Hazardous Material Control

Hazardous waste

Chemical Hygiene/Lab std.

Pathogens – Blood born pathogen std.

Resource Conservation and Recovery Act (RCRA)

- Passed by Congress in 1976 to provide a cradle-to-grave management of hazardous waste

- Enforced by the following governmental agencies:
  - Federal - Environmental Protection Agency (EPA)
  - State - Department of Environmental Conservation (DEC)
  - Local - Department of Environmental Protection (DEP)

Major Events that Led to the Development of RCRA

- **Love Canal, NY**
  - Hooker Chemical began dumping chemicals in 1941
  - School built on the old dump site in 1954
  - School and nearby houses became affected
  - Cancer rates increased and an emergency was declared

- **Times Beach, MO**
  - Dioxin contaminated oil used to control dust on town roads in 1972
  - Government spent 32 million to buy resident homes in 1982-83 after numerous people and animals became sick

Hazardous Waste

- RCRA definition:
  - Causes or significantly contributes to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or poses a substantial present or potential future hazard to human health or the environment when improperly treated, stored, transported or disposed, or otherwise mismanaged.

What is Hazardous Waste?

- Any waste that has the following characteristics:
  - Ignitable
  - Corrosive
  - Reactive
  - Toxic

Finding Chemical Hazard Information

- Chemical labels: National Fire Prevention Association (NFPA) Fire Rating
- Material Safety Data Sheets (MSDS)
- Hazard Information on the Internet

HEALTH HAZARD

4 - Deadly
3 - Extreme danger
2 - Hazardous
1 - Slightly hazardous
0 - Normal material

FIRE HAZARD

Flash Point
4 - Below 73° F
3 - Below 100° F
2 - Below 200° F
1 - Above 200° F
0 - Will not burn

SPECIFIC HAZARD

Oxidizer	OXY
Acid	ACID
Alkali	ALK
Corrosive	COR
Use NO WATER	W
Radiation Hazard	☢

REACTIVITY

4 - May detonate
3 - Shock and heat may detonate
2 - Violent Chemical change
1 - Unstable if heated
0 - Stable

Material Safety Data Sheets

- Chemical Identification
- Ingredients (products containing hazardous chemicals)
- Physical Data
- Chemical Reactivity Data/chemical incompatibilities
- Health Hazard Data (occupational exposure limits, routes of entry, health effects)
- Spill/leak procedures
- Disposal procedures
- Miscellaneous info

Hazardous Waste Generator

- **Large quantity generator:**
  - >2,200 lbs/month of hazardous waste
  - >2.2 lbs/month of acutely hazardous waste

- **Small quantity generator:**
  - Between 220 - 2,200 lbs/month of hazardous waste
  - $\leq$ 2.2 lbs/month of acutely hazardous waste

- **Conditionally exempt small quantity generator:**
  - Up to 220 lbs/month of hazardous waste
  - $\leq$ 2.2 lbs/month of acutely hazardous waste

Hazard Control

- Chemical Hazard Information
- Engineering Controls
- Process/ Administrative
- Personal Protective Equipment

Standard Operating Procedures-Control Measures

- Establish SOPs that includes safety and health measures:
  - Control measures-Minimize chemical exposures-Use general safety precautions-
    - Engineering Controls
      - Fumehoods-ventilation
    - Hygiene practices
      - Washing
      - Changing out PPE
      - Minimizing exposures of hazardous chemicals
    - Personal protective equipment (PPE)
      - Available, used and maintained

Administrative Controls

- Purchasing Controls (Non-mandatory)
  - Monitor chemical use
  - Monitor chemical disposal
  - Monitor purchasing
- Inspections (Non-mandatory)
  - Periodic Housekeeping (safety)-quarterly inspections
  - Routine emergency equipment inspection
  - Look for outdated chemicals
- Review of Chemical Exposures-Usage
  - Continuing not one time
  - Ensure below recommended PEL's/TLVs

