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CFR 1926 Subpart D

Occupational Health

&

Environmental Controls

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Lesson Overview

Purpose:

To provide workers with introductory information about construction health hazards and their control.

Topics:

- Health Hazards In Construction
- Industrial Hygiene
- Hazard Communications
- Personal Protective Equipment

Health Hazards In Construction

- Chemical Hazards
- Physical Hazards
- Biological Hazards
- Ergonomic Hazards
- Stress Hazards

Chemical Hazards

- Airborne
- Liquid
- Solid

Airborne Contaminants

- Dusts – formed from mechanical action
- Smoke – formed from combustion
- Fumes – formed from volatilizing metal
- Mists – tiny water droplets
- Vapors – evaporate of liquid
- Gases – particles without defined shape or volume
- Aerosols – atomized particulate

Airborne Particulate Classifications

- Breathable
  - Small enough to enter airway
- Inhalable
  - Upper respiratory tract
  - 100 microns
- Thoracic
  - Upper airways of the lungs
  - 5-15 microns
- Respirable
  - Able to reach the alveoli (air sacs) of the lung
  - < 5 microns

Note: micron = 1x10^-6 meter

Asbestos

- Occurs naturally in the environment
- Utilized in thousands of products
- Only a hazard when it becomes airborne
- OSHA PEL is 0.1 f/cc for 8-hour work day
- OSHA Excursion 1.0 f/cc for 30 minutes
- OSHA and EPA requirements are extensive
- Compliance monitoring achieved by personal “breathing zone” air sampling.

Refractory Ceramic Fibers (RCF)

- Suspect carcinogen
- Not regulated by OSHA
- Used as an insulating material
- Exposure guideline established by the Refractory Ceramic Fiber Coalition
    - 0.5 f/cc 8-hour TWA Recommended Exposure Guideline (REG)
- National Institute for Occupational Safety & Health
    - 0.5 f/cc 8-hour TWA REG

Chemical Hazards - Metals

- Toxic
- Highly Toxic
- Carcinogens

Toxic Metals

Toxic Metal Fumes

- Antimony, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, vanadium, and zinc.
- Commonly associated with welding and hot metal operations.
- Volatilization produces fume, fume becomes airborne and breathable.

Toxic Metals

Manganese

- Suspected to cause Parkinsons
- OSHA Ceiling Limit is 5 mg/m3
- ACGIH TLV is 0.2 mg/m3 for 8-hours

Toxic Metals

Zinc

- Galvanized coatings
- Causes **Metal Fume Fever**
  - Chills, elevated temperature, flu like symptoms
- OSHA PEL is 5 mg/m3 as zinc oxide fume for an 8-hour Time Weighted Average (TWA)

Highly Toxic Metals

Cadmium

- Coating on metal surfaces such as electroplating and paints
- Occurs in alloys and silver solders
- Highly toxic and can be fatal in **HIGH** concentrations
- Cancer is a long term hazard
- Ingestion and Inhalation hazard
- OSHA PEL is 5 ug/m3 for an 8-hour TWA

Highly Toxic Metals

Lead

- Steel additive
- Occurs in painted surfaces
- Volatilized into a fume
- Abrading creates dust
- Ingestion and Inhalation hazard
- OSHA PEL is 50 ug/m3 for an 8-hour TWA
- OSHA Action Level (AL) is 30 ug/m3 for an 8-hour TWA

Highly Toxic Metals

Lead in Surface Coatings

- HUD has established a limit of 0.5 % weight for coatings containing lead
  - Many industries adopt this guideline for determining what surfaces are lead containing
- However, OSHA compliance requires personal "breathing zone" air sampling
- Any potential for airborne lead exposure requires Awareness Training for employees; 1926.62(l)(1)(i)

Highly Toxic Metals

Mercury

- Naturally occurring element in several forms
- Used in meters, gauges, valves, switches, batteries and lamps
- Silver liquid, limited inhalation hazard
- Contaminates surfaces
- OSHA PEL for Hg vapor is .1mg/m3 TWA & has a skin designation

Carcinogenic Metals

Arsenic

- Occurs naturally in the environment
- Combined with other elements to form inorganic arsenic
- Exposure occurs through inhalation, ingestion, skin or eye contact
- OSHA PEL is 10 ug/m3 for an 8-hour TWA
- OSHA AL is 5 ug/m3 for an 8-hour TWA

Carcinogenic Metals

Hexavalent Chromium

- Dyes, paints, inks and plastics
- Surface coatings and electroplating
- Produced during oxidation of metals containing chromium (i.e. “hot work”)
- Exposure occurs through inhalation, skin or eye contact
- OSHA PEL is 5 ug/m3 for an 8-hour TWA
- OSHA AL is 2.5 ug/m3 for an 8-hour TWA

Dusts

- Toxic
  - Silica
  - Dusts contaminated with PCBs

- Soluble / *Non-Toxic*
  - Nuisance

Gases & Vapors

Acute Hazards

- Hydrogen Cyanide (HCN)
- Hydrogen Sulfide (H2S)
- Carbon Monoxide (CO)
- Anhydrous Ammonia

Gases & Vapors

Chronic Hazards

- Benzene
- Coal Tar Pitch Volatiles
- Solvents

PCBs

What are Polychlorinated biphenyls (PCBs)?

- group of manufactured organic chemicals that contain 209 individual chlorinated chemicals - no known natural sources
- either oily liquids or solids; colorless to light yellow; no known smell or taste
- don't burn easily and are good insulating material
- used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment
- manufacture stopped in the U.S. in 1977
  because they build up in the environment
  and cause harmful health effects
- Don’t break down easily; found
  widely distributed in our environment
  and concentrated up the food chain

PCBs

Exposures

- Food – fish
- Surface Soils – run-off
- Indoor Air – older transformers leaking
- In the Workplace: Industrial accidents

Health Effects

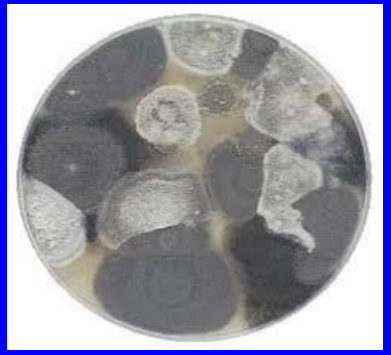
- Neurological development of children
- Skin and mucous membrane dermatitis
- Harmful to the reproductive system
- Harmful to the immune system
- May cause cancer
- Endocrine disruptor

A typical transformer. Note manufacturer's identification plate and warning labels.

Physical Agents

- Ionizing radiation
- Non-ionizing radiation
- Light
- Noise
- Vibration

Biological Hazards



- Plant poisons
- Mold allergens
  - Individual susceptibility
- Healthcare
  - Tuberculosis
  - HIV and Hepatitis B
- Legionella Bacteria
  - Cooling towers, coolants on hot surfaces

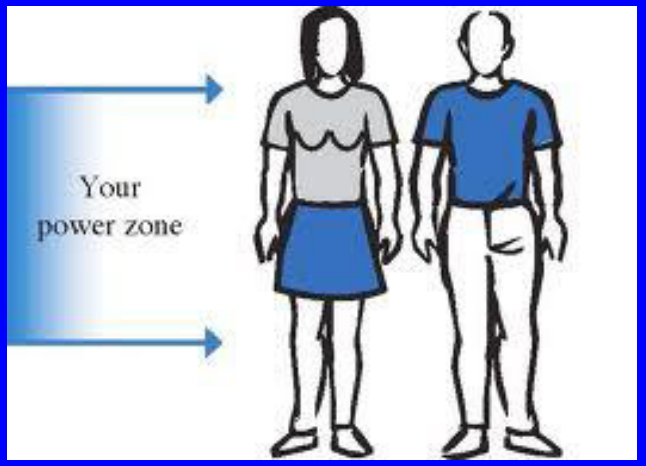
Biological Hazards

- Pigeon droppings
  - Histoplasmosis
- Animal bites
  - Rabies/Infection
- Insect stings/bites
  - Lyme Disease

Ergonomic Hazards

- Poor tool design
- Poor workplace design
- Repetitive Stress Disorders
- Lower Back Injuries
- Cumulative Trauma Disorders

Use the "Power Zone"



Stress Hazards

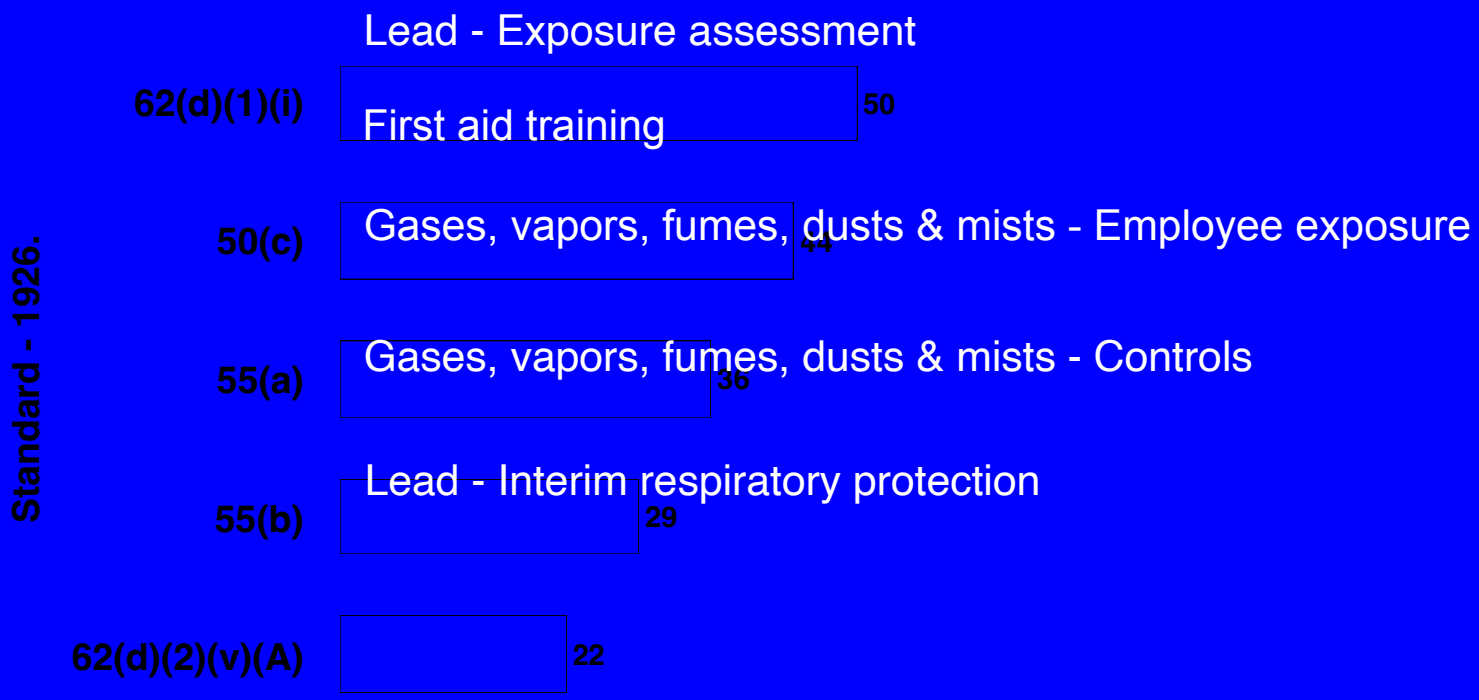
- Mental Stress
- Heat Stress
- Cold Stress
- Noise Induced Stress

Methods Of Control

- Engineering Controls
  - substitution
  - isolation
  - ventilation
  - wet methods

- Administrative Controls
  - work rotation
  - work practices
- PPE

Subpart D - Occupational Health & Environmental Controls (1926.50 - 66)



1926.50 Medical Services

- Medical personnel available for advice and consultation
- Provisions made ***prior to commencement of the project*** for prompt medical attention in case of serious injury.
- Medical facility readily available and/or person trained in first-aid available at the work site

1926.50 Medical Services

- First aid supplies must be easily accessible
- Non-mandatory Appendix A references ways to determine first-aid kit contents
- Contents must be in a weatherproof container with individual sealed packages for each type of item.

