



Hazardous Materials

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Naryn, 10:10 am, April 1, 2023



Lessons learnt last time



- Introduction
- Common fall hazards
- Fall hazard controls
- Employer/employee requirements
- After a fall – First Aid
- Ropes and knots for the solar-photovoltaic roof installations

What we gonna discuss today?

- Introduction
- Example of hazardous materials
- Exposure to hazardous materials
- Hazards of hazardous materials
- Controlling physical hazards
- Controlling health hazards
- Hazardous materials worksheet



Introduction



- 99.9% sure we all have experience with hazardous materials
- Pls share your experience with your teammate(s) (teams of up to 3 people; 1-2 min) on this experience
- Pls share the experience of your team in a class (1 min)

Where can you find chlorine?



Swimming Pools

Have you ever gone swimming? People put chlorine in the pool to kill bacteria and other disease producing organisms. It is also used to control the growth of slime and Algae in pipes and Storage tanks



Making Paper

Chlorine is used to make paper white. It bleaches the paper of all color, which results in the white colour.



Bleach

Whenever you wash white clothes you use bleach. That's chlorine you're using! It also takes the color out of darker clothes, so you have to take care. Used in the manufacturing of Bleaching powder.

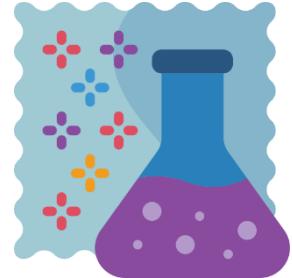


Water Purification

Chlorine is used to clean the water that comes to your house to control widespread of diseases like Typhoid, Cholera.



Introduction



- Hazardous materials in the workplace can cause severe health problems and/or physical injury to the worker
- Employers have the responsibility to anticipate, recognize, evaluate, and control hazards associated with hazardous materials in the workplace
- Hazard abatement must be accomplished through a hierarchy of controls
- Hazardous materials can unexpectedly be brought home to a worker's family causing illness!

Example of hazardous materials: Batteries

- Nickel-cadmium batteries
 - NiCads contain cadmium, a metal that is toxic to humans when inhaled or ingested
 - NiCads' common sizes: AA, AAA, C, Sub C, D, and 9 Volt

- AAA

- AA

- C

- D

- 9 volt



Example of hazardous materials: Batteries (cont.)

- Button batteries (small, round, silver-colored; examples of usage – watches and hearing aids): **Many button batteries contain mercury, a metal that is toxic to humans when inhaled or ingested**

Several sizes of button and coin cell with four 9V batteries as a size comparison



Example of hazardous materials: Batteries (cont.)

- Lithium batteries (AA, AAA, C, 9V and button; mainly used in computers and cameras). **Lithium is reactive with water and can cause serious fires.**



Example of hazardous materials: Batteries (cont.)

https://www.youtube.com/watch?v=_Cd2WIxKRDK

- Note 7 Battery Explosion :(



Example of hazardous materials: Batteries (cont.)

- An automotive battery is a rechargeable battery that is used to start a motor vehicle. **Usually, it contains sulfuric acid that can burn skin.**

A typical 12 V, 40 Ah lead-acid car battery



Example of hazardous materials: Batteries (cont.)

- What is 18650 battery?



Example of hazardous materials: Batteries (cont.)



- What should we do with used batteries?



Example of hazardous materials: how to rejuvenate a damaged rechargeable battery

<https://www.youtube.com/watch?v=FMP-ynCZLc8>

- Sometimes it works 😊, sometimes it does not work 😞



Welcome to the DIY Tinker Channel

www.youtube.com/digtinker

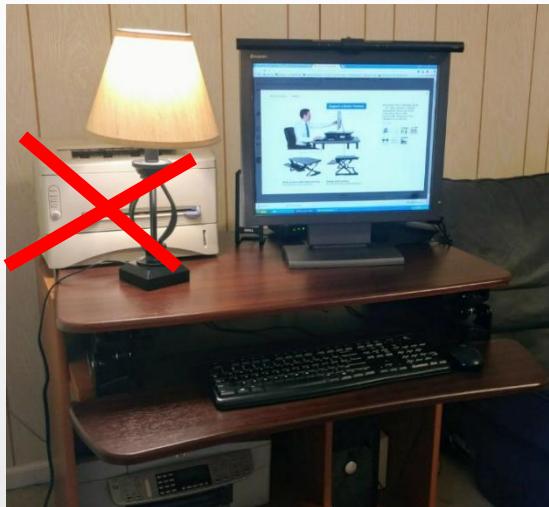
HOW TO REJUVENATE
A DAMAGED
RECHARGEABLE BATTERY

Example of hazardous materials: Laser printers and copiers' toner cartridges



- Laser printers and copiers are suspected to emit toner dust and volatile organic compounds
 - Long-term inhalation of high toner concentrations ($>>1\text{mg}/\text{m}^3$) can lead to an overload of the lung clearance mechanisms and to an accumulation of toner particles in the lung. This can cause inflammatory processes and increased formation of connective tissue (fibrotic changes).

