# Lead Awareness Training for City Workers

# Learning Objectives

- Familiarize city workers with the OSHA Lead Standard
- Learn possible occupational exposure to lead
- Understand routes of entry
- Describe symptoms of overexposure
- Identify control measures

# Lead

- Chemical Symbol - Pb
- Heavy Gray Metal
- Soft and Pliable
- Galena most common lead-containing ore

# Characteristics of Lead

- Prevents Corrosion
- Kills Mold and Mildew
- Easy to Shape (Melts at 621$^{o}$F)
- Durable
- Poor conductor of heat and electricity
- Blocks Radiation
- Blocks Sound
- Helps Paint Dry
- Paint Pigment

# Where is Lead Found?

The process of extracting lead from ore (Smelting)

# History of Uses

- 6500 B.C.: earliest known object made of lead
- Roman Times:  80,000 tons/year
  - vessels, aqueducts, glazes
- Industrial Age: occupational exposure accelerated
- 1923:  Leaded gasoline goes on sale
- 1930: Company founded in England to sell leaded gas overseas
- Up to 1980:  paint pigments, construction materials, water and sewer pipes, chemical additives

# Historical Accounts

- ★ 370 B.C.- Hippocrates documented lead colic
- ★ 1427 - France and Spain prohibited adding lead to wine
- ★ 1786 - Benjamin Franklin wrote letter on Lead Poisoning
- ★ 1887 - US medical authorities diagnose childhood lead poisoning
- ★ 1913 - Dr. Hamilton wrote a pamphlet on protecting painters from lead hazards
- ★ 1921 - National Lead Company admits lead is a poison

# Historical Accounts

- ★ 1922 - League of Nations bans white-lead interior paint; US declines to adopt
- ★ 1924 - NY Board of Health bans sales of Tetraethyl lead (TEL) - enhanced gasoline
- ★ 1926 - Ethyl is back for sale
- ★ 1936 - 90% of gasoline in US contains Ethyl

# OSHA Lead Standards

- 1984 — 29 CFR 1910.1025
  OSHA Lead Standard for General Industry

- 1993 — 29 CFR 1926. 62
  OSHA Standard for Lead in Construction

# *OSHA Requirements*

- **Employee exposure monitoring is performed with air samples collected in the workers "Breathing Zone" to measure permissible exposure levels**
  - **(Action level 30µg/M$^3$ and PEL 50µg/M$^3$ over 8hrs)**

# OSHA Requirements

- One employee can be used to perform sampling in a work environment or assignment (task –specific)
- The samples are analyzed by a laboratory and the results assist in selecting worker protection
- Sampling results must be available for employees to review.
- Lead Awareness Training for workers with incidental contact

  Incidental contact- minor/limited exposure

# Classes of work

★ For construction related work there are 3 classes of worker presumed exposure, class I, II, III

- ➢Class I: includes manual scraping Lead paint, and exposures are expected up to **50µg/M$^3$**
- ➢**Cl**ass II: Includes Lead burning and an exposure of up to **500µg/M$^3$** can be expected
- ➢Class III: Includes abrasive blasting and an expected exposure of more that **2,500µg/M$^3$**

# Occupational Exposure to Lead

- Work activities with potential exposure to lead
  - **Lead-based paint**
    - Disturbance
  - **Firing ranges**
    - Trainers/Maintenance Staff
  - **Construction sites**
    - Demolition/Repair

# Occupational Exposure to Lead

- Bridge work
  - Sand-blasting paint
- Plumbing
  - Burning/soldering pipes
- Elevator repair
  - Babbitt

# Medical Monitoring/Surveillance

- When affected workers exposure reach the action level, blood sampling under a medical surveillance program is used to record a worker's blood lead level (BLL)
- The blood sampling is typically performed every 2 to 6 months and more frequently when the BLL remains above 40 micrograms per deciliter ( µg/dl )
- In extreme cases of exposure, if the BLL remains persistently above 50 µg/dl, worker is medical removed from the work environment

# Hierarchy of Controls

Together with engineering controls, administrative controls and personal protective equipment can reduce worker exposure to below permissible levels

- ★ Engineering Controls
- ★ Administrative Controls
- ★ Personal Protective Equipment

# Engineering Controls

- Methods built into the design of equipment or a process to minimize the hazard.
- Isolate area with plastic sheets over doors, and floors to prevent the spreading of lead dust
- Ventilate the work area to allow airborne contamination to be exhausted away from workers

# Administrative Controls

- Changes in work procedures, such as written safety policies, schedules, and training with the goal of reducing the duration, frequency, and severity of exposure.
- Employee rotation to reduce worker exposure
- Conduct employee training, toolbox talks, etc.

# Work Practice Controls

- Workers involved in cleaning tasks, can use a High Efficiency Particulate Air (HEPA) filter Vacuum cleaner to prevent dust dispersion
- Using wet methods to reduce dust generated by activities like scraping paint
- Prompt collection and containerizing of any debris also contributes in avoiding increased exposures

# Work Practice Controls

- Good personal hygiene practices
  - During work assignment/zone
    - Do not eat, drink, or smoke in work area
    - Wash face and hands following work assignments
- Don personal protective equipment when working in restricted areas
- Discard used personal protective equipment in designated receptacle

# Personal Protective Equipment

- Personal protective equipment is the least desired option to reduce worker's exposure, the primary way of reducing the hazard is a combination of engineering controls and good work practices
- Selection of personal protective equipment will based on a risk assessment

  Examples includes, disposable coveralls, gloves, foot covers and eye protection
- Air sampling results may indicate the type of respiratory protection needed

# Respirators

Respirators can vary from a N-95 particulate dust masks for some maintenance work, to air-filtering respirators that require medical clearance. When respiratory protection is required for work, a program must be implemented

# Respiratory Protection Program

- Agency must develop a written program that details medical clearance, fit testing, respirator selection and maintenance
- The type of respirator is based on worker exposure, monitoring results and the type of work performed.
  * Scraping lead paint vs. melting lead
- N-95 respirators can be used for low dust producing task
  * Work that generates high dust and fumes will require cartridge respirators (Burning a lead Babbitt)

# Sources of Lead (fix fonts)

Storage Batteries

Ceramic Dishware

Leaded Gasoline

Drinking Water

Paint and Varnish

# Lead in Paint

# Lead in Paint

- **Tens of millions of houses contain some