1926.50 Medical Services

- The contents of the first-aid kit shall be checked by the employer before being sent out on each job and
- At least weekly on each job to ensure that the expended items are replaced.

1926.50 Medical Services

- Proper equipment for prompt transportation of the injured person to a physician or hospital, or
- A communication system for contacting necessary ambulance service is required

1926.50 Medical Services

- Emergency numbers posted
- Eyewash required for injurious corrosive materials

Sanitation 1926.51

- Adequate supply of potable water shall be provided in all places of employment
- Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap.
- Water cannot be dipped from containers.

Sanitation 1926.51

- Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose
- The common drinking cup is prohibited

"Potable water" means water which meets the quality standards prescribed in the U.S. Public Health Service Drinking Water Standards, published in 42 CFR part 72, or water which is approved for drinking purposes by the State or local authority having jurisdiction.

Sanitation - Applicable 1910 Standards

- Every enclosed workplace constructed, equipped, and maintained, so far as reasonably practicable, as to prevent the entrance or harborage of rodents, insects, and other vermin.

- A continuing and effective extermination program shall be instituted were their presence is detected.

Sanitation - Applicable 1910 Standards

- Washing facilities required when applying paints, coatings, herbicides, insecticides, or when exposed to other harmful contaminants
- They shall be located near the worksite and maintained in a sanitary condition
- Lavatories provided with hot &

  cold, or tepid running water
- Soap/similar cleaning

  agent must be provided

Toilet Provisions: Table D - 1

Number of Employees	
20 or less	1
20 or more	1 toilet seat and 1 urinal per 40 workers
200 or more	1 toilet seat and 1 urinal per 50 workers

1926.52 Noise Exposure

- Noise levels in excess of Table D - 2 require administrative or engineering controls to control noise levels
- If controls fail to reduce sound levels within the levels of the table PPE must be provided to reduce levels within the table
- In all cases where sound levels exceed the values shown in the table, a continuing, effective hearing conservation program must be administered

TABLE D - 2 PERMISSIBLE NOISE EXPOSURES

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

1926.52 Noise Exposure

- When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each.
- Use the following formula to calculate exposure in this situation:

1926.52 Noise Exposure

- Fe = (T1 / L1) + (T2 / L2) + ... + (Tn / Ln) where:
  - Fe = The equivalent noise exposure factor.
  - T = The period of noise exposure at any essentially constant level.
  - L = The duration of the permissible noise exposure at the constant level (from Table D-2).
  - See example calculation on next slide:

1926.52 Noise Exposure

- If the value of Fe exceeds unity (1) the exposure exceeds permissible levels.
- 110 dB A 1/4 hour.
- 100 dB A 1/2 hour.
- 90 dB A 1 1/2 hours.
- Fe = (1/4 / 1/2)+(1/2 / 2)+(1 1/2 / 8)
- Fe = 0.500+0.25+0.188
- Fe = 0.938
- Since the value of Fe does not exceed unity, the exposure is within permissible limits.

1926.52 Noise Exposure

Decibel Level	Example
90	Truck traffic, lawn mower
100	Chain saw, pneumatic drill, excavator
120	Close thunder, rock concert
140	Jet plane, gunshot blast Exposure to impulse/impact noise should not exceed 140

1926.53 Ionizing radiation

- In construction and related activities involving the use of sources of ionizing radiation, the pertinent provisions of the Nuclear Regulatory Commission Standards for Protection Against Radiation (10 CFR Part 20), relating to protection against occupational radiation exposure, shall apply.
- Competent person needed.

1926.54 Non-Ionizing radiation

- Only qualified and trained employees assigned to install, adjust, and operate laser equipment.
- Proof of qualification of the laser equipment operator available and in possession of the operator at all times.
- light greater than 0.005 watts (5 milliwatts) exists, shall be provided with anti-laser eye protection

1926.55 Gases, vapors, fumes, dusts, and mists.

- Exposure of employees to inhalation, ingestion, skin absorption, or contact with any material or substance at a concentration above those specified in the "Threshold Limit Values of Airborne Contaminants for 1970" of the American Conference of Governmental Industrial Hygienists, *shall be avoided.*
- See Appendix A to this section.

1926.55 Gases, vapors, fumes, dusts, and mists.

- Engineering or Administrative controls first
- PPE if engineering controls not feasible
- All equipment & technical measures approved by competent industrial hygienist or other technically qualified person
- Whenever respirators are used, their use shall comply with 1926.103.

1926.56 Illumination

- General. Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in Table D-3 while any work is in progress:

Foot candles	Area of Operation
5.....	General construction area lighting.
3.....	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5.....	Indoors: warehouses, corridors, hallways, and exitways.
5.....	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading)
10.....	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms.)
30.....	First aid stations, infirmaries, and offices.

1926.57 Ventilation

- "General." Whenever hazardous substances such as dusts, fumes, mists, vapors, or gases exist or are produced in the course of construction work, their concentrations ***shall not exceed the limits specified in 1926.55(a).***
- When ventilation is used as an engineering control method, the system shall be installed and operated according to the requirements of this section.

1926.57 Ventilation

- Exhaust systems designed that dusts, fumes, mists, vapors, or gases are not drawn through the work area of employees.

1926.57 Ventilation

- Abrasive blasting operations produces respirable dust.
- Concentrations in levels above those specified in 1926.55 require controls

1926.57 Ventilation

- Wherever dry grinding, dry polishing or buffing is performed, and employee exposure, without regard to the use of respirators, exceeds the permissible exposure limits prescribed in 1926.55 or other pertinent sections of this part, a local exhaust ventilation system shall be provided and used to maintain employee exposures within the prescribed limits.

1926.57 Ventilation

- Spray booths or spray rooms are to be used to enclose or confine all operations.

1926.59 = 1910.1200
Hazard Communication

Hazard Communication

- Material Safety Data Sheets
- Labels
- Written Program
- Training of Employees

Major Points

- Employees must know the hazards of chemicals such as toxicity, and carcinogenic
- Many employees use dangerous chemicals without personal protective equipment
- The contractor must have data sheets of other employer's chemicals if their own employees are exposed

Purpose

- The purpose of the standard is to make sure that the hazards of chemicals are evaluated
- That information concerning their hazards is communicated to employers and employees


Improper: Container not labeled

Employers

- Employers are required to provide information to their employees about the hazardous chemicals to which they are exposed using:
  - A hazard communication program
  - labels and other forms of warnings
  - material safety data sheets (MSDS)
  - information and training

Labeling Exemptions

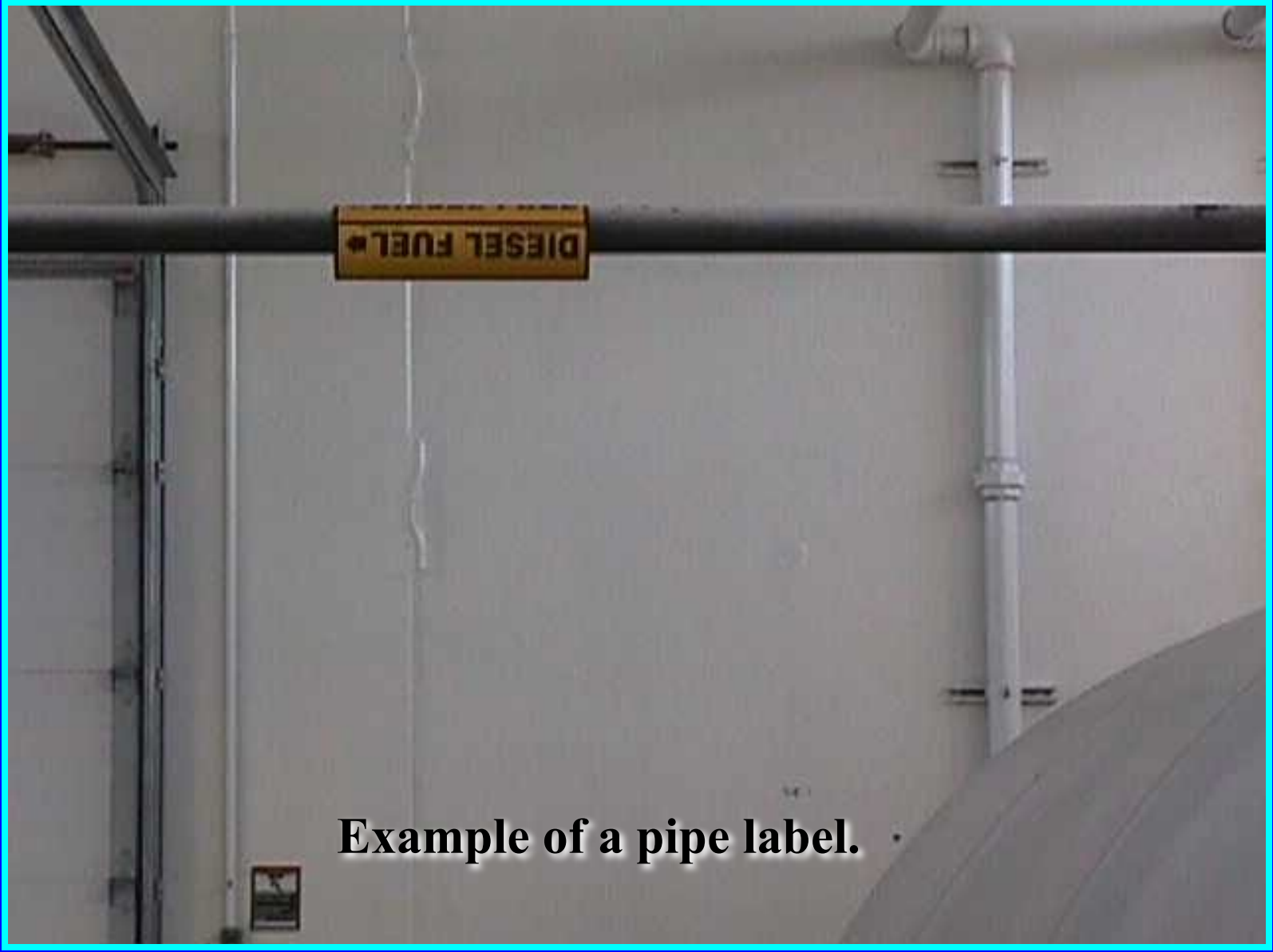
- Pesticides
- Chemicals covered under the Toxic Substance Control Act (TSCA)
- Foods or food additives
- Distilled Spirits, tobacco
- Consumer products, lumber, cosmetics
- Hazardous wastes

Employer Requirements- Written Program

- Employers must develop a ***written program*** that covers at least:
  - Labels and other forms of warnings
  - Material Safety Data Sheets
  - Employee Information and Training

Employer Requirements- Written Program

- Employers must develop a written program that covers at least:
  - A list of the hazardous chemicals known to be present at the facility along with MSDS's for each chemical
  - The methods the employer will use to inform employees of the hazards non-routine tasks
  - The hazards of chemicals in unlabeled pipes



Example of a pipe label.