DON'T sit
next to
the laser
printer!



Example of hazardous materials: Printer Toner Safety Guide - Is Toner Toxic?

<https://www.youtube.com/watch?v=uOkDYlo0Vt8>



Example of hazardous materials: Fluorescent lamps (mercury)

- Fluorescent lamps, including energy saving compact fluorescents, contain mercury. **When a lamp breaks, it releases mercury into the air, which is toxic to the human nervous system** and can poison wildlife.
- **When a lamp breaks, projected shards of glass may injure eyes or skin**



Compact fluorescent lamp with electronic ballast

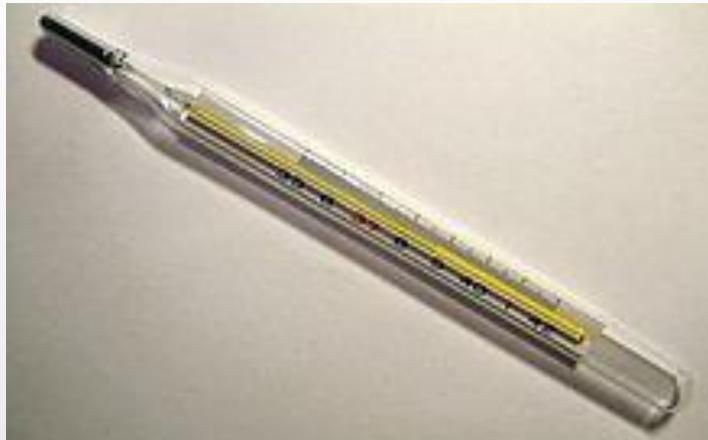


Typical F71T12 100 W bi-pin lamp used in tanning beds. The (Hg) symbol indicates that this lamp contains mercury.

Example of hazardous materials: Mercury-in-glass thermometers



- The mercury-in-glass or mercury thermometer consists of a bulb containing mercury attached to a glass tube of narrow diameter. **When a mercury thermometer breaks, it releases mercury into the air, which is toxic to the human nervous system.**



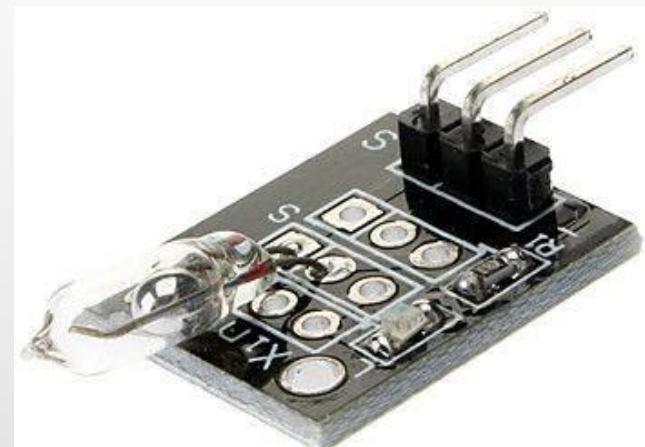
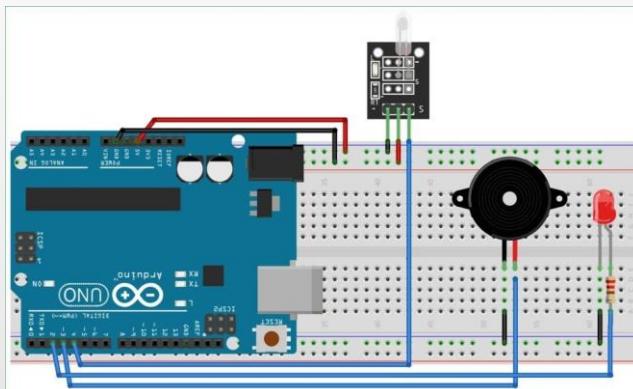
A medical mercury-in-glass thermometer



Mercury-in-glass thermometer for measurement of room temperature

Example of hazardous materials: Mercury tilt switch sensor

- Mercury tilt switch sensor is an electronic device that detects the orientation of an object and gives its output High or Low. Basically, it has a mercury ball inside it which moves and makes the circuit. So, tilt sensor can turn on/off the circuit based on the orientation. **When a mercury sensor breaks, it releases mercury into the air, which is toxic to the human nervous system.**



Exposure to hazardous materials

- What are hazardous materials?