Waste Minimization

- **Purchase only what is needed**
- Minimize and rotate inventories; redistribute excess chemicals
- Substitute hazardous substances with less hazardous materials
- Review and modify process to minimize amount of waste generated
- Recycle waste materials back into the same process or into a different process
- Separate hazardous waste from non-hazardous waste
- Reduce the amount of hazardous materials used in a procedure
- Do not purchase mercury-containing thermometers
- Share unused chemicals with other laboratories

OSHA - Hazard Communication

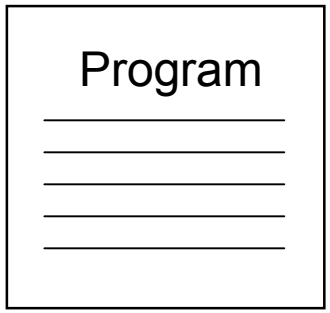
Introduction

- About 32 million workers work with and are potentially exposed to one or more chemical hazards
- There are approximately 650,000 existing chemical products, and hundreds of new ones being introduced annually
- Chemical exposure may cause or contribute to many serious health effects such as heart ailments, central nervous system damage, kidney and lung damage, sterility, cancer, burns, and rashes
- Some chemicals may also be safety hazards and have the potential to cause fires and explosions and other serious accidents

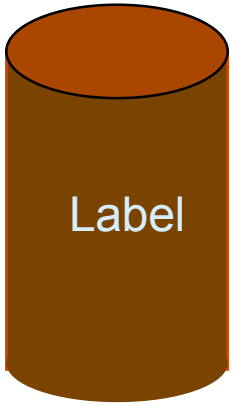
Purpose of OSHA's Hazard Communication Standard

To ensure that employers and employees know about work hazards and how to protect themselves so that the incidence of illnesses and injuries due to hazardous chemicals is reduced.

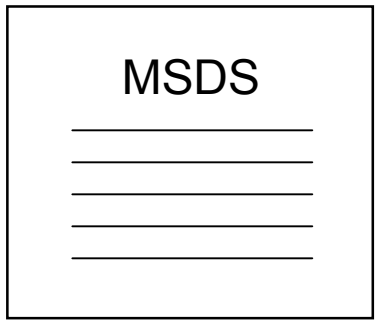
Hazard Communication Program



Container Labeling



Material Safety Data Sheet



Who is covered?

OSHA's Hazard Communication (HazCom) standard applies to general industry, shipyard, marine terminals, longshoring, and construction employment and covers chemical manufacturers, importers, employers, and employees exposed to chemical hazards.

Standards: 29 CFR - 1910.1200

Employer Responsibilities

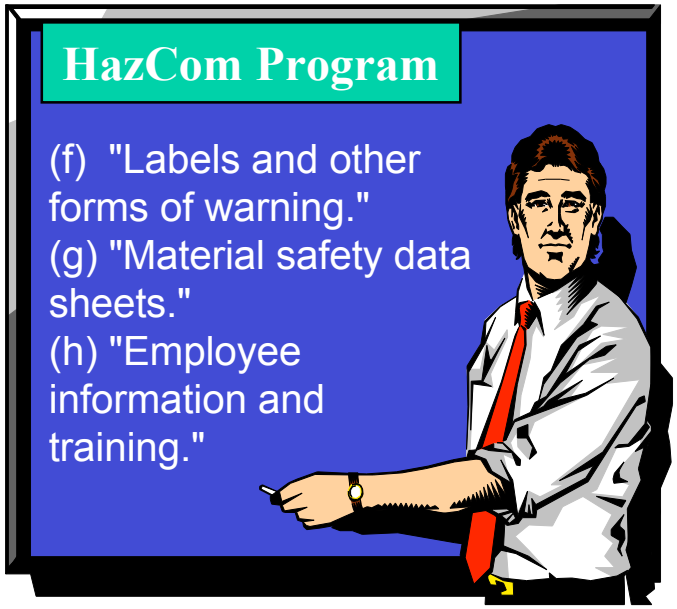
- Identify and list hazardous chemicals in their workplaces
- Obtain Material Safety Data Sheets (MSDSs) and labels for each hazardous chemical, if not provided by the manufacturer, importer, or distributor
- Implement a written HazCom program, including labels, MSDSs, and employee training
- Communicate hazard information to employees through labels, MSDSs, and formal training programs

