe, painful skin, eye and mucous membrane irritation often referred to as chemical burns or water blisters

Lachrymator- causes tears and eye irritation

Sternutator- irritates the nasal and respiratory passages and causes coughing, sneezing, lachrymation (tearing of the eyes), and possibly vomiting

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SDS: Exposure Terms

- **LD50**- Lethal Dose to 50% of the population
  When this amount of chemical is taken (by contact or ingestion) 50% of the test subjects (usually mice) die. Reported in mg of substance per kg body weight. The smaller the number, the more lethal the substance is.
- **TLV**- Threshold Limit Value
  The maximum established amount a worker may be exposed to in the 8-hour day/40-hr week work environment without requiring additional controls or PPE to reduce exposure. Reported in mg/m^3 or ppm as a volume of air space in the room.
- **PEL**- Permissible Exposure Limit
  A legal standard of exposure in the workplace for a typical 8-hr work day. This value may not be exceeded.
- **STEL**- Short Term Exposure Limit
  The maximum amount believed (not necessarily known to be) safe for a single short term exposure (<15 minutes), which should not be exceeded.
- **IDLH** – Immediately Dangerous to Life and Health
  An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere. [29 CFR* 1910.120]

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Common Routes of Exposure

Inhalation

This is the most common mode of exposure. Some chemicals have no odor (like Mercury); some odors you get used to after a while (attenuated) or your nose loses the ability to smell it. Strength of odor is not equal to how toxic it may be or how concentrated they are.

Skin and Eye Contact

You may think of skin as barrier, but chemicals can penetrate the skin. Chemical vapors, gases, aerosols, or mists can be absorbed through the mucous membranes of the eyes, mouth, nose, throat or skin. Contact may be indirect such as when you adjust your glasses while wearing dirty gloves and then later adjust your glasses with gloves off, or contact with items contaminated by others.

Eye exposure can be indirect through vapors, or direct via a splash (when not wearing goggles), or by touching your eye while your hand or glove is contaminated by a chemical.

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Common Routes of Exposure

Ingestion

Ingestion is usually by accident. It is avoided by keeping food away from chemicals and work surfaces, and by washing your hands after working with chemicals, not touching your face or mouth when working with chemicals, etc.

Injection

This can occur by skin puncture with a scratch, dirty piece of glassware or apparatus or accidental needle injury. Breaking a piece of glassware is a common route for laboratories; chemicals can enter through a cut.

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LABELS

- Manufacturer info
- NFPA format
- GHS format & Pictograms
- Comparison
- Maintaining the Original Label
- Secondary container Labels
- Alternative Labeling

23

Manufacturer's Bottle Labels

Original HazCom Labeling Requirements for now	GHS Labeling Requirements (by 2015)
Name of the product as appears on MSDS/SDS	
Name and address of Manufacturer	Name and address and telephone of manufacturer or responsible party
Physical and Health hazards known	Hazard statements and Signal word "Danger" or "Caution"
NFPA diamond and/or GHS system	Pictograms
	Precautionary statements for handling, storage, and disposal

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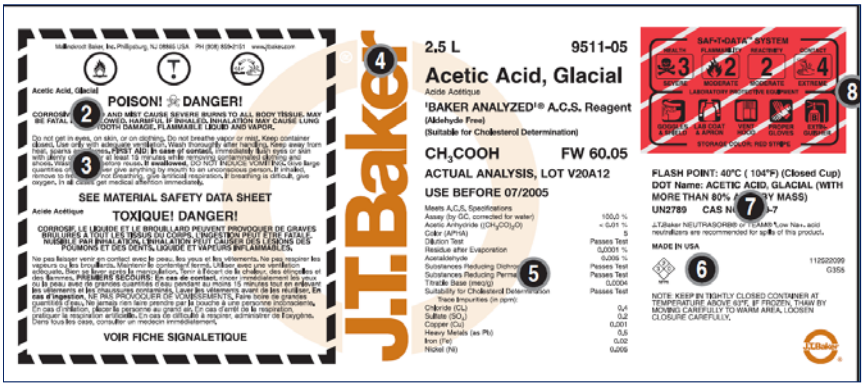
Product Labels



Most new chemical products contain hazard information. Here is an example. Reputable companies may provide this information on the label, though warnings weren't required before 1985, and no format is required until full effect of Global Harmonized System on 6/1/15.

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New GHS Product Labels

Identifier: NOMIXUP 7042012

DANGER!