- Group of products for which the storage, handling, and use are regulated under the Hazardous Materials standard(s)
- Primarily associated with physical hazard
- May also pose health hazard



Exposure to hazardous materials (cont.)



- Examples of worksite exposure:

- Operations involving the storage, handling, and/or use of:
 - Compressed gases
 - Liquefied gases – anhydrous ammonia, chlorine, propane, nitrous oxide, and carbon dioxide
 - Non-liquefied gases – oxygen, nitrogen, helium, and argon
 - Dissolved gases - acetylene



Exposure to hazardous materials (cont.)



- Examples of worksite exposure:

- Operations involving the storage, handling, and/or use of:

- Flammable liquids

- Category 1 – ethyl ether, isopentane, propylene oxide

- Category 2 – acetone, benzene, ethyl alcohol, gasoline isopropyl alcohol, toluene

- Category 3 – naphtha, turpentine, xylene

- Category 4 – ethylene glycol, glycerine

- Cryogenics and refrigerated liquids – oxygen, nitrogen, argon, hydrogen, helium LNG, Liquid methane, carbon monoxide

- Liquefied petroleum gases (LPGs) – propane, propylene, butane, and butylene

- Explosives and blasting agents



Exposure to hazardous materials (cont.)

- Spray finishing operations
- Dipping and coating operations
- Processing of highly hazardous chemicals
- Clean-up and management of hazardous waste operations and emergency response



Exposure to hazardous materials (cont.)



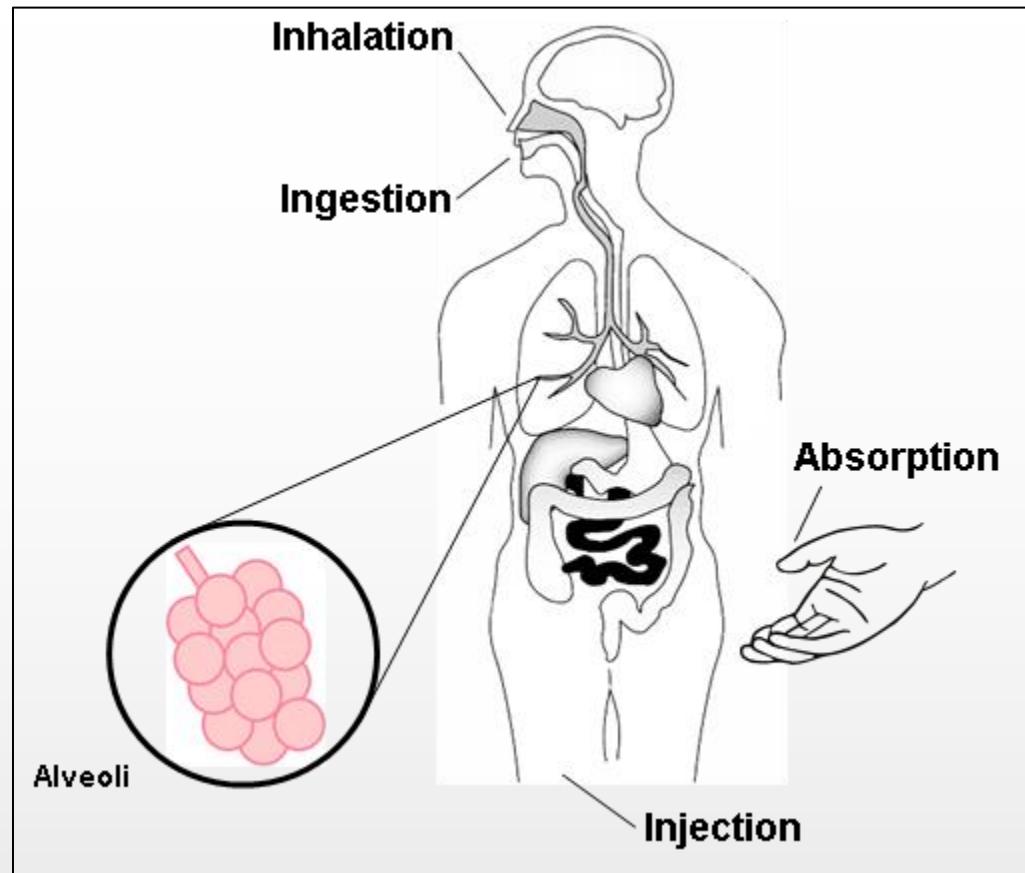
- Additional precautions for hazard exposures:
 - Hazardous (classified) locations
 - Confined spaces



Exposure to hazardous materials (cont.)