Exemptions

- Pesticide Labeling
- EPA regulated wastes labeled appropriately
- Foods, cosmetics
- Alcoholic beverages
- Consumer products

The Standard Requires

- Chemical Inventory
- Written Program
- Obtaining Material Safety Data Sheets
- Container Labeling
- Employee Training



Written HazCom Program
Requirements

- Describes container labeling, MSDSs, and employee training for each workplace
- List of the hazardous chemicals
- Make information regarding hazards and protective measures available to other employers onsite

OSHA 29CFR1920.1450: **OSHA Laboratory Standard**

- **OSHA Laboratory Standard** of 1990 to address research laboratory work hazards (students, PostDocs, professors too!)
- Outgrowth of HazCom Std.
- Performance based standard
- "For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits (PEL's) specified in 29 CFR 1910, subpart Z"

The OSHA Laboratory Standard

- Employee Exposure Determination
  - Initial Monitoring
    - If above action level or PEL
  - Periodic Monitoring
    - If initial monitoring warrants
  - Employee Notification of Monitoring
    - Within 15 days
    - In writing

The OSHA Laboratory Standard

- Employee Information (right to know)
  - Must be apprised of chemical hazards
  - Prior to work
  - New procedures/hazards
  - Include the Standard, CHP Location, and the PEL's of the substances
    - If no PEL, then signs and symptoms of exposure and location of reference material and MSDS's

The OSHA Laboratory Standard

- Employee Training
  - Methods and observations that may be used to detect hazards
  - Physical and health hazards
  - Measures used to protect themselves
    - SOP's
    - Emergency Procedures
    - PPE
  - Implementation of the CHP

The OSHA Laboratory Standard

- Medical Consultation and Examinations
  - Medical Attention and Follow-Up Exams will be provided when
    - Signs and symptoms
    - Monitoring reveals routine exposure above action level or PEL
    - Accident/Spill/Leak
  - Exams by a Licensed Physician without cost or loss of pay at a reasonable time and place

The OSHA Laboratory Standard

- Hazard Identification
  - Labels shall not be removed or defaced
  - MSDS's shall be maintained and accessible
  - For Chemicals Developed in the Laboratory
    - The employer shall determine the hazard
    - Provide appropriate training
  - Follow Hazard Communication Standard (1910.1200) with respect to MSDS's and Labeling
- Use of Respirators
  - In accordance with the Respiratory Standard (1910.134)
- Recordkeeping
  - In accordance with 1910.20: 30 Years

The OSHA Laboratory Standard

The Chemical Hygiene Plan

- A Written Plan Capable of
  - Protecting employees from health hazards
  - Keeping exposures below PEL or action limit
  - Readily available to employees
  - Shall include
    - SOP's
    - Control Measures using
      - Engineerinig Controls
      - Administrative Controls
      - PPE

The OSHA Laboratory Standard

The Chemical Hygiene Plan Shall include:

- **Establishment of a Designated Use Area**
- **Use of Containment Devices such fume hoods and glove boxes**
- **Procedures for the safe removal of waste**
- **Decontamination Procedures**
- **Fume Hood Performance measures**
- **Information and training to workers**
- **Prior Approvals for certain operations**
- **Provisions for medical consultations**
- **Designation of Personal that Implement CHP**
- **Chemical Hygiene Officer**
- **Chemical Hygiene Committee**

CHP Responsibilities

- Designation of Responsible person for CHP
  - All levels of management responsible-CEO ultimate responsibility
  - Chemical Hygiene Officer appointed-works with all levels of management
  - Establish Safety or Hygiene Committee (recommended)
  - Employee is also held responsible
  - Written CHP needs to be reviewed yearly and must be made available to all employees

OSHA Laboratory Standard Respirator Use

- *Respirator use is not recommended!*
- Considered the *last* line of defense against exposure
- Modify work practices or experimental procedures instead

