

HAZARDOUS MATERIALS I



Unit Overview

Hazardous Materials I provides information on the physical hazards of chemicals and the federal regulations for protecting people from the hazards associated with chemicals. This information is important for people working in the fabrication of MicroElectroMechanical Systems (MEMS)

This unit should take about 15 minutes to review.

Objectives

- ❖ Describe at least five chemical characteristics that are physical hazards
- ❖ Match the physical hazards to their warning symbols

OSHA Facts

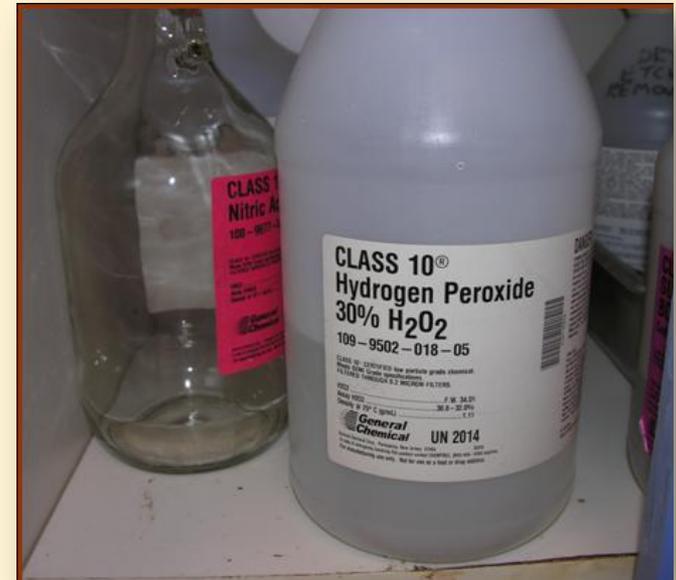
- ❖ Over 32 million Americans work with chemicals.
- ❖ Approximately 650,000 chemicals are in the workplace and increasing.
- ❖ Exposure to certain chemicals may cause or contribute to health problems.
- ❖ Many chemicals present safety hazards from fire and explosions.



Working with Chemicals

MEMS and Chemicals

- ❖ Companies that manufacture MEMS devices are heavily dependent upon chemicals in their processes.
- ❖ An understanding of the hazards associated with chemicals is a requirement of all employees.
- ❖ It is also the responsibility and right of every employee to know these hazards.



The Need to Know

Anyone working with or around hazardous chemicals

- ❖ must understand what they are working with,
- ❖ must know how to protect themselves and others, and
- ❖ must be able to interpret information about the chemicals in their work or educational environment.

The Right to Know

OSHA requires employers to provide the following:

- ❖ List of all chemicals in the workplace
- ❖ Hazard evaluation by the manufacturer
- ❖ Product warning label system
- ❖ Accessible SDS's for all chemicals
- ❖ Written hazard communications program
- ❖ Training program



Employee Training

Review Questions

- ❖ Why should you learn about hazardous materials?
- ❖ What information should your employer provide?
- ❖ What is your "right to know"?

Understanding Hazardous Materials



Physical Hazards

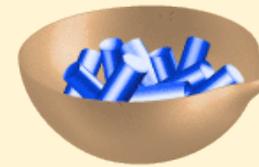
In order to effectively interpret a SDS and chemical label, one must understand

- ❖ terminology associated with chemicals
- ❖ health and physical hazards
- ❖ characteristics of various chemicals

Physical Forms of Chemicals

Chemicals can be

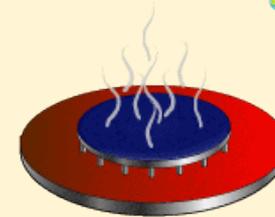
- ❖ Liquids
- ❖ Solids
- ❖ Gases
- ❖ Vapors
- ❖ Fumes
- ❖ Mists



**Metal
Pellets**



Liquid



Fumes

Physical Forms of Chemicals

Some chemicals are generated in the workplace through daily operations.

- ❖ Welding fumes
- ❖ Dusts
- ❖ Exhaust fumes
- ❖ Process by-products



**Process
By-products
(fumes)**

Evaporating Solvents

Atmospheric Hazards

Fumes, gases, dusts, mists are types of atmospheric hazards.

In many cases, these hazards are toxic or corrosive.

Example: Hydrochloric gas is produced when water is used to clean machine parts that have been exposed to a chlorinated by-product.

Physical Hazards

Chemicals exhibit various characteristics. These characteristics are used to help identify the physical and health hazard of a chemical.

Physical hazards are associated with any chemical that produces a violent change when subjected to external factors such as heat, vibration, or oxygen, or in some cases, [standard temperature and pressure](#).

Physical Hazards include flammable, radioactive, combustible.

Health Hazards

Health Hazards are associated with any chemical that may produce acute and chronic health effects to humans through exposure.

Health Hazards include carcinogen, poison, and irritant.

(SCME Hazardous Materials II discusses health hazards of chemicals.)

Examples of Physical Hazards

- ❖ Combustible
- ❖ Explosive
- ❖ Flammable
- ❖ Peroxide
- ❖ Oxidizer
- ❖ Pyrophoric
- ❖ Radioactive
- ❖ Reactive



Explosive



Flammable



Oxidizer



Radioactive



Reacts with Water

Warning Symbols for Physical Hazards

Review Question

Which of the following chemical characteristics is NOT a physical hazard?

- ❖ Oxidizer
- ❖ Explosive
- ❖ Carcinogen
- ❖ Flammable

Review Question

Which of the following chemical characteristics is NOT a physical hazard?

- ❖ Oxidizer
- ❖ Explosive
- ❖ Carcinogen
- ❖ Flammable

➤ *Answer: Carcinogen is a health hazard.*

Review Questions



What physical hazard is represented by each of these symbols?

Defining Physical Hazards

What is the difference between an explosive and a combustible chemical?

Defining Physical Hazards

What is the difference between an explosive and a combustible chemical?

Combustible – Generally, any liquid or solid that will burn. OSHA defines a combustible as any liquid that burns when heated to 100 degrees F (37.8 C) or higher.

Explosive - Substance that explodes if heated or subjected to an electric spark. An explosive can release dangerous gases and continue to feed a fire.

Defining Physical Hazards

What is the difference between a flammable and an oxidizer?

Defining Physical Hazards

What is the difference between a flammable and an oxidizer?

Flammable - Substance that can easily be set on fire and once set continues to fuel the fire. A liquid, as well as its vapor, can be flammable.

Oxidizer - Chemical that causes a reaction with oxygen. This reaction aids in maintaining a fire once started.

Review Questions



What physical hazard is represented by each of these symbols?

- ❖ *Explosive*
- ❖ *Reacts with Water (Do not mix with Water)*

Summary

In order to understand the information presented in SDS's and on chemical labels, one must know and understand the

- ❖ terminology associated with hazardous materials and
- ❖ hazard warnings associated with chemicals.

Disclaimer

The information contained herein is considered to be true and accurate; however the Southwest Center for Microsystems Education (SCME) makes no guarantees concerning the authenticity of any statement. SCME accepts no liability for the content of this unit, or for the consequences of any actions taken on the basis of the information provided.

Acknowledgements

Made possible through grants from the National Science Foundation
Department of Undergraduate Education #0830384, 0902411, and 1205138.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and creators, and do not necessarily reflect the views of the National Science Foundation.

Southwest Center for Microsystems Education (SCME) NSF ATE Center

© 2009 Regents of the University of New Mexico

Content is protected by the CC Attribution Non-Commercial Share Alike license.

Website: www.scme-nm.org