Multi-Employer Workplaces

- If employees of other employers could be exposed to hazardous chemicals, the program must include methods to provide contractor employees with on-site access to MSDS for each chemical those workers may be exposed to
- The methods used to inform other employers of any precautionary measures to be taken for normal and emergency situations
- The employers chemical labeling system

Labels, Tags and Markings

- The employer must ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with the following:
  - Identity of the hazardous chemical
  - Appropriate hazard warnings
- This above labeling information is required of the manufacturer so the employer must ensure that the original labels from the manufacturer are on all containers and remain legible.

Container Labeling Exemption for Portable Containers

- The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the ***immediate use*** *by* ***the employee who performs the transfer.***


Improper: Containers not labeled
FIBERGLASS
RESIN

The employer need not affix new labels to comply with the standard if existing labels already covey the required information

New Hazard Information

- One important function of the individual(s) in charge of maintaining MSDS for the employer is to replace current MSDS with the revised version, when it is received.
- Companies can have copies in several locations, so updating all copies requires a conscientious effort by the individual(s) responsible for maintaining MSDS.

MSDS availability off-site

- For employees who work off-site:
  - MSDS may be kept at the central location
  - In an emergency, the employer must have provisions in place to ensure that employees can immediately obtain the required information

MSDS kept in other forms

- MSDS may be kept in any form
- Including operating procedures, or
- Groups of chemicals where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals

Employee Information and Training

- Employers must provide employees effective information and training on hazardous chemicals in their work area:
  - At the time of their initial assignment
  - Whenever a new physical or health hazard the employees have not previously been trained about is introduced into their work area
- Training may cover categories of hazards or specific chemicals

Employee Information

- Employers must inform employees:
  - Of the training requirements of this section (1910.1200);
  - Any operations in their work area where hazardous chemicals are present;
  - The location and availability of the written hazard communication program

Employee Information

- Employers must inform employees:
  - The location and availability of the list of hazardous chemicals
  - The location and availability of material safety data sheets

Employee Training

- Employee training shall include **at least:**
  - Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area
  - The physical and health hazards of chemicals in the work area
  - Measures employees can take to protect themselves
  - Details of the employers specific program

Hazard Definitions

IH Terms

- PEL – Permissible Exposure Limit (OSHA)
- TLV – Threshold Limit Value (ACGIH)
- TWA - Time Weighted Average
- ACGIH - American Conference of Governmental Industrial Hygienist's

Chemical Exposure Severity & Duration

- “Acute” effects usually occur rapidly as a result of short-term exposures, and are of short duration.
- “Chronic” effects generally occur as a result of long-term exposure, and are of long duration.

Acute Effects

- Irritation
- Corrosives
- Sensitization
- Lethal Dose

Chronic Effects

- Carcinogenicity
- Teratogenicity
- Mutagenicity

Corrosive

- Visible destruction, or irreversible damage to body tissue
- Acids
- Caustics (or bases)

Toxic and Highly Toxic

- Can cause death or serious injury from a single exposure
- Ingestion
- Dermal contact
- Inhalation

- Highly toxic, small dose; severe effects
- Toxic, larger dose; severe effects

Irritant

- Not a corrosive
- Causes reversible inflammatory effect

Material Safety Data Sheets (MSDS) are one of the most important tools available to employers for providing information, and protection to workers from hazardous chemicals which are used in the workplace.

Material Safety Data Sheet**U.S. Department of Labor**

May be used to comply with Occupational Safety and Health Administration

OSHA's Hazard Communication Standard, (Non-Mandatory Form)

29 CFR 1910.1200. Standard must be consulted for specific requirements.

Form Approved

OMB No. 1218-0072

IDENTITY *(As Used on Label and List)* Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name Emergency Telephone Number

Address *(Number, Street, City, State, and ZIP Code)* Telephone Number for Information

Date Prepared

Signature of Preparer *(optional)*

Section II - Hazard Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity;

Common Name(s)) OSHA PEL ACGIH TLV Other

Limits

Recommended %*(optional)*

Section III - Physical/Chemical Characteristics

Boiling Point

Specific Gravity (H_2O = 1)

Vapor Pressure (mm Hg.)

Melting Point

Vapor Density (AIR = 1)
(Butyl Acetate = 1)

Evaporation Rate

Solubility in Water

Appearance and Odor

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used) Flammable Limits LEL
UEL

Extinguishing Media

Special Fire Fighting Procedures

Unusual Fire and Explosion Hazards

Section V - Reactivity Data

Stability Unstable Conditions to Avoid

Stable

Incompatibility *(Materials to Avoid)*

Hazardous Decomposition or Byproducts

Hazardous
Polymerization May Occur Conditions to Avoid

Will Not Occur

Section VI - Health Hazard Data

Route(s) of Entry: Inhalation? Skin? Ingestion?

Health Hazards *(Acute and Chronic)*

Carcinogenicity: NTP? IARC Monographs? OSHA Regulated?

Signs and Symptoms of Exposure

Medical Conditions
Generally Aggravated by Exposure

Emergency and First Aid Procedures

Section VII - Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

Waste Disposal Method

Precautions to Be taken in Handling and Storing

Other Precautions

1926.61 Retention of DOT Markings, Placards and Labels

- An employer who receives a package, container or vehicle of hazardous material required to be marked, labeled or placarded in accordance with the U. S. DOT Haz Mat Regulations (49 CFR Parts 171 through 180) shall retain those markings, labels and placards on the package until the packaging is sufficiently cleaned of residue and purged of vapors to remove any potential hazards.

CFR 1926 Subpart Z

Toxic and Hazardous

Substances

1910.1000-1450

1926.1100-1152

Trainer Objectives

- Describe the science of Industrial Hygiene (IH).
- Describe the use of Tables Z-1, Z-2, and Z-3.
- Describe the hazards presented by silica.
- Describe the hazards presented by asbestos.
- Describe the hazards presented by lead.

Introduction

- Industrial hygiene is the science (and art) of anticipating, recognizing, evaluating, and controlling workplace conditions that may cause workers' injury or illness

Introduction

- OSHA relies on, among many others, industrial hygienists to evaluate jobs for potential health hazards
- Developing and setting mandatory occupational safety and health standards involves determining:
  - The extent of employee exposure to hazards; and,
  - Deciding what is needed to control these hazards, in order to protect workers

IH Personnel

- CIH - Certified Industrial Hygienist has knowledge, experience, and education and passed national exam administered by the American Board Of Industrial Hygiene. Needs continuing education to keep up with the latest technology and issues.
- IH - Industrial Hygienist has knowledge, experience, and education to practice IH but has not taken CIH exam.
- OHST - Occupational Health and Safety Technologist has practical health & safety knowledge Certified by the Board of Certified Safety Professionals.
- IHT – Industrial Hygiene Technician is specifically trained to do IH exposure monitoring, done under the supervision of a CIH or IH.

Industrial Hygiene program

- Why Do You Need an IH Program?
  - Protect your workers from hazards that ether you bring into the work place or is there because of the process hazards the process units.
  - The OSHA regulations require you provide a healthy and safe work place for your employees. (General Duty Clause)
  - The host facility requires you have IH programs to protect your employees.
  - Specific work place standards like noise, lead, benzene, hexavalent chromium, just to name a few.
  - Keep you workman's compensation cost down.
  - Protect you and the host company from law suits.

Industrial Hygiene program

- Proactive process to look at the need to conduct exposure monitoring.
- Review the hazards in the work place and determine the need to do exposure monitoring using the hazard risks and the potential for exposures to those hazards.
- Develop a sampling strategy, based on the degree of the hazard and the potential for exposure.
- Conduct Industrial Hygiene monitoring. This could include quantitative as well as qualitative analysis.
- Compare the results to exposure standards and report the results, with corrective actions, if needed.

IH Consultants

- Typical IH Bid
  - Scope of work
  - Conditions (length of work day, overtime, etc)
  - Hourly rate
  - Travel expenses, if applicable
  - IH Equipment needed and cost (rental)
  - Laboratory cost

IH Consultants

- Cost Benefit of contractor sharing of IH services
  - Labor cost can be shared when several contractors on one job site have the same basic Industrial Hygiene program and the monitoring is conducted by the same person.
  - For example, one IH Tech can monitor six people in one day just as easy as it takes to monitor three people.
  - The cost per sample analysis will typically be lower, once certain minimum quantities are achieved.

IH Consultants

- Analysis Cost
  - The cost of analysis depends on several factors, varying on which chemical and how fast you need the analysis.
  - Example: a sample for benzene and other solvents on the same tube or badge may cost about $40 for the first component and $15 for each additional component for a two week turn around.
  - Example: a chromium VI filter may cost about $50 for a one week turn around, and up to $150 for a same day analysis.
  - Remember you need to submit a blank per the requirements of the applicable sampling method

Evaluation

- Air Monitoring
  - How Much?
    - OSHA Compliance
    - Labor Relations
    - Reduce Long-Term Liability

IH Monitoring

- **Common Mistakes**
  - Wrong sampling method
  - Not sampling long enough or a high enough flow rate for the sensitivity of the method.
  - Comparing a short term sample results or area sample results to an 8 hr TWA exposure limit.
  - Not calibrating equipment before and after each use.
  - Using a pump calibrator that is out of calibration.
  - Mislabeling samples
  - Not documenting notes and information on the samples collected.
  - Not submitting a blank per the requirements of the applicable sampling method

IH Monitoring

- Things that can invalidate a sample
  - Tubing is pulled off of the pump by accident by the worker.
  - Sample filter falls off sampling device.
  - Pump stops due to a bad battery or from a flow interrupt.
  - Obvious tampering with the samples.
  - Not documenting the monitoring

IH Equipment Lab

- Handle various types of IH equipment
- Place noise dosimeter and/or air pump, hose and cassette on another student

Subpart Z Introduction

- Subpart Z covers the regulations for toxic and hazardous substances in the workplace
- Major sections of Subpart Z include:
  - 1910.1000 Air Contaminants; This section includes OSHA's Z tables, which set limits on worker exposure to specific listed substances (also see 1926.55 & Appendix A)
  - 1910.1001-1096 Specific regulations for a number of listed potentially hazardous and toxic substances including asbestos (1910.1001); lead (1910.1025) and bloodborne pathogens (1910.1030), among many others (Expanded requirements)
  - 1910.1200 Hazard Communication (1926.59)

Standard Interpretations 05/23/1985 - Method for exposure compliance determination for substances regulated under Subpart Z.

- “In response to your letter inquiring how the Occupational Safety and Health Administration (OSHA) makes exposure compliance determinations for substances regulated under Subpart Z of 1910.”
- “Such determinations consider many factors. Workplace conditions (e.g., production levels, control integrity, work practices, etc.) are examined to ensure that representative samples are collected.”

Standard Interpretations 05/23/1985 - Method for exposure compliance determination for substances regulated under Subpart Z.

- "Where feasible, the relative results of direct reading and other analytical results are considered."
- "Thus, when OSHA determines that employee exposure to a regulated substance exceeds the permissible limits prescribed by our standards, we then also assess employer compliance with all other applicable provisions of the standard that are dependent on employee exposure levels."

1910.1000 - Air Contaminants

- An employee's exposure to any substance listed in Tables Z-1, Z-2, or Z-3 cannot exceed the limits given in the tables, according to the requirements set for each table
- To achieve compliance with the requirements of this section a hierarchy of controls must first be determined and implemented whenever feasible:
  - Engineering controls
  - Administrative controls
  - Personal protective equipment

Standard Interpretations 06/24/2002 - Hierarchy of controls for exposure to air contaminants

- "Employers must use engineering or administrative controls to bring employee exposure to airborne contaminants within the levels permitted under 29 CFR 1910.1000."
- ***"You may use personal protective equipment (PPE) to supplement engineering and administrative controls only when these controls cannot be feasibly implemented to reduce employee exposure to permissible levels."***
- "Thus, when it is not feasible to achieve compliance through administrative or engineering controls, you must also use PPE or other protective measures to prevent employee exposure to air contaminants from exceeding the prescribed limits."