Bloodborne Pathogens

Regulations

- OSHA 29CFR1910.1030 (1989—2004)
  - Exposure to blood and blood products and other potentially infectious material (OPIM)
  - Definition of OPIM-human body fluids: semen, vaginal secretions, cerebrospinal fluid, lung fluid, heart fluid, abdominal fluid, amniotic fluid, saliva in dental procedures, any other body fluid that is visibly contaminated with blood such as saliva or vomit
  - Body fluids in situations where it is difficult or impossible to differentiate between body fluids such as emergency response;

Applicability

- Human Pathogens-blood borne only!
  - Ex: HIV (Human Immunodeficiency), HBV (Hepatitis B) and HCV (Hepatitis C)

- Types of Business
  - Biotech/Drug companies-Research labs
  - Emergency Response personnel
  - Hospitals/Doctors/Dentists/

Bloodborne Pathogens

- Hepatitis B
  - Vaccine available
  - Can be fatal to infected person
- Hepatitis C
  - No vaccine
  - Only 15 % who become infected recover
  - Lifelong illness – generally ending in death after 25-30 years
- HIV – Human Immunodeficiency Virus
  - No vaccine
  - Therapy available, effective for only a short time?

The philosophy of Universal Precautions

Assume all persons, tissues, bodily fluids and other potentially infectious material (OPIM) carry all diseases at all times.

Exposure Plan

Written Plan

- Reviewed and Updated yearly
- Biological Safety Officer (BSO) designation

- Determination of who is affected
  - Job classification vs occupational exposure
- Engineering Controls
  - Needle less systems
  - Biosafety hoods

Written Plan (continued)

- Sharps Injury Log
- Incident Report on Exposures
  - Who, what and where
- Universal Precautions
  - Hand Washing
  - PPE
  - Prohibited practices-capping of needles
  - No food or drinks, etc in affected areas
  - Minimize aerosols-spraying etc.

Exposure Plan continued

- Disposal of waste
  - Sharps container-not liquids/leak proof/labeled
  - Liquid waste needs to be in labeled containers
  - Offsite disposal-manifests/licensed
  - Onsite treatment-autoclaves/chemical disinfectant
- PPE
  - Provided free
  - Includes not limited to gloves, lab coat, surgical clothes, safety glasses/face shield
  - Employer determines appropriate PPE-Employee input
  - Comfortable, laundry provided, repaired and replaced

Exposure Plan continued

- Post –Exposure-what to do in an emergency
  - Access to medical care
  - Prophylaxis treatment
  - Counseling
  - Testing
  - Determination of exposure
  - Medical record-keeping required

Exposure Plan continued

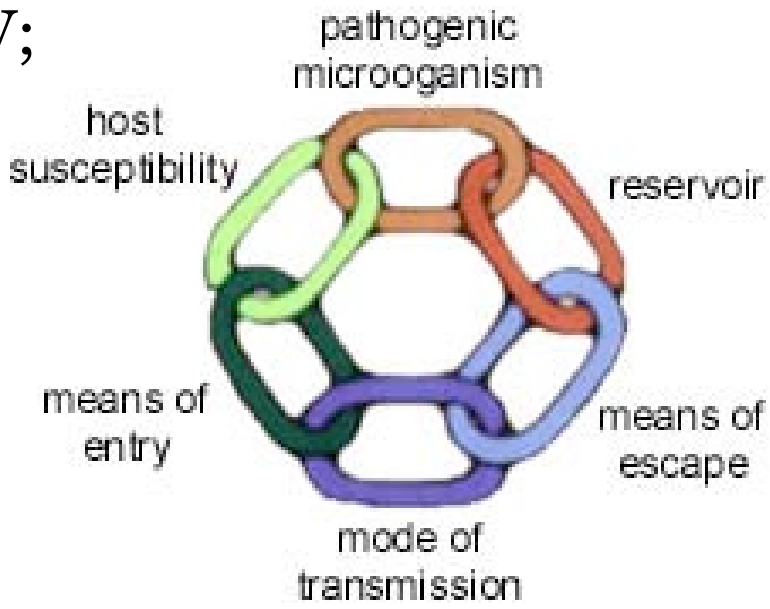
- Hepatitis B Vaccination
  - Declination
- Signage
  - Outside of Labs stating type of infectious agent
  - Requirements for entering area-PPE
  - Responsible people and telephone numbers
- Biosafety Cabinets
  - Annual certification