Hazard Statements:	Extremely Flammable Gas May Cause Cancer May Cause Respiratory Irritation In Contact with Water Releases Flammable Gas
Precautionary Statements:	Keep away from heat/sparks/open flames/hot surfaces.-No Smoking Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid breathing vapors and mists. Wear protective gloves and eye protection. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call poison center/doctor if you feel unwell. Leaking Gas Fire: Do not extinguish unless leak can be stopped safely. Eliminate all ignition sources if safe to do so. Store in tightly closed container in a well-ventilated place, locked up. Use outdoors or use in a well-ventilated place. Dispose of contents in accordance with local/regional/national regulations.

XYZ Chemical Company 123 Main St. Anywhere , NY, USA 1-800-000-1111

This is an example of the new GHS label requirements, which are required to be provided by manufacturers and importers by June 1, 2015. Employers have until June 1, 2016 to make adjustments.

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New GHS System

- The Globally Harmonized System (GHS) of Classification and Labeling of Chemicals is a **worldwide initiative** to promote **standard criteria for classifying chemicals** according to their health, physical and environmental hazards.
- It uses **pictograms, hazard statements, and signal words** "Danger" and "Warning" **to communicate hazard information on product labels** and Safety Data Sheets (SDS) logically and completely.
- The **primary goal of GHS** is better protection of **human health** and the environment by providing chemical users with enhanced and consistent information on chemical hazards.
- Manufacturers must comply by June 1, 2015 but may have already started updating labels and Safety Data Sheet (SDS).
- Employees must be trained on the new format by December 1, 2013.

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New GHS System Labeling

- Is geared more towards **informing workers** of hazards rather than to fire responders in an emergency.
- **Number system** for GHS Hazards (on SDS) **is Opposite** of NFPA.

	Most Severe	Least Harmful
NFPA	4	1
GHS	1	4

- Includes Acute **and Chronic** health hazards, with **Precautionary statements** about hazardous properties and health effects.
- **Physical Hazards** have broader list to include or more clearly indicate: Pyrophoric Air or Water Reactive materials, Organic Peroxides, Self-Reactive or Self-Heating substances, Flammable Gases and Aerosols, or materials that create flammable gases from reaction with water. There are subcategories for some based on degree of hazard, which are semi-quantitiative.

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NFPA® OSHA® QUICK CARD

Comparison of NFPA 704 and HazCom 2012 Labels

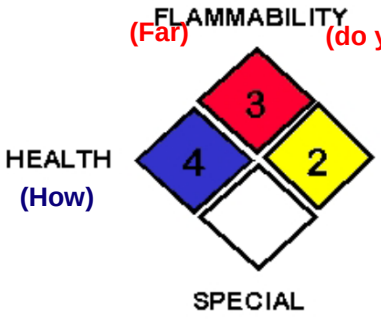
	NFPA 704	HazCom 2012
Purpose	Provides basic information for emergency personnel responding to a fire or spill and those planning for emergency response.	Informs workers about the hazards of chemicals in workplace under normal conditions of use and foreseeable emergencies.
Number System: NFPA Rating and OSHA's Classification System	0-4 0-least hazardous 4-most hazardous	1-4 1-most severe hazard 4-least severe hazard • The Hazard category numbers are NOT required to be on labels but are required on SDSs in Section 2. • Numbers are used to CLASSIFY hazards to determine what label information is required.

Original Hazard Communication Warning information

HAZARD LEVEL

0 very low
1 slight
2 moderate
3 severe
4 extreme

NFPA DIAMOND
NATIONAL FIRE PROTECTION ASSOCIATION



MSDS FORMS ABBREVIATE THE DIAMOND:

NFPA 704M RATING : 4-3-2

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Health Hazards

	Health Hazard
4	Very short exposure could cause death or serious residual injury even though prompt medical attention was given.
3	Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
2	Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.
1	Exposure could cause irritation but only minor residual injury even if no treatment is given.
0	Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

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Flammability

	Flammability
4	Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
3	Liquids and solids that can be ignited under almost all ambient conditions.
2	Must be moderately heated or exposed to relatively high temperature before ignition can occur.
1	Must be preheated before ignition can occur.
0	Materials that will not burn.

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Reactivity

Instability[1]	
4	Readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Capable of detonation or explosive reaction, but requires a strong initiating source or must be heated under confinement before initiation, or reacts explosively with water.
2	Normally unstable and readily undergo violent decomposition but do not detonate. Also: may react violently with water or may form potentially explosive mixtures with water.
1	Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.
0	Normally stable, even under fire exposure conditions, and are not reactive with water.