- Routes of entry:
 - Inhalation*
 - Ingestion
 - Absorption
 - Injection

* Most Common



Exposure to hazardous materials (cont.)



- **Inhalation** is the primary route of entry for hazardous chemicals in the work environment. Nearly all materials that are airborne can be inhaled.
Remember, if you can smell it, you're inhaling it!
- **Ingestion** - toxic materials can be swallowed and enter the body through the gastrointestinal tract. In the workplace, people can unknowingly ingest harmful chemicals when they eat, drink, or smoke in a contaminated work areas.
- **Absorption** through the skin is another route of entry. The skin is the largest organ of our body and a common exposure site for liquid and airborne chemicals. Absorption through the skin can occur quite rapidly if the skin is cut or abraded. Intact skin is an effective barrier to many hazardous materials.
- **Injection** occurs when a sharp object punctures the skin, allowing a chemical or infectious agent to enter your body. For example, injection can occur when a contaminated object such as a rusty nail punctures the skin.

Hazards of hazardous materials

- Types of **physical hazards** associated with hazardous materials:
 - Oxidizer
 - Flammable
 - Explosion
 - Corrosive to metal
 - High-pressure systems



Hazards of hazardous materials (cont.)

- Types of **health hazards** associated with hazardous materials:
 - Acute/chronic toxicity
 - Skin corrosion or irritation
 - Aspiration hazard
 - Serious eye damage or eye irritation
 - Respiratory or skin sensitization
 - Germ cell mutagenicity
 - Carcinogenicity
 - Reproductive toxicity
 - Specific target organ toxicity



Hazards of hazardous materials (cont.)

- Compressed gases:
 - Oxygen displacement
 - Fires
 - Explosion
 - Toxic gas exposures
 - Physical hazards associated with high pressure systems



Hazards of hazardous materials (cont.)



- Cryogenic and refrigerated liquids:

- Extreme cold
- Extreme pressure
- Asphyxiation
- Fire or explosion



Hazards of hazardous materials (cont.)

- Flammable liquids:
 - Fire
 - Explosion



Criteria for Flammable Liquids	
Category	Criteria
1	Flashpoint < 73.4°F and initial boiling point ≤ 95°F
2	Flashpoint < 73.4°F and initial boiling point > 95°F
3	Flashpoint ≥ 73.4°F and ≤ 140°F
4	Flashpoint > 140°F and ≤ 199.4°F

Hazards of hazardous materials (cont.)

- Spray finishing:
 - Flammable/combustible materials
 - Health hazards
 - Example: Isocyanates
 - Powerful irritant to eyes and gastrointestinal and respiratory tracts
 - Inflammation to skin



Hazards of hazardous materials (cont.)

- Liquefied petroleum gases (LPG):

- Pictograms:  
- Signal word: Danger
- Hazard statements:
 - Extremely flammable gas
 - Contains gas under pressure; may explode if heated.
 - May cause frostbite
 - May form explosive mixtures in air
 - May displace oxygen and cause rapid suffocation



Hazards of hazardous materials (cont.)

- Liquefied petroleum gases (LPG):

- Pictograms:
-

- Signal word: Danger
- Hazard statements:

- Flammable Gas
- Contains gas under pressure
- May explode if heated
- Toxic if inhaled
- Causes severe skin burns and eye damage
- Corrosive to respiratory tract



Hazards of hazardous materials (cont.)

- Hazardous (classified) locations:

- Class I – flammable gases or vapors

- Division 1
 - Division 2

- Class II – combustible dust

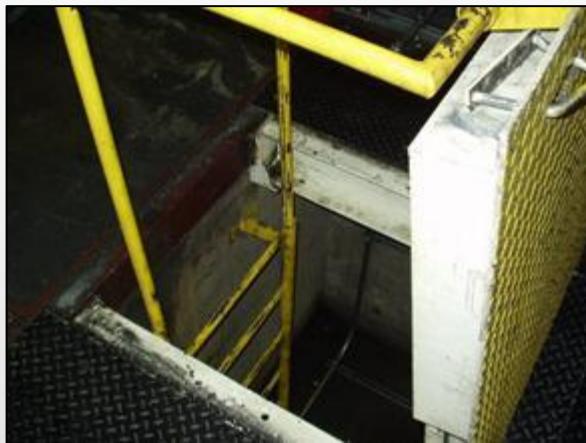
- Division 1
 - Division 2

- Class III – ignitable fibers or flyings



Hazards of hazardous materials (cont.)