Training Requirements

- Training
  - Potential for contamination
  - Symptoms and Route of contamination
  - HIV, HBV and HCV
  - Hep B vaccination/declination
  - Labels and signs
  - Engineering controls and PPE
  - Provide copy of regs and exposure plan
  - Proper Microbiological techniques
  - Should include non-bloodborne if working with them

Training Example

- The infectious disease process typically consists of three routes of entry:
- **PENETRATION** into the bloodstream, exemplified by Hepatitis B Virus and HIV/HCV;
- **INHALATION** of airborne organisms, such as Mycobacterium (TB); and
- **INGESTION** of organisms, demonstrated by salmonella.
- **The Infectious Disease Process (**For an infectious disease to occur, each link in the chain must be connected



Control of Infectious Agents

- Bloodborne Pathogens
- Herpes B Virus
- Research Agents
- Select Agents

Research Agents

Laboratory Biosafety Levels

- BL-1 E. coli K-12
- BL-2 Human Tissue
- BL-3 M. tuberculosis
- BL-4 Ebola

Select Agents

USA PATRIOT ACT

- Center for Disease Control (CDC)
- Select Agents (42 CFR Part 72)
  - 13 Viruses
  - 7 Bacteria
  - 3 Rickettsiae
  - 1 Fungi
  - 12 Toxins
- Must Register with CDC/institution
- Security measures must be taken

Select Agents: Viruses

- Crimean-Congo haemorrhagic fever
- Eastern Equine Encephalitis
- Ebola
- Equine Morbillivirus
- Lassa Fever
- Rift Valley Fever
- Tick-borne Encephalitis Complex
- Variola Major (Small Pox)
- Venezuelan Equine Encephalitis
- Yellow Fever
- Viruses causing Hantavirus Pulmonary Syndrome
- South American Haemorrhagic Fever
    - Junin, Machupo, Sabia, Flexal, Guannarito

Select Agents

TOXINS

Arbin
Aflatoxins
Botulinum
Clostridium Perfringens Epsilon
Conotoxin
Diacetoxysirpenol
Ricin
Saxitonxin
Shigatoxin
Straphylococcal Enterotoxins
Tetrodotoxin
T-2 toxin

BACTERIA/FUNGI

Bacillus anthracis
Brucella abortus, B. melitensis, B. suis
Burkholderia (Pseudomonas) mellei
Burkholderia (Pseudomonas) pseudomallei
Clostridium botulinum
Francisella tularensis
Yersinia pestis
RICKETTSIAE
Coxiella burnetii
Rickettsia prowazekii
Rickettsia rickettsii
FUNGI
Coccidioides immitis

The End!

Related Regulations/Guidelines

- CDC 42 CFR 73-Select Agent
- CDC/NIH Biosafety in Microbiological and Biomedical Laboratories
- NIH Guidelines for Research Involving Recombinant DNA Molecules, 2002

Selected References

- CDC/NIH Biosafety in Microbiological and Biomedical Laboratories
- NIH Guidelines for Research Involving Recombinant DNA Molecules
- Laboratory Safety-Principles and Practices-Diane Fleming, et. Al.
- CRC Handbook of Laboratory Safety-A. Furr
- CDC 42 CFR 73 (Select Agent Program)
- CAL-OSHA Title 8, Section 5193

Websites

- http://www.cdc.gov/od/sap/
- CDC's Biosafety Manual:
  http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm
- http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=0&p_keyvalue=1910_1030.html
- Canada's Safety site-MSDSs for infectious organisms:
  http://www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/index.html
- AIHA website:
  http://www2.umdnj.edu/eohssweb/aiha/technical/biosafety.htm
- http://www4.od.nih.gov/oba/rdna.htm
- Cal-OSHA:

  http://www.dir.ca.gov/Title8/sb7g16a109.html

The very end!