[1] Prior to 1996, this section was titled "Reactivity". The name was changed because many people did not understand the distinction between a "reactive hazard" and the "chemical reactivity" of the material. The numeric ratings and their meanings remain unchanged.

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Special Hazards

Special Hazards	
This section is used to denote special hazards. There are only three NFPA 704 **approved** symbols:	
OX	This denotes an oxidizer, a chemical which can greatly increase the rate of combustion/fire.
SA	This denotes gases which are simple asphyxiants. The only gases for which this symbol is permitted are nitrogen, helium, neon, argon, krypton, and xenon. The use of this hazard symbol is optional.
W	Unusual reactivity with water. This indicates a potential hazard using water to fight a fire involving this material. When a compound is both water-reactive and an oxidizer, the W/bar symbol should go in this quadrant and the OX warning is placed immediately below the NFPA diamond.

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Other Special Hazards

ACID	This indicates that the material is an acid, a corrosive material that has a pH lower than 7.0
ALK	This denotes an alkaline material, also called a base. These caustic materials have a pH greater than 7.0
COR	This denotes a material that is corrosive (it could be either an acid or a base).
	This is a another symbol used for corrosive.
	The skull and crossbones is used to denote a poison or highly toxic material. See also: CHIP Danger symbols.
	The international symbol for radioactivity is used to denote radioactive hazards; radioactive materials are extremely hazardous when inhaled.
	Indicates an explosive material. This symbol is somewhat redundant because explosives are easily recognized by their Instability Rating.

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New GHS System Pictograms Hazards

Health Hazard	Flame	Exclamation Mark
		
▪ Carcinogen ▪ Mutagenicity ▪ Reproductive Toxicity ▪ Respiratory Sensitizer ▪ Target Organ Toxicity ▪ Aspiration Toxicity	▪ Flammables ▪ Pyrophorics ▪ Self-Heating ▪ Emits Flammable Gas ▪ Self-Reactives ▪ Organic Peroxides	▪ Irritant (skin and eye) ▪ Skin Sensitizer ▪ Acute Toxicity ▪ Narcotic Effects ▪ Respiratory Tract Irritant ▪ Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder	**Corrosion**	**Exploding Bomb**
		
▪ Gases Under Pressure	▪ Skin Corrosion/Burns ▪ Eye Damage ▪ Corrosive to Metals	▪ Explosives ▪ Self-Reactives ▪ Organic Peroxides
Flame Over Circle	**Environment** (Non-Mandatory)	**Skull and Crossbones**
		
▪ Oxidizers	▪ Aquatic Toxicity	▪ Acute Toxicity (fatal or toxic)

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Maintaining the Original Label

You can add information to the container but **you cannot remove or deface the original label** information.

The Hazard Communication Act **Requires Re-labeling of primary containers** if the label becomes illegible.

If you must replace the original label, **the replacement label must include:**

- Identity of the chemical as listed on the SDS;
- Appropriate hazard warnings (words, pictures, symbols, or combo) for the chemical's physical and health hazards, including target organ effects;
- Manufacturer's name and address

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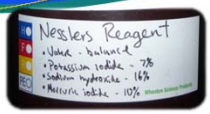
Secondary Container Labels



When a chemical is transferred to a secondary container, the new container must be labeled with:

1) The name of the chemical as listed on the SDS (chemical formula may be used, but **no acronyms or abbreviations or structures**) in English, and
2) Appropriate hazard warnings, words, pictures/symbols or combinations that provide general information on the hazards of the chemical.

This is **required** unless the container is for the **immediate** use of the individual who made the transfer.

- The contents must be written on the container before it is left unattended.