- Confined spaces:
 - Limited or restricted means for entry/exit; not designed for continuous occupancy
 - PRCS (permit-required confined space) contains or has potential to contain hazardous atmospheres



Controlling physical hazards

- Compressed gases:
 - Compressed gas cylinders shall be in a safe condition to the extent that this can be determined by visual inspection



Controlling physical hazards (cont.)

- Safety can:

- Not more than 5 gallons (18.93 liters) capacity
- Spring-closing lid
- Designed to relieve internal pressure when subjected to fire



Controlling physical hazards (cont.)

- Cabinets:
 - Not more than 60 gallons of Category 1, 2, or 3 flammable liquids, nor more than 120 gallons of Category 4 flammable liquids
 - Suitable fire control devices shall be available at locations where flammable liquids are stored



Controlling physical hazards (cont.)



- Ventilation:
 - Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot of solid floor area



Controlling physical hazards (cont.)

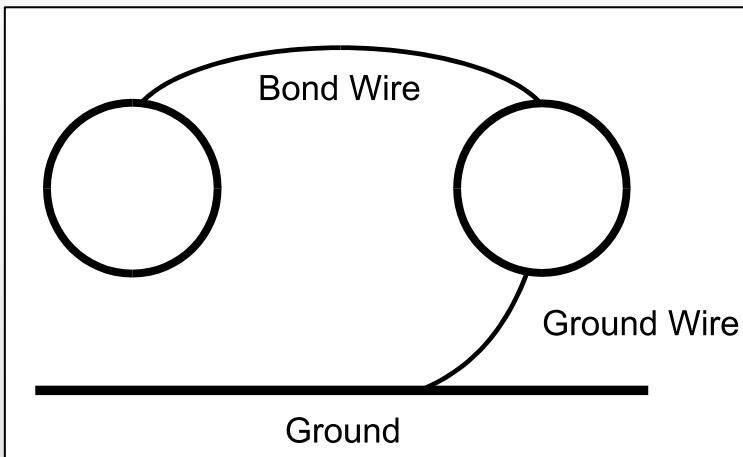
- Explosion-proof apparatus:
 - Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes or explosion of the gas or vapor within, and that operates at such an external temperature that it will not ignite a surrounding flammable atmosphere



Controlling physical hazards (cont.)

- Grounding:

- ° Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100 °F (37.8 °C), shall not be dispensed into containers unless the nozzle and container are electrically interconnected



Controlling physical hazards (cont.)



- Intrinsically safe:
 - An apparatus/equipment in which all the circuits in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air



Controlling health hazards

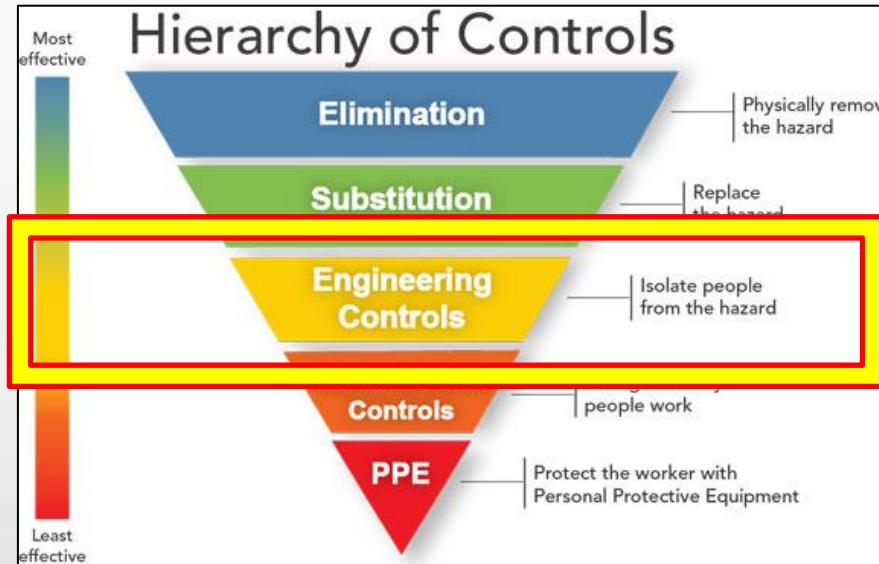
- Elimination and/or substitution controls can be accomplished by transitioning to safer chemicals



Controlling health hazards (cont.)