1910.1000(a) - Table Z-1

- Lists common chemicals that may be found in the workplace
- Limits are given as either:
  - **8-hour Time Weighted Average (TWA) or**
  - **Ceiling (C) limits**
- "Substances with limits preceded by "C" - Ceiling Values." An employee's exposure to any substance in Table Z-1, the exposure limit of which is preceded by a "C", shall at no time exceed the exposure limit given for that substance

1910.1000(a) - Table Z-1

- "Other substances" - "8-hour Time Weighted Averages (TWA)":
  - An employee's exposure to any substance in Table Z-1, the exposure limit of which is not preceded by a "C", shall not exceed the 8-hour TWA given for that substance in any 8-hour work shift of a 40-hour work week

Standard Interpretations 11/10/1999 - OSHA policy regarding PEL adjustments for extend work shifts

- As stated in a previous memorandum dated November 8, 1996:
- Compliance officers can choose one of two approaches for employees who work extended work shifts beyond 8-hours. The choice taken will depend on the nature of the hazardous chemical.

Standard Interpretations 11/10/1999 - OSHA policy regarding PEL adjustments for extend work shifts

- "The first approach is to sample what the compliance officer believes to be the worst continuous 8-hour work period of the entire extended work shift."
- "The second approach is to collect multiple samples over the entire work shift. Sampling is done such that multiple personal samples are collected during the first 8-hour work period and additional samples are collected for the extended work shift. Unless a compliance officer is dealing with lead, the PEL in this approach is calculated based upon the worst 8-hours of exposure during the entire work shift."

1910.1000(a) - Table Z-1

- The ceiling and 8 hour TWA's listed in Table **Z-1** are expressed in:
  - Parts per million **(ppm) for gases and vapors** from liquids; or,
  - milligrams per meter cubed **(mg/m^3)** for **dusts, fumes & mists**

1910.1000 TABLE Z-1 (Examples)

Substance	8-hr TWA	Ceiling
Acetone	1000 ppm	
Carbon monoxide	50 ppm	
Chlorine		1 ppm
Particulates not otherwise regulated (PNOR)	15 mg/M^3, Total dust	
	5 mg/M^3, Respirable fraction	

NOTE: The employer must ensure no employee exceeds any PEL

1910.1000(b) - Table Z-2

- Table Z-2 was adopted from ANSI* standards
- OSHA has developed expanded standards for some of the substances found in Z-2 for example:
  - Benzene 1910.1028
  - Cadmium 1910.1027
  - Formaldehyde 1910.1048
  - Methylene chloride 1910.1052

***American National Standards Institute**

1910.1000(b) - Table Z-2

- The substances listed can have limits expressed as:
  - 8-hour TWAs
  - Ceilings
  - Peaks
- If a substance has both ceiling and peak limits, the peak now becomes the level never to be exceeded
- Any employee's exposure level exceeding the ceiling but under the peak are required to comply with the margin notes provided in the table

1910.1000(b) - Table Z-2

Substance	8-hr TWA	Ceiling	Peak	Notes
Carbon Disulfide	20 ppm	30 ppm	100 ppm	30 min
Hydrogen sulfide		20 ppm	50 ppm	10 min
Styrene	100 ppm	200 ppm	600 ppm	5 min in any 3 hrs
Toluene	200 ppm	300 ppm	500 ppm	10 min

* Benzene has an expanded standard 1910.1028. If .1028 does not apply, then the employer will follow limits in Z-2

1910.1000(b) - Table Z-2

- "Table Z-2." An employee's exposure to any substance listed in Table Z-2 shall not exceed the exposure limits specified as follows:
  - "8-hour time weighted averages." An employee's exposure to any substance listed in Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in Table Z-2.

1910.1000(b) - Table Z-2

- "Acceptable ceiling concentrations." An employee's exposure to a substance listed in Table Z-2 shall not exceed at any time during an 8-hour shift the ceiling concentration limit given for the substance except for:
  - A time period, and up to a concentration ***not exceeding the maximum duration and concentration*** allowed in the column under **"acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift"**

1910.1000(b) - Table Z-2

- Example:
  - During an 8-hour work shift, an employee may be exposed to a concentration of Substance A (with a 10 ppm TWA, 25 ppm ceiling and 50 ppm peak) above 25 ppm (but never above 50 ppm) only for a maximum period of 10 minutes.
  - Such exposure must be compensated by exposures to concentrations less than 10 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 ppm.

1910.1000(c) - Table Z-3

- "Table Z-3." An employee's exposure to any substance listed in Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in the table

1910.1000(c) - Table Z-3

- OSHA adopted this table from the American Conference of Governmental Industrial Hygienist's (ACGIH) mineral limits

1910.1000(c) - Table Z-3

Substance	PEL
Crystalline Silica (Respirable fraction)	$\frac{10 mg/M^3}{\% Sio2 + 2}$
Coal dust (< 5% SiO2)	2.4 mg/M^3
Nuisance total dust	15 mg/M^3
Nuisance respirable dust	5 mg/M^3

Silica

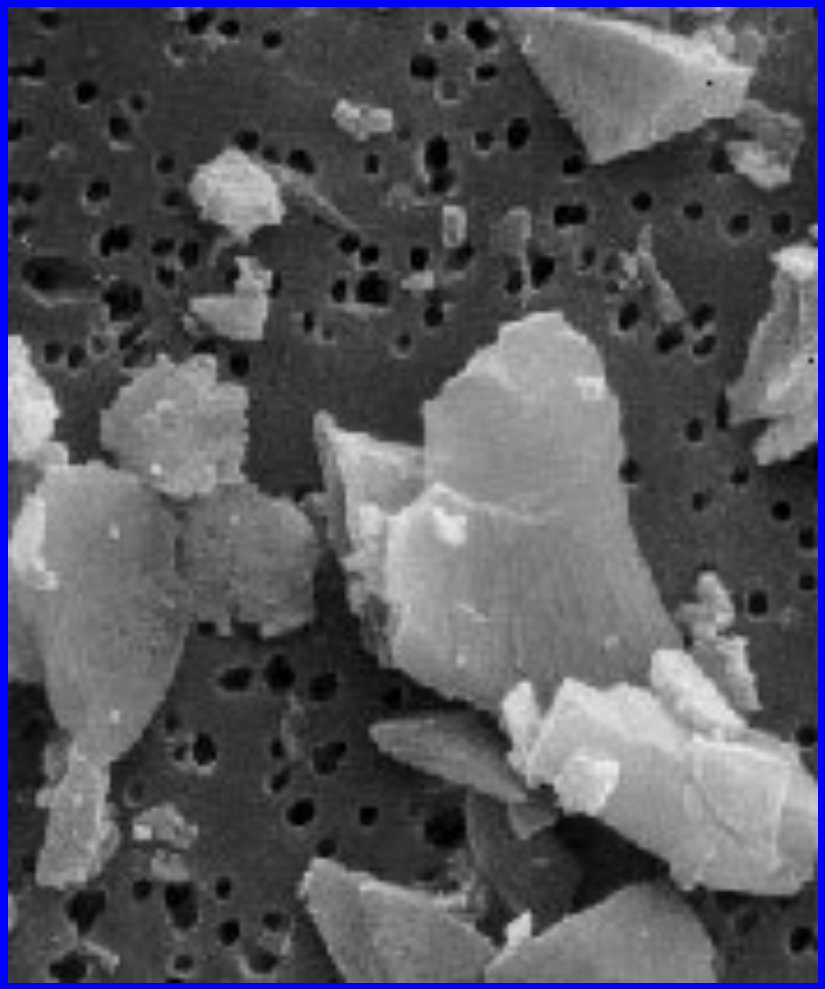
- The Z-3 Table sets the limits for employee exposure to various forms of silica
- At least 1.7 million U.S. workers are exposed to respirable crystalline silica in a variety of industries occupations, including construction, sandblasting, and mining

Silica

- Silicosis, an irreversible but preventable disease, is the illness most closely associated with occupational exposure to the material, which also is known as silica dust.
- Some studies also have linked respirable crystalline silica with risks for lung cancer and some auto-immune diseases.

1910.1000(e) - To achieve compliance

- To achieve compliance with the requirements of Tables Z-1, Z-2, and Z-3, a hierarchy of controls must first be determined and implemented whenever feasible:
  - Engineering controls
  - Administrative controls
  - Personal protective equipment



Detailed microscopic view of silica particles on a filter

(Scanning electron micrograph by William Jones, Ph.D.)

1910.1000(e) - To achieve compliance

- Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person
- Whenever respirators are used, their use shall comply with 1910.134

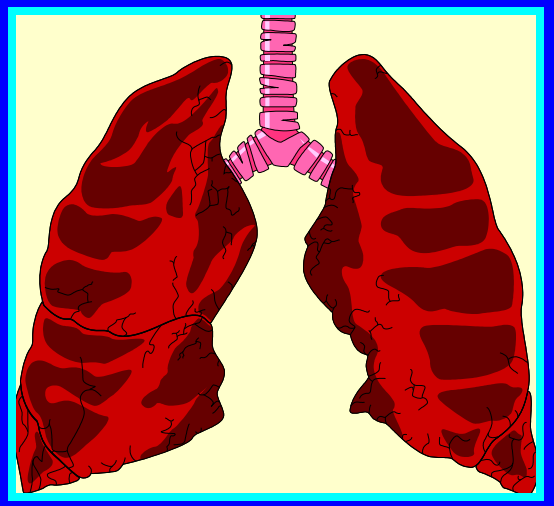
Asbestos

CFR 1926.1101

Introduction

- The asbestos minerals have a tendency to separate into microscopic-size particles that can remain in the air and are easily inhaled. Persons occupationally exposed to asbestos have developed several types of life-threatening diseases, including lung cancer

A fiber of asbestos or related substance is coated by an iron-protein complex and surrounded by macrophages



Why is asbestos hazardous?

- Asbestos is a mineral that is resistant to chemicals, heat and biochemical defenses
- Length of fiber is approximately 1/5000 of an inch
- Size and shape allows the fiber to reach the alveoli
- Fibers remain in the lung tissue or pierce the alveoli and get lodged in the pleura that surrounds the lung
- The asbestos kills macrophages which lead to scarring

Permissible exposure limit (PELS)

- The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average (TWA).

Main topics of the Standard

- Definitions
- Classification of asbestos work
- Regulated areas
- Exposure assessment
- Methods of Compliance: Engineering and work practice controls
- Prohibited activities
- PPE
- Hygiene facilities
- Training requirements
- Medical surveillance
- Recordkeeping

Standard Interpretations 05/08/1995 - (OSHA) revised asbestos standard

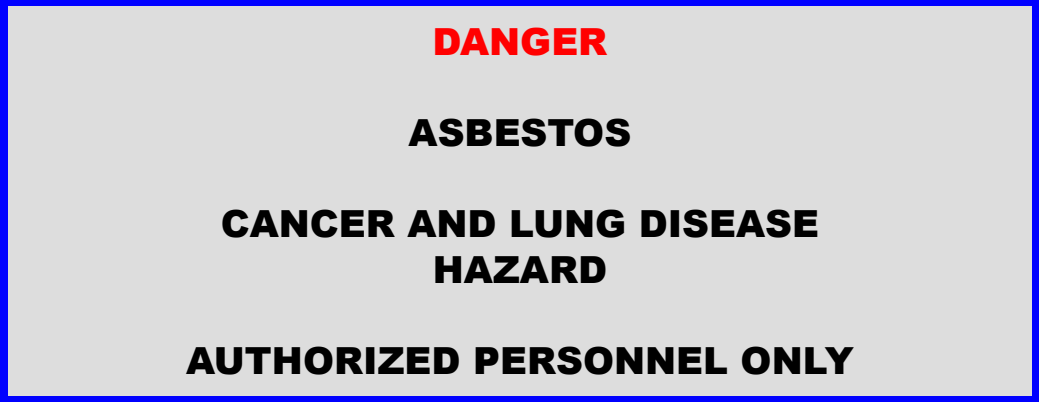
- “The standard requires the employer to know the presence, location, and quantity of asbestos-containing material (ACM) and presumed asbestos-containing material (PACM) and to communicate this to employees who work in areas where ACM or PACM is present.”