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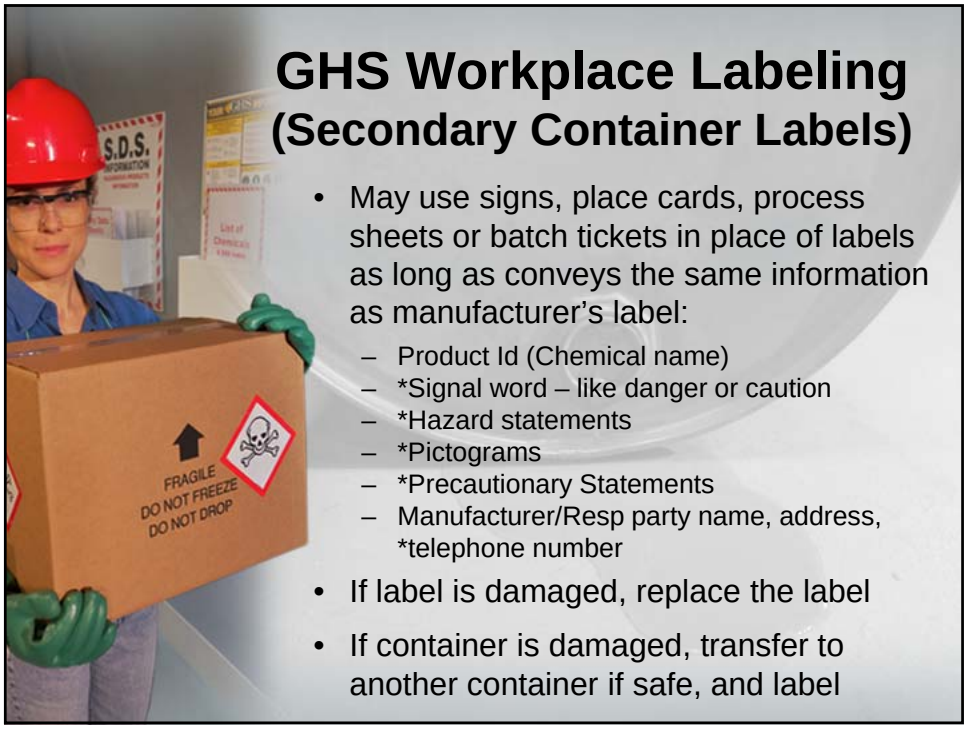
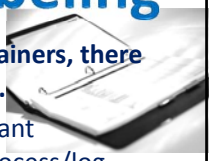


GHS Workplace Labeling (Secondary Container Labels)

- May use signs, place cards, process sheets or batch tickets in place of labels as long as conveys the same information as manufacturer's label:
  - Product Id (Chemical name)
  - *Signal word – like danger or caution
  - *Hazard statements
  - *Pictograms
  - *Precautionary Statements
  - Manufacturer/Resp party name, address, *telephone number
- If label is damaged, replace the label
- If container is damaged, transfer to another container if safe, and label

Alternative Container Labeling



To make labeling easier for multiple containers or small containers, there are some allowable alternatives to full labeling of containers.

- **Tank or Equipment Process Logs-** For containers with constant material changes, such as those inside equipment, signs, process/log sheets, operating procedures, or other similar written materials may be used in lieu of affixing labels. The alternative method must identify the containers to which it is applicable and convey both the name and hazards required.
- **Associated with Label** – smaller containers may have a unique id or acronym **and** *a logbook or sign nearby* which explains what it is.
- **Outer container** labeling for multiple smaller containers of an identical material. The outer container can have the full label.
- The National Fire Protection Association (NFPA) 704m Standard diamond may be used until 6/1/15 to indicate hazards, along with chemical name.

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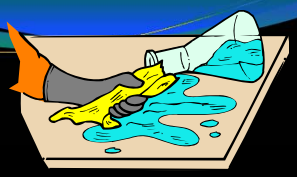
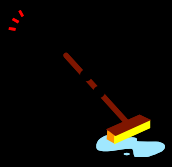
Chemical Spills



It is your responsibility to clean up any chemicals that you spill.

If a spill is more than can easily be cleaned up:

- Evacuate the area
- Notify your supervisor,
  - EH&S at extension 2106
  - Campus police at extension ext. 2222



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Emergency Procedures

With all chemical exposure incidents, follow-up with a professional Medical evaluation, and ensure someone observes those injured for the next 24hrs.

- **Eyes:** Flush with water for 15 minutes while holding your eyelids open with your fingers
- **Skin:** Remove contaminated clothing and wash with soap and water for 15 minutes
- **Inhalation:** Move to fresh air
- **Swallowing:** Consult SDS and get emergency assistance

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Emergencies

Get follow-up medical attention!

Laceration – wash under water, let bleed a little to cleanse the wound, then compress and bandage and seek medical attention

Needle stick – injection can lead to infection. Take care when handling needles, DON'T recap!

Burns – wash for 15 minutes with cold water, then apply burn gel if necessary for minor burns. Do not use fire blanket alone as this traps heat in the body.

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First Aid

Get follow-up medical attention!

Acid or Base Burns – wash under water for at least 15 minutes. Bases have a slippery feel like soap. Acids have a "non-skid" feeling and may burn.