- Engineering controls

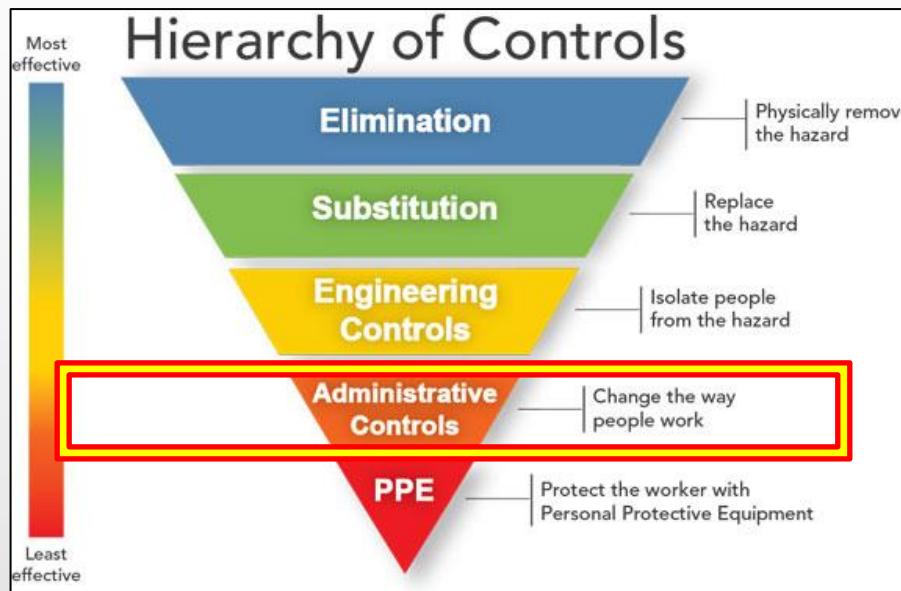
- Change process to minimize contact with hazardous chemicals
- Isolate or enclose the process
- Use of wet methods to reduce generation of dusts or other particulates
- General dilution ventilation
- Use fume hoods



Controlling health hazards (cont.)

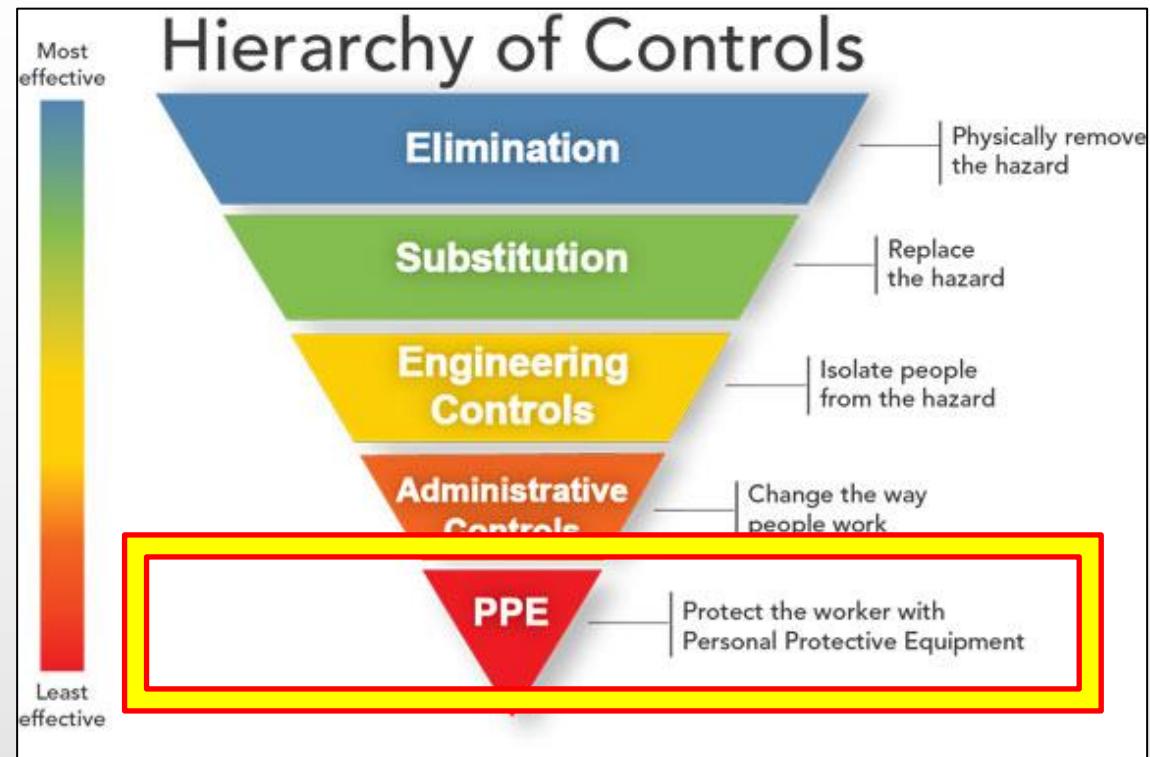
- Administrative controls

- Rotate job assignments
- Adjust work schedules so that workers are not overexposed to a hazardous chemical
- Establish and enforce safe work practices
- Train employees



Controlling health hazards (cont.)