Building Owner Requirements

- Building and facility owners shall determine the presence, location and quantity of ACM and/or PACM and inform tenants, their employees and employers of employees (who will inform their employees) who will perform work activities in or near areas which contain it

Building Owner Requirements

- Posting:
  - Warning signs shall be provided and displayed at each regulated area.
  - In addition, warning signs shall be posted at such a distance from such areas so that an employee may read the signs and take necessary protective steps before entering the area.



Standard Interpretations 02/21/1996 - Building and/or facility owner notification requirements

- “Rule 29 CFR 1926.1101(k)(2)(ii)(B) pertains to employees of the building and/or facility owner.”
- “The rule requires the owner to notify his/her maintenance and custodial employees of the presence, location, and quantity of ACM or PACM in the areas of the building or facility where they perform work.”
- “In addition, the rule requires the owner to notify his/her other employees who work in or adjacent to areas where work about to take place of the presence, location, and quantity of ACM or PACM in the areas.”

Lead

1910.1025
1926.62

Introduction

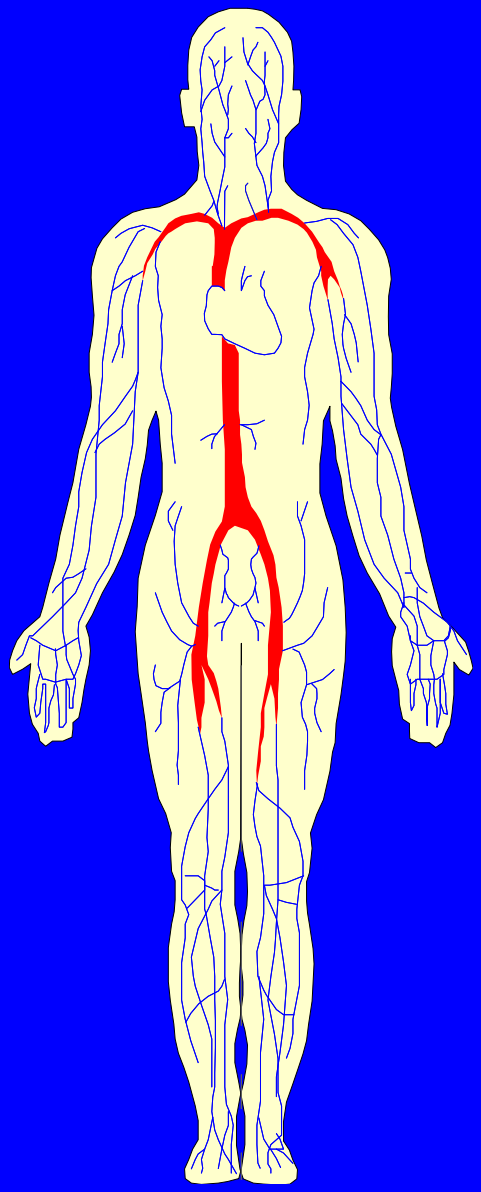
- Overexposure to lead is one of the most common overexposures found in industry.
- A leading cause of workplace illness.
- OSHA has established the reduction of lead exposure to be a high strategic priority.

Introduction

- Lead is commonly added to industrial paints because of its characteristic to resist corrosion.
- Industries with particularly high potential exposures include: construction work involving welding, cutting, brazing, blasting, etc., on lead paint surfaces;
- Oral ingestion represents a major route of exposure in contaminated workplaces.

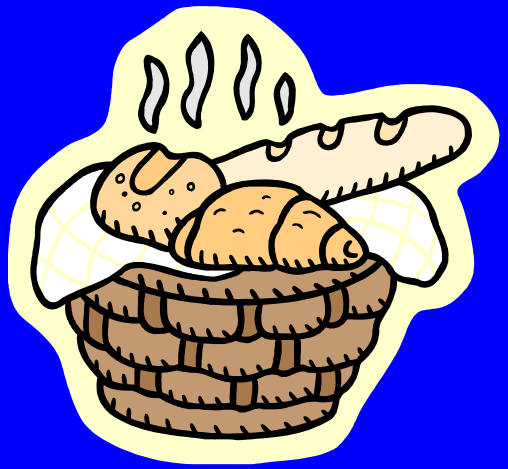
Introduction

- You may not be aware of any immediate symptoms of disease
- Lead stored in your tissues can slowly cause irreversible damage, first to individual cells, then to your organs and whole body systems



Introduction

- You can absorb lead through your digestive system if lead gets into your mouth and is swallowed
- If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion



Introduction

- Taken in large enough doses, lead can kill you in a matter of days

- A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest.
- A short term dose of lead can lead to acute encephalopathy

Introduction

- Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems

- Common symptoms of chronic overexposure include loss of appetite, metallic taste, anxiety, constipation, nausea, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, tremors, numbness, dizziness

Scope

- Applies to all construction work where an employee may be occupationally exposed to lead, including:
  - Demolition or salvage operations;
  - Removal or encapsulation of materials containing lead;
  - New construction, alteration, repair or renovation;
  - Installation of products containing lead;
- This section does not apply to agricultural operations covered by 29 CFR Part 1928

Permissible exposure limit (PEL)

- The employer shall assure that no employee is exposed to lead at concentrations greater than 50 ug/m3 averaged over an 8-hour period
- For > 8 hours exposure PEL = 400/hours worked
- Determine if any employee may be exposed to lead at or above the action level (30 ug/m3).
- Determination based on exposure levels if employee ***not using a respirator***

Initial determination

- Each employer who has a workplace or work operation covered by this standard shall determine if any employee may be exposed to lead at or above the action level

Basis of initial determination

- Any information, observations, or calculations which would indicate employee exposure to lead;
- Any previous measurements of airborne lead; and
- Any employee complaints of symptoms which may be attributable to exposure to lead

Negative Initial Determination

- Written Record
- Date
- Location
- Name
- SSN

Written Compliance Program

- A written program is required if occupational exposure to lead exists:
  - Each employer shall establish and implement a written compliance program to reduce exposures to or below the permissible exposure limit

Written Compliance Program

- A description of each operation in which lead is emitted;
  - e.g. machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices;
- A description of the specific means that will be employed to achieve compliance, including:
  - methods selected for controlling exposure to lead;
- Air monitoring data which documents the source of lead emissions;
- A schedule for implementation of the program

Additional Requirements

- Multi-contractor Site Arrangements
- Mechanical Ventilation
- Respirator Selection & Use and PPE clothing
- Housekeeping
- Hygiene and Facility Practices
- Medical Requirements
- Training

Standard Interpretations
04/25/1979 - Training program requirements in the lead standard

- "The employer is required by provision (1)(I)(v)(A) of the lead standard to summarize the standard and its appendices for each employee covered by provision (1)(I)(ii)."

CFR 1926 Subpart E

Personal Protective & Life Saving Equipment

Learning Objectives/Outcomes

Upon completion of the lesson, participants will be able to:

1. Describe the two primary means of protecting employees from workplace hazards, prior to considering personal protective equipment (PPE).

2. List at least four of the seven items that should be covered during PPE training.

3. Identify at least three elements of an appropriate PPE program.

4. Match the appropriate PPE to a described hazard.

Protecting Employees from Workplace Hazards

- OSHA regulations require employers to protect their employees from workplace hazards such as machines, work procedures, and hazardous substances that can cause injury
- Employers must institute all feasible engineering and work practice controls to eliminate and reduce hazards before using PPE to protect against hazards

Engineering Controls

If…

You can physically change the machine or work environment to prevent employee exposure to the potential hazard

Then…

You can eliminate the hazard with an engineering control

Engineering Controls (cont'd)

Examples…

- Initial design specifications
- Ventilation
- Substitution with less harmful material
- Enclosure of process
- Isolation of process
- Change the process

Work Practice Controls

If…

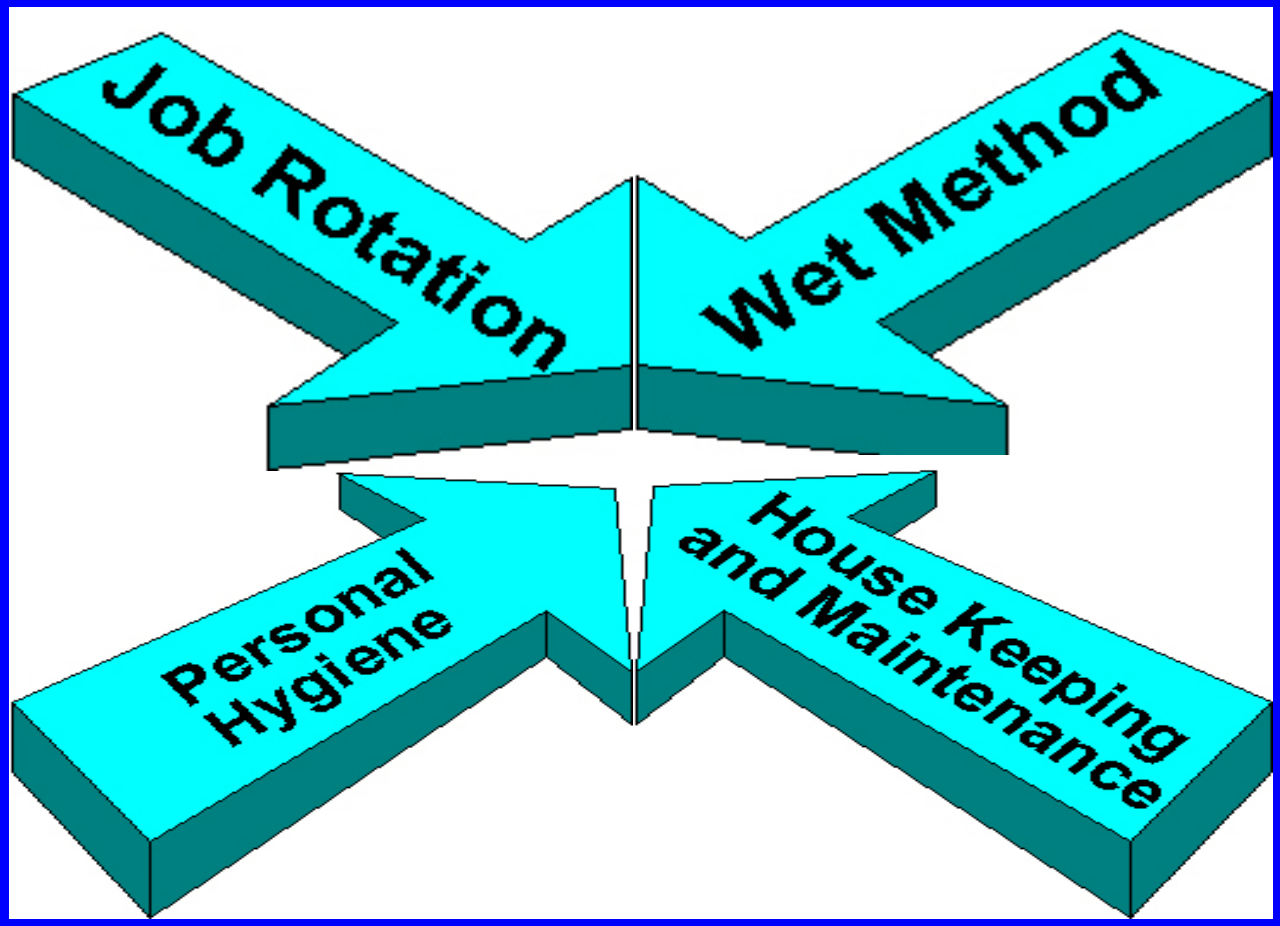
You can remove your employees from exposure to the potential hazard by changing the way they do their jobs,

Then…

You can eliminate the hazard with a work practice control

Work Practice Controls (cont'd)

Examples…



Responsibilities

- Employer
  - Assess workplace for hazards
  - Provide PPE
  - Determine when to use
  - Instruct employees in proper use
- Employee
  - Use PPE in accordance with instructions
  - Inspect daily and maintain

Examples of PPE

- Eyes - safety glasses, goggles
- Faces - face shields
- Heads - hard hats
- Feet - safety shoes
- Hands and arms - gloves
- Bodies - vests
- Hearing - ear plugs, earmuffs

Note:

Rubber insulating equipment (gloves, sleeves, blankets, etc.) is also considered PPE. However, because OSHA has specific requirements for them, they are not discussed in this general guide.