Accidental Ingestion – Call the local poison control center for advice. Do not drink anything unless instructed

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Protective Work Practices

- **Never allow chemicals to touch your skin or hands.**
- Breakthrough is the movement of a chemical through a protective material, such as a rubber glove. This may be a chemical's gradual permeation through or chemical degradation of the glove/material.
- Wash your hands frequently
  - After removing gloves
  - Before you leave the work area
- Use good housekeeping
  - Clean up the work surface where chemical products are used
  - Return items to their proper storage
  - Clean up any spills
- Understand the hazards of your work

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PPE: Personal Protection Equipment

Protect yourself:

- Eyewear
  - Goggles indirect vented so liquids don't splash into eye
- Gloves
  - Check compatibility with the chemical in use
- Foot protection
  - Closed toe shoes, non-absorbent preferred
- Clothing
  - long sleeved shirt and pants

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Personal Safety with Chemicals

- Review SDS carefully before use. Don't use a chemical you don't know the hazards of, including unlabeled containers.
- Use chemicals only as directed and for their intended purposes.
- Avoid direct contact with any chemical to your hands, face, or clothing (including shoes) by wearing proper PPE and washing hands after use.
- Never smell, inhale or taste chemicals. Be sure there is adequate ventilation where products are used.
- Be careful when carrying containers. Support them from the bottom as well as side or top to prevent drops, spills or splash on yourself.
- No horseplay, pranks, or other mischief.

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Housekeeping

- The work area should be keep clean and uncluttered, with chemical products and equipment stored away when not in use.
- **Prevent slips and trips** by cleaning up spilled liquids promptly and by keeping the floor free of loose items, including electrical cords
- **Never block or even partially block** the pathway to an exit or to safety equipment, such as the eye wash, safety shower, or fire extinguisher. Keep aisles clear of obstacles such as boxes and other storage items that might be put there (even temporarily).

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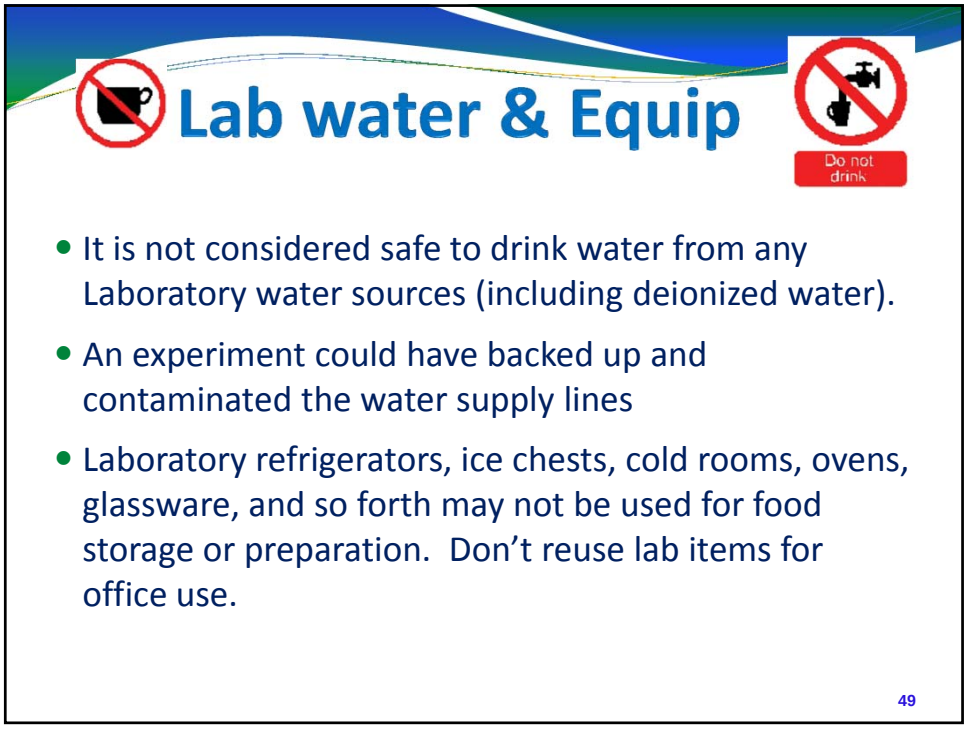
Lab water & Equip
Do not drink
It is not considered safe to drink water from any Laboratory water sources (including deionized water).
An experiment could have backed up and contaminated the water supply lines
Laboratory refrigerators, ice chests, cold rooms, ovens, glassware, and so forth may not be used for food storage or preparation. Don't reuse lab items for office use.
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