- Personal protective equipment
 - Use chemical protective clothing
 - Wear respiratory protection
 - Use gloves
 - Wear eye protection



Controlling health hazards (cont.)

- Process Safety Management (PSM) of highly hazardous chemicals:
 - Regulations designed to prevent the release of toxic, reactive, flammable and/or explosive chemicals
 - Contains a list and threshold limits for when employers must comply
 - Anhydrous Ammonia - 10,000 pounds (4536 kg)
 - Chlorine - 1,500 pounds (680 kg)



Controlling health hazards (cont.)

- Hazardous Waste Operations and Emergency Response (HAZWOPER):
 - Applies to employers and their employees who are exposed to hazardous substances and who are engaged in several operations including clean-up, treatment, storage and disposal of hazardous waste

HAZWOPER
Training at
Cleanup Sites



Hazardous materials worksheet

- Complete the Worksheet (Checklist created by Construction Safety Council)

Hazard Anticipation

Anticipated or Potential Hazardous Materials (Check all that Apply):					
<input type="checkbox"/> Gases <input type="checkbox"/> Vapors <input type="checkbox"/> Fumes <input type="checkbox"/> Dusts <input type="checkbox"/> Fibers <input type="checkbox"/> Mists					
Anticipated or Potential Physical Hazards (Check all that Apply):					
<input type="checkbox"/> Fire <input type="checkbox"/> Explosion <input type="checkbox"/> Oxidizer <input type="checkbox"/> Corrosive to Metal <input type="checkbox"/> Gas under Pressure <input type="checkbox"/> Self-Heating Substance					
Anticipated or Potential Health Hazards (Check all that Apply):					
<input type="checkbox"/> Toxic <input type="checkbox"/> Skin/Eye Irritant <input type="checkbox"/> Respiratory/Aspiration Hazard <input type="checkbox"/> Carcinogen <input type="checkbox"/> Reproductive Toxicity					
<input type="checkbox"/> Confined or enclosed spaces (hazardous atmospheres). <input type="checkbox"/> Contaminated soil conditions (hazardous atmospheres). <input type="checkbox"/> Unsanitary conditions (poor housekeeping, poorly kept toilet facilities, etc.). <input type="checkbox"/> Presence of hazardous materials (dangerous coatings on structures & metal containing alloys). <input type="checkbox"/> The use of hazardous chemicals (gases, solvents, glues and concrete). <input type="checkbox"/> The presence of residues left by degreasing agents, usually chlorinated hydrocarbons (chloroform and carbon tetrachloride). <input type="checkbox"/> Older buildings and structures; unoccupied dwellings (fungi/mold, asbestos & lead).			<input type="checkbox"/> Homes built before 1978 – suspect to contain lead-based paint, according to the EPA. <input type="checkbox"/> Extreme temperatures (hot & cold environments). <input type="checkbox"/> Radiological exposures (nuclear power plants, antennas, hospitals, laboratories and the sun). <input type="checkbox"/> Loud noise (use of tools and equipment). <input type="checkbox"/> Hot work (welding and cutting). <input type="checkbox"/> The presence of plant and/or animal wildlife (poisonous venom, feces, rabies...). <input type="checkbox"/> Other: _____		

Hazardous materials worksheet (cont.)

- Complete the Worksheet (Checklist created by Construction Safety Council)

Hazards Identification

Description of Health Hazard: _____					
<input type="checkbox"/> Gas	<input type="checkbox"/> Vapor	<input type="checkbox"/> Fume	<input type="checkbox"/> Dust/Fiber	<input type="checkbox"/> Mist	<input type="checkbox"/> Fungi (Mold)
<input type="checkbox"/> Radiation	<input type="checkbox"/> Other _____				
C.A.S # _____	Flash Point (FP) _____	Vapor/Gas Density _____	Lower Flammable Limit (LFL) _____		
PEL: _____	TLV: _____	REL: _____	AL: _____	C: _____	STEL: _____
 ➤ Is there a safe alternative? Yes/No (If yes, describe: _____)					
➤ Is the work being performed by qualified people? Yes/No (List special training, certification and/or licensing required): _____					
➤ Does the work involve entry into confined or enclosed spaces? Yes/No (if yes, follow confined space entry procedures).					
➤ Is there a Safety Data Sheet (SDS) available on the job-site for all hazardous chemicals? Yes/No					
➤ Are hazard controls being implemented in order of preference? Yes/No					
1. Engineering; ventilation & wet methods.					
2. Administrative; work practices, scheduling workers to minimize exposure, extended breaks, etc.					
3. Personal Protective Equipment (PPE); respiratory and hearing protection, protection of face, hand, feet, eyes & whole body.					

Hazardous materials worksheet (cont.)

- Complete the Worksheet (Checklist created by Construction Safety Council)

Hazards Evaluation

Health Hazard Route of Entry(s)

Inhalation Ingestion Absorption Injection Other _____

Environmental & Personal Air Monitoring:

- Air monitoring does not measure you or what you are doing, but rather what you are exposed to on the job.
- Air monitoring must be done by a trained health professional (industrial hygienist or technician).
- Monitoring can be done by measuring the air in a fixed location in the work area (*area monitoring*) or by placing the monitoring equipment on individual workers and measuring the amount they are exposed to (*personal monitoring*). |

Hazard Evaluation (Employee Exposure Monitoring and/or Medical Surveillance)

Exposure Records: TWA: _____ C: _____ STEL: _____

(This information must be maintained by employer for 30 years.)

Medical Records (List):

(This information must be maintained by employer for duration of employment, plus 30 years.)

Hazardous materials worksheet (cont.)

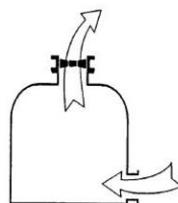
- Complete the Worksheet (Checklist created by Construction Safety Council)

Hazards Controls - Engineering

Engineering Controls (Select engineering controls to be implemented):

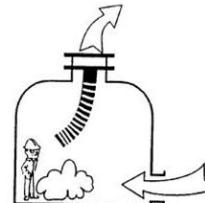
- Dust suppression (wet methods): _____
- Dust collection systems (vacuum): _____
- General (dilution) ventilation; works best when air contaminants are widely disbursed through the area.
- Local (exhaust) ventilation system; works well when air contaminants are generated at a single source.

Describe mechanical ventilation system used:



General (Dilution) Ventilation...

Forces fresh air into an area and dilutes contaminants; this allows air to move through a space which ensures a fresh continual supply.



Local (Exhaust) Ventilation...

Removes contaminated air at its source; this prevents harmful dust, fumes & mists from contaminating the breathing air of the worker.

If no engineering controls are being implemented, person authorizing the non-use of engineering controls:

Name: _____

Date: _____

Reason (explain): _____

Hazardous materials worksheet (cont.)

- Complete the Worksheet (Checklist created by Construction Safety Council)

Hazards Controls - Administrative

Administrative Controls (used with personal protective equipment):

- Gather all specialty equipment, including, ventilators, warning signs, personal protective equipment, etc. (list all specialty equipment needed for job): _____
- Operations that involve toxic substances are scheduled at times when other workers are not present? Yes/No (describe): _____
- Work is isolated to just a few protected employees; signs posted and controlled access zones established? Yes/No (describe): _____
- Employees are rotated in and out of jobs to minimize exposure? Yes/No (describe):

- Employees removed from working around hazardous substances once they have reached a predetermined level of exposure? Yes/No (describe): _____
- Are hot and cold work environments considered? Yes/No (describe): _____
- Employees trained on proper housekeeping & good personal hygiene? Yes/No
- Employees trained on the proper procedures that minimize exposures? Yes/No
- Employees trained on how to inspect and maintain process and equipment on a regular basis? Yes/No
- No eating, drinking, smoking, chewing tobacco or gum, and applying cosmetics in hazardous areas? Yes/No

Hazardous materials worksheet (cont.)

- Complete the Worksheet (Checklist created by Construction Safety Council)

Hazards Controls - PPE

Controlling a hazard at its source is the best way to protect workers. However, when engineering, work practices and administrative controls are not feasible* or do not provide sufficient protection, employers must provide **personal protective equipment (PPE)** to the employee and ensure its proper use.

Description of personal protective equipment being used: Eye/Face Protection Foot Protection
 Body Protection Gloves Respirator Other _____ Other _____

- Is the device approved? Yes/No (describe): _____
- Is the device appropriate for the type of hazard? Yes/No (explain): _____
- Is the worker wearing the device properly trained to understand the use, limitations and care instructions of the device? Yes/No (explain): _____
- Does the material have sufficient strength to withstand the environment? Yes/No (explain):

- Will the material withstand repeated use after contamination and decontamination? Yes/No (explain):

- Is the material flexible or pliable enough to allow end users to perform needed tasks? Yes/No (describe):

- Will the material maintain its protective integrity and flexibility under hot and cold extremes? Yes/No (explain):

Summary

Stop health hazards before they stop you!



Do you have any
questions or
comments?





Thank you
for your attention !

In this presentation:

- Some icons were downloaded from flaticon.com and iconscout.com