Establishing a PPE Program

- Procedures for selecting, providing and using PPE
- First -- assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of PPE
- Once the proper PPE has been selected, the employer must provide training to each employee who is required to use PPE

Training

If employees are required to use PPE, train them:

- Why it is necessary
- How it will protect them
- What are its limitations
- When and how to wear
- How to identify signs of wear
- How to clean and disinfect
- What is its useful life & how is it disposed

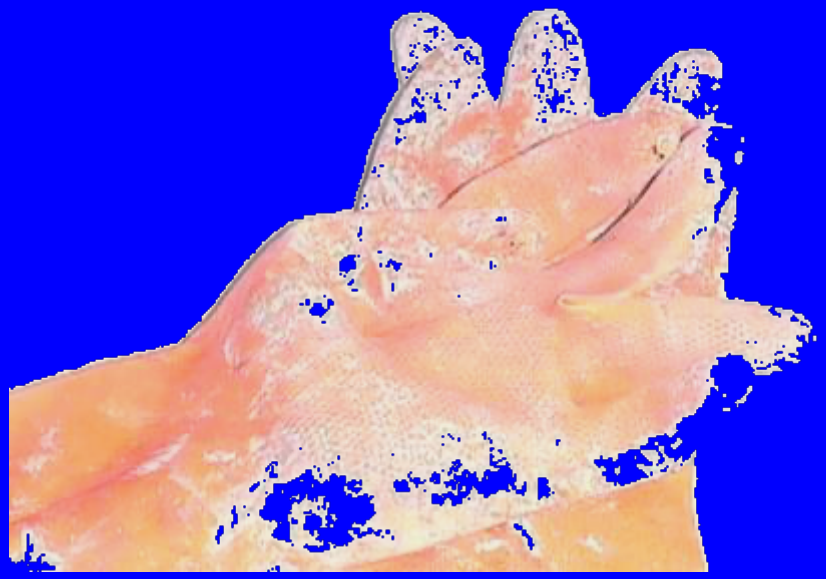
1926.95(a)

"Application." Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reasor of hazards of processes or environment, chemical hazards, radiological hazards, or mechanica irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

1926.95(b)

"Employee-owned equipment." Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

Employee owned gloves



1926.95(c)

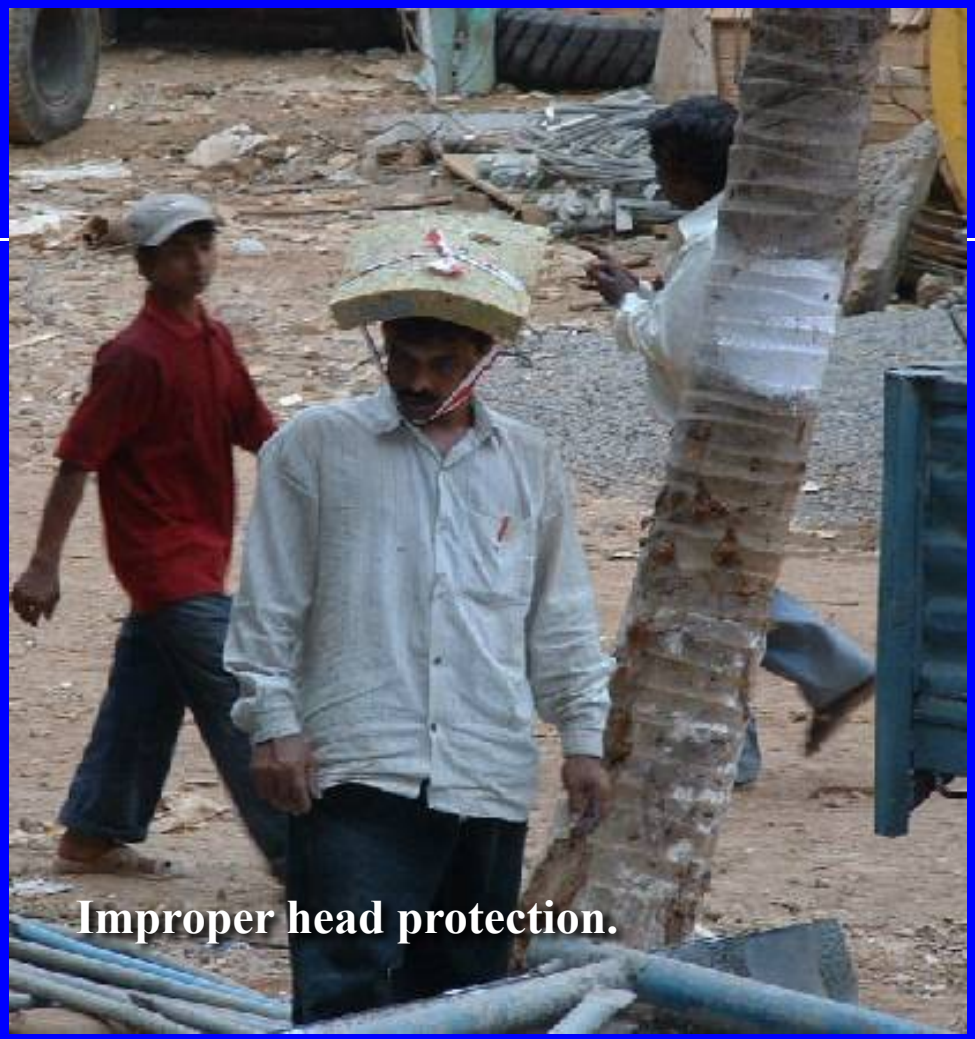
"Design." All personal protective equipment shall be of safe design and construction for the work to be performed.

HARD HATS

Potential overhead hazards must be present

Causes of Head Injuries

- Falling objects such as tools
- Bumping head against objects, such as pipes or beams
- Contact with exposed electrical wiring or components



Improper head protection.

1926.100 Head Protection

(a) Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets.

(b) Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

(c) Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, Z89.2-1971.

Classes of Hard Hats

Class A

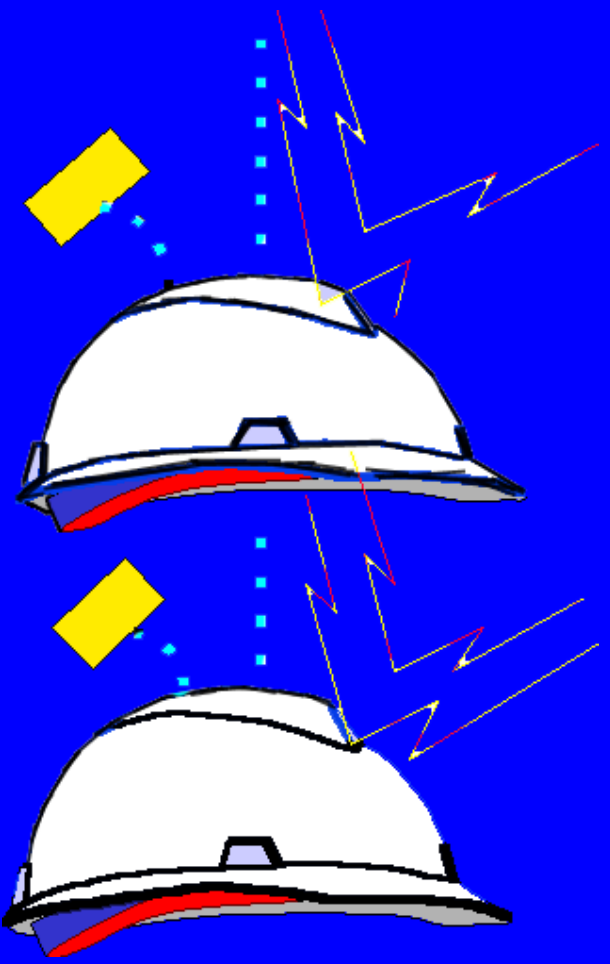
Used for general service (e.g., mining, building construction, shipbuilding, lumbering, manufacturing)

Provides impact protection but limited voltage protection

Class B

Used for electrical work

Protects against falling objects and high-voltage shock and burns



2,200

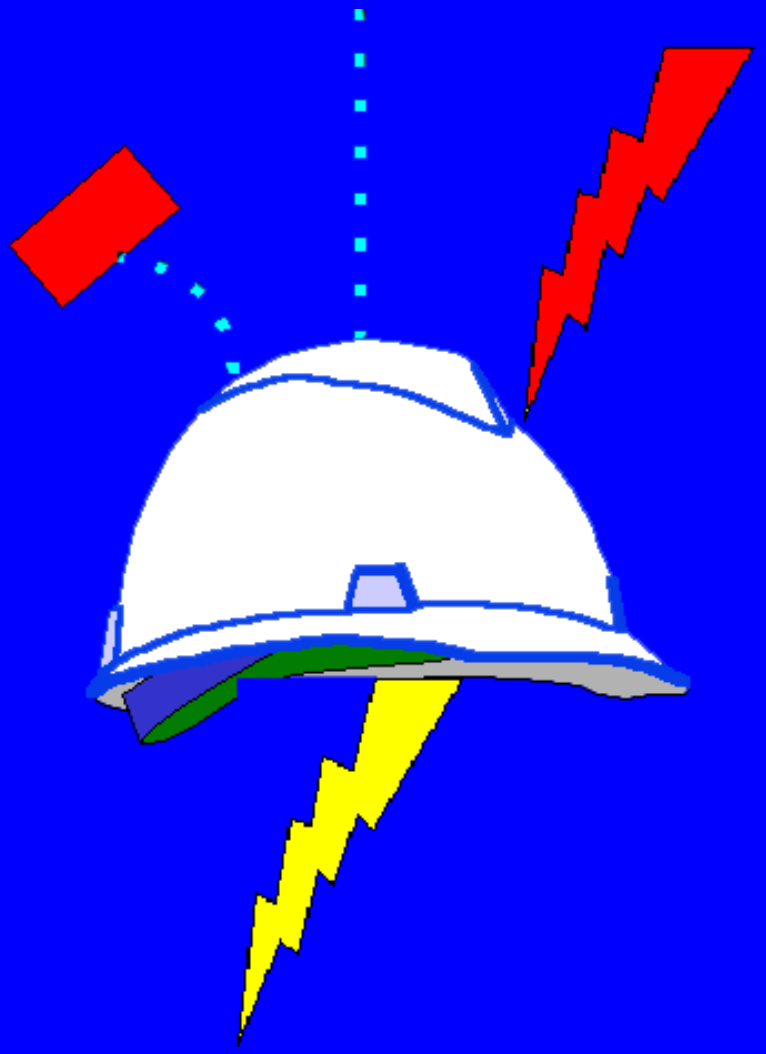
20,000

Classes of Hard Hats (cont'd)

Class C

Designed for comfort, offers limited protection

Protects head that bumps against fixed objects, but does not protect against falling objects, or electrical shock.



BUMP CAP

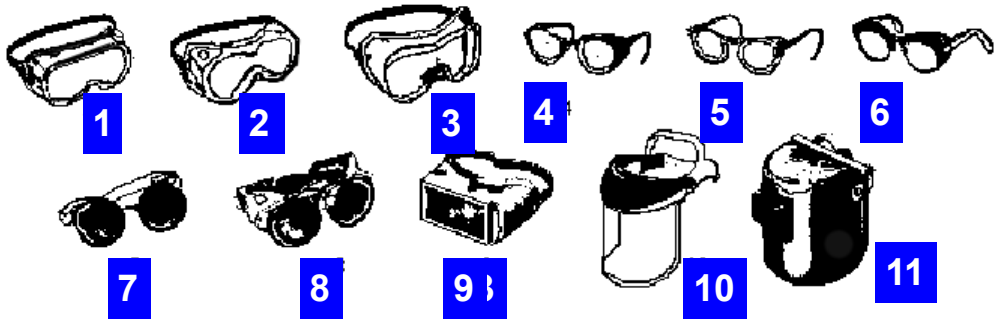
A bump cap should never be used in construction areas since it is not rated to protect against construction hazards.

1926.102
Eye and face protection

(a)(1) General. Employees shall be provided with eye and face protection equipment when machines or operations present potential eye or face injury from physical, chemical, or radiation agents.

(a)(2) Eye and face protection equipment required by this Part shall meet the requirements specified in American National Standards Institute, Z87.1-1968, Practice for Occupational and Educational Eye and Face Protection.

EYE AND FACE PROTECTION EYE CHART



APPLICATIONS

OPERATION	HAZARDS	PROTECTORS
ACETYLENE BURNING ACETYLENE CUTTING ACETYLENE WELDING	SPARKS, HARMFUL RAYS, MOLTEN METAL FLYING PARTICLES	7,8,9
CHEMICAL HANDLING	SPLASH, ACID BURNS, FUMES	2(For severe exposure add 10)
CHIPPING	FLYING PARTICLES	1,3,4,5,6 7A,8A
ELECTRIC (ARC) WELDING	SPARKS, INTENSE RAYS, MOLTEN METAL	11 (In combination with 4,5,6, in tinted lenses advisable)
FURNACE OPERATIONS	GLARE, HEAT, MOLTEN METAL	7,8,9, (For severe exposure add 10)
GRINDING - LIGHT	FLYING PARTICLES	1,3,5,6, (For severe exposure add 10)
GRINDING - HEAVY	FLYING PARTICLES	1,3, 7A, 8A (For severe exposure add 10)
LABORATORY	CHEMICAL SPLASH, GLASS BREAKAGE	2(10 in combination with 5,6,)
MACHINING	FLYING PARTICLES	1,3,5,6, (For severe exposure add 10)
MOLTEN METALS	HEAT, GLARE, SPARKS, SPLASH	7,8, (10 in combination with 5,6, in tinted lenses
SPOT WELDING	FLYING PARTICLES, SPARKS	1,2,3,4,5,6 (Tinted lenses advisable; for severe exposure add 10)

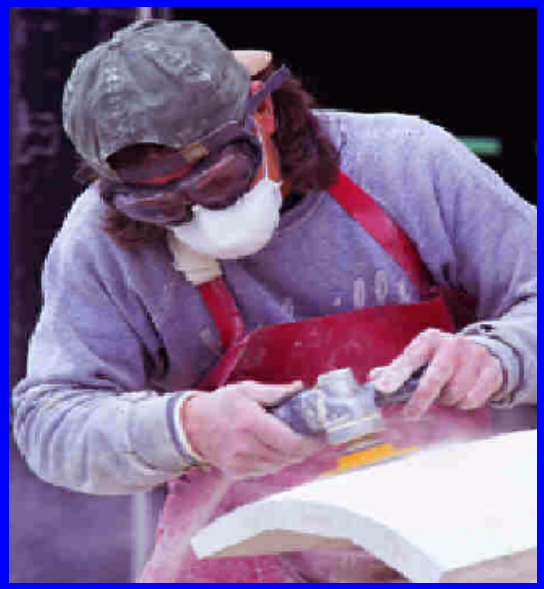
1926.102(a)(3)

Lenses
Employees whose vision requires the use of corrective lenses in spectacles, when required by this regulation to wear eye protection, shall be protected by goggles or spectacles of one of the following types:

(a)(3)(i) Spectacles whose protective lenses provide optical correction;

(a)(3)(ii) Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles;

(a)(3)(iii) Goggles that incorporate corrective lenses mounted behind the protective lenses.



Safety Glasses

- Made with metal/plastic safety frames
- Most operations require side shields
- Used for moderate impact from particles produced by jobs such as carpentry, woodworking, grinding, and scaling
- Must meet ANSI Z87.1-1968 at a minimum

Goggles

- Protects eyes and area around the eyes from impact, dust, and splashes
- Some goggles fit over corrective lenses
- Must meet ANSI Z87.1-1968 at a minimum

Face Shields

- Full face protection
- Protects face from dusts and splashes or sprays of hazardous liquids
- Does not protect from impact hazards
- Wear safety glasses or goggles underneath
- Must meet ANSI Z87.1-1968 at a minimum

Welding Shields

- Protects eyes against burns from radiant light
- Protects face and eyes from flying sparks, metal spatter, & slag chips produced during welding, brazing, soldering, and cutting

Improper PPE

1926.102(b)(2) Laser protection

(b)(2)(i)
Employees whose occupation or assignment requires exposure to laser beams shall be furnished suitable laser safety goggles which will protect for the specific wavelength of the laser and be of optical density (O.D.) adequate for the energy involved. Table E-3 lists the maximum power or energy density for which adequate protection is afforded by glasses of optical densities from 5 through 8.

1926.102(b)(2) Laser protection

(b)(2)(ii) All protective goggles shall bear a label identifying the following data:

(b)(2)(ii)(a) The laser wavelengths for which use is intended;

(b)(2)(ii)(b) The optical density of those wavelengths;

(b)(2)(ii)(c) The visible light transmission.

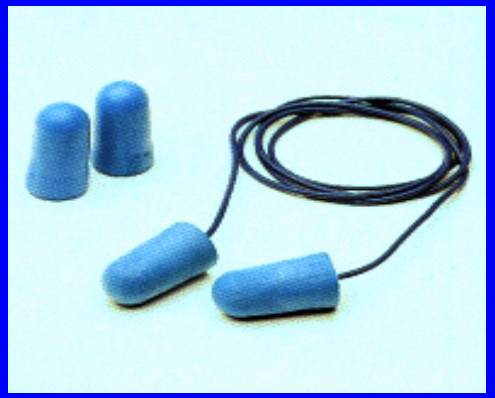
1926.101 Hearing protection

(a) Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2, Permissible Noise Exposures, in 1926.52, ear protective devices shall be provided and used.

(b) Ear protective devices inserted in the ear shall be fitted or determined individually by competent persons.

Examples of Hearing Protectors

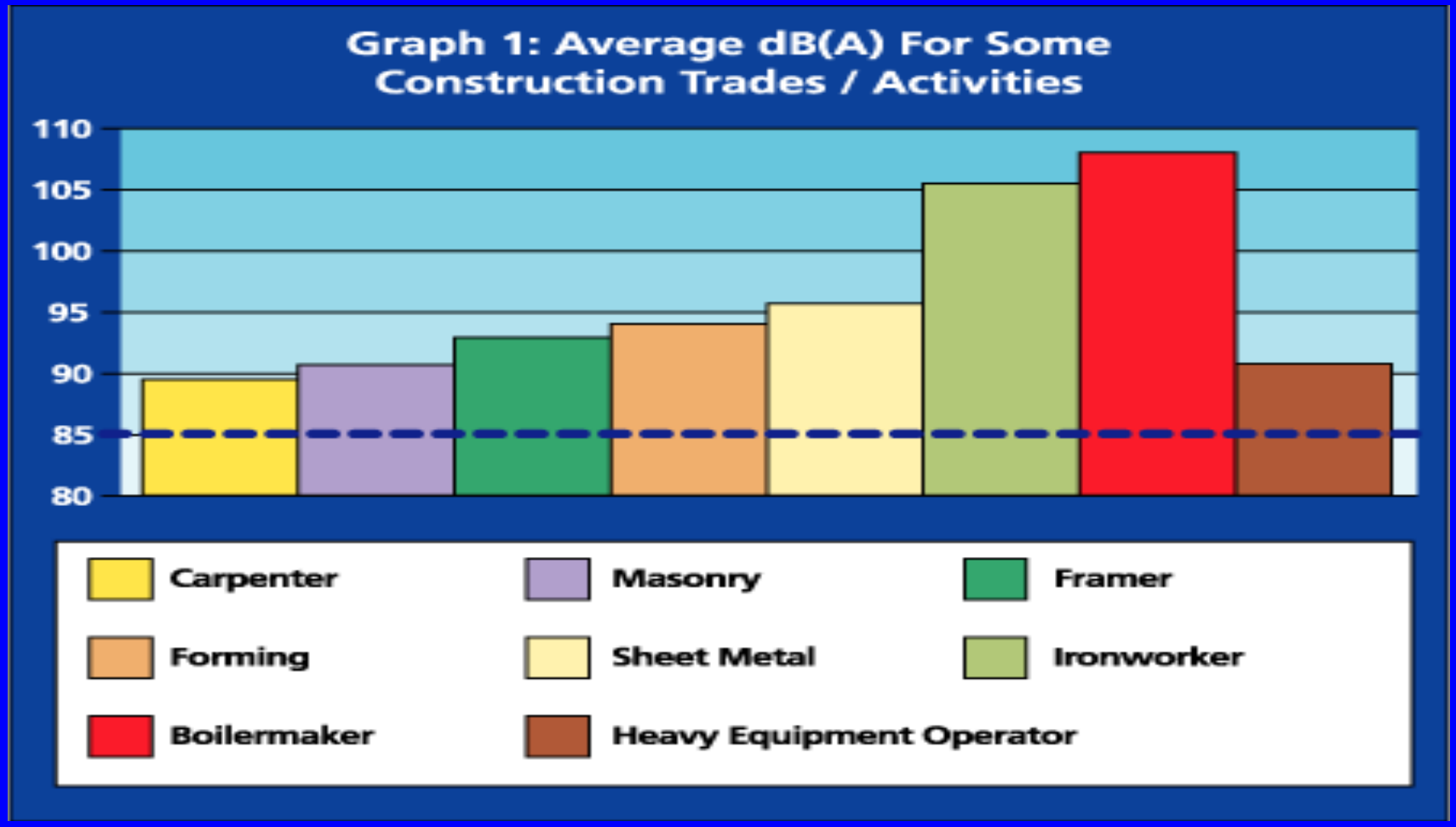
Earmuffs



Earplugs

Canal Caps

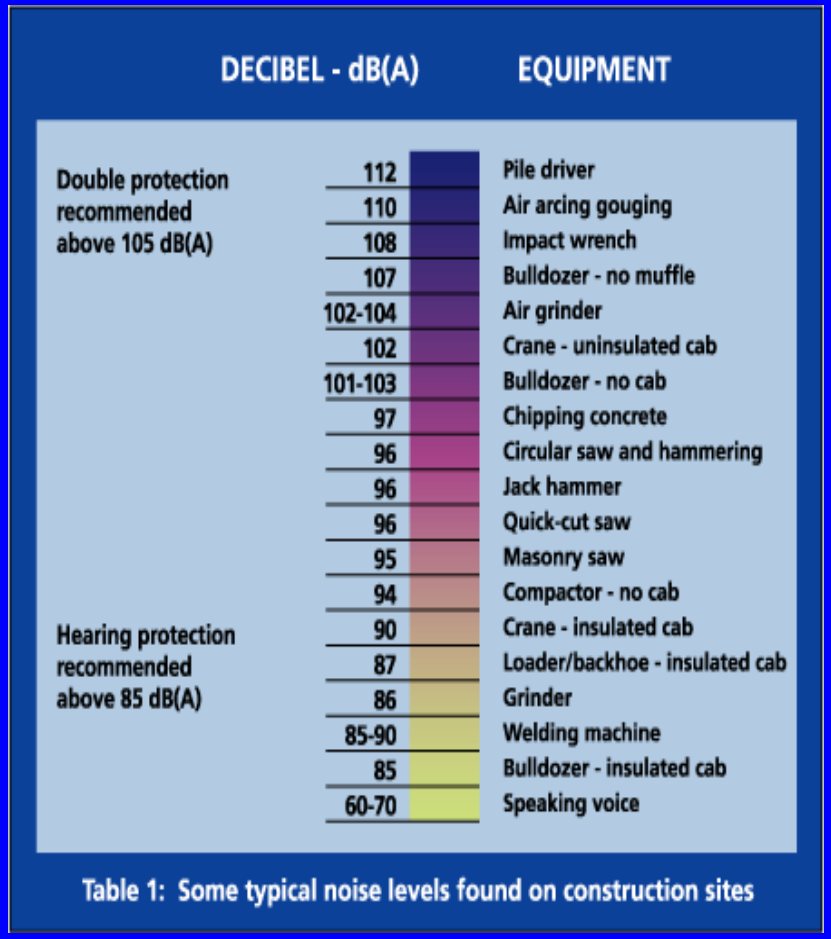
Hearing Protection



Hearing protection

When it is not feasible to reduce the noise or Its duration – use ear protective devices.

Ear protective devices inserted in the ear shall be fitted.



	DECIBEL - dB(A)	EQUIPMENT
Double protection recommended above 105 dB(A)	112	Pile driver
	110	Air arcing gouging
	108	Impact wrench
	107	Bulldozer - no muffle
	102-104	Air grinder
	102	Crane - uninsulated cab
	101-103	Bulldozer - no cab
	97	Chipping concrete
	96	Circular saw and hammering
	96	Jack hammer
	96	Quick-cut saw
	95	Masonry saw
	94	Compactor - no cab
Hearing protection recommended above 85 dB(A)	90	Crane - insulated cab
	87	Loader/backhoe - insulated cab
	86	Grinder
	85-90	Welding machine
	85	Bulldozer - insulated cab
	60-70	Speaking voice

Table 1: Some typical noise levels found on construction sites

When Must Hearing Protection be Provided?

- After implementing engineering and work practice controls
- When employee's noise exposure exceeds an 8-hour time-weighted average sound level (TWA) of 90 dBA
- When employees are exposed to an 8-hour TWA of 85 dBA and have hearing loss.

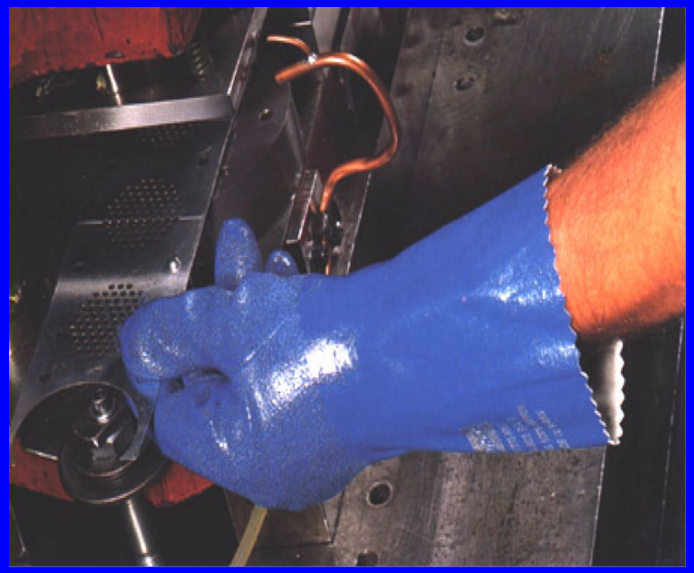
1926.101(c) Plain cotton is not an acceptable protective device.

Hand Protection

When Must Hand Protection be Provided?

When any of these are present:

- Burns
- Bruises
- Abrasions
- Cuts
- Punctures
- Fractures
- Amputations
- Chemical Exposures

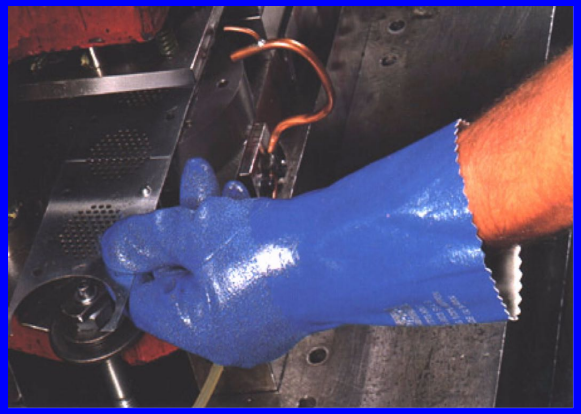


What Kinds of Protective Gloves are Available?

- Durable gloves made of metal mesh, leather, or canvas.
  - Protects from cuts, burns, heat
- Fabric and coated fabric gloves.
  - Protects from dirt and abrasion
- Chemical and liquid resistant gloves.
  - Protects from burns, irritation, and dermatitis
- Insulating rubber gloves.
  - Reduces exposure to blood

Types of Rubber Gloves

Nitrile **protects against solvents, harsh chemicals, fats and petroleum products and also provides excellent resistance to cuts and abrasions.**



Butyl **provides the highest permeation resistance to gas or water vapors**

Other Types of Gloves

Kevlar **protects against cuts, slashes, and abrasion.**

Stainless steel mesh **protects against cuts and lacerations.**

Body Protection

Body Protection

Improper PPE

What are the Major Causes of Body Injuries/Illnesses?

- Intense heat
- Splashes of hot metals and other hot liquids
- Impacts from tools, machinery, and materials
- Cuts
- Hazardous chemicals
- Contact with potentially infectious materials, like blood
- Radiation

Body Protection
Criteria for Selection

- Provide protective clothing for parts of the body exposed to possible injury
- Types of body protection:
  - Vests
  - Aprons
  - Jackets
  - Coveralls
  - Full body suits

Body Protection

Cooling Vest

Full Body Suit

Sleeves and Apron

Body Protection

1926.96 Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.

When Must Foot Protection be Provided?

- When any of these are present:
  - Heavy objects such as barrels or tools that might roll onto or fall on employees' feet
  - Sharp objects such as nails or spikes that might pierce ordinary shoes
  - Molten metal that might splash on feet
  - Hot or wet surfaces
  - Slippery surfaces

Safety Shoes

- Impact-resistant toes and heat-resistant soles protect against hot surfaces common in roofing and paving
- Some have metal insoles to protect against puncture wounds
- May be electrically conductive for use in explosive atmospheres, or nonconductive to protect from workplace electrical hazards

1926.104 Safety belts, lifelines, and lanyards

(a) Lifelines, safety belts and lanyards shall be used only for employee safeguarding. Any subjected to in-service loading shall be immediately removed from service and not used again for employee safeguarding.

(b) Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.

1926.104 Safety belts, lifelines, and lanyards

(c) Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum of 7/8-inch wire core manila rope. For all other lifeline applications, a minimum of 3/4-inch manila or equivalent, with a minimum breaking strength of 5,400 pounds, shall be used.

(d) Safety belt lanyard shall be a minimum of 1/2-inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds.

1926.104 Safety belts, lifelines, and lanyards

(e) All safety belt and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges.

(f) All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation.

1926.105 Safety nets

(a) Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or where the use of ladders scaffolds, catch platforms, temporary floors, or safety lines/belts are impractical.

(b) Where safety net protection is required by this part, operations shall not be undertaken until the net is in place and has been tested.

(c) (1) Nets shall extend 8 feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface.

(d) The mesh size of nets shall not exceed 6 inches by 6 inches.

1926.106 Working over or near water

(a) Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jacket or buoyant work vests.

(b) Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy.

(c) Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations not to exceed 200 feet spacing.

(d) At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

CFR 1910.134

CFR 1926.103

Respiratory Protection

1910.134(a) Permissible practice

- 1st Priority: **Engineering controls**:
  - Enclosure or confinement of the operation,
  - General and local ventilation, and
  - Substitution of less toxic materials
- When engineering controls are being instituted respirators can be used

1910.134(a)(2) Employers responsibilities

- Respirators:
  - Provided by the employer
  - Must provide the respirators which are applicable and suitable for the purpose intended
  - The employer is responsible for the establishment and maintenance of a respiratory protection program

1910.134(c) Respiratory protection program

- Requires worksite-specific procedures and elements for required respirator use
- The program must be administered by a suitably trained program administrator*

***The Small Entity Compliance Guide contains criteria for the selection of a program administrator and a sample program that meets the requirements of this paragraph. Copies of the Small Entity Compliance Guide are available from the OSHA Office of Publications, Room N 3101, 200 Constitution Avenue, NW, Washington, DC, 20210 (202-219-4667).**

1910.134(c) Respiratory protection program

- Where respirators are necessary:
  - Written program
  - Worksite-specific procedures
  - Required elements:
    - Training
    - Fit testing
    - Medical evaluations
    - Maintenance
    - Procedures for respirator selection
    - Procedures for routine & emergency use
    - Evaluating program effectiveness

1910.134(c)(2) Where respirator use is not required:

- If voluntary respirator use is permissible, provide the respirator users with the information contained in **Appendix D** and,
- Establish and implement those elements of a written respiratory protection program* necessary to ensure that any employee using a respirator voluntarily is medically able to use that respirator
- That the respirator is cleaned, stored, and maintained so that its use does not present a health hazard to the user

***Written program not required for voluntary use of dust masks**

Appendix D Highlights

- If your employer provides respirators for your voluntary use, of if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard:
  - Heed all manufacturers instructions on use, maintenance, cleaning & care
  - Choose certified respirators
  - Understand its application and limitations
  - Don’t mix it up with someone else’s

1910.134(e) Medical evaluations

- Medical evaluations provided ***before***:
  - Fit testing
  - Worker respirator use
- Identify a physician or other licensed health care professional **(PLHCP)** to perform medical evaluations using a medical questionnaire:
  - Obtain the information requested by the questionnaire in Sections 1 and 2, Part A of Appendix C

Summary

To determine if PPE is needed employers must:

- Assess the workplace for hazards
- Use engineering and work practice controls to eliminate or reduce hazards before using PPE
- Select appropriate PPE to protect employees from hazards that cannot be eliminated
- Inform employees why the PPE is necessary and when it must be worn
- Train employees how to use and care for their PPE and how to recognize deterioration and failure
- Require employees to wear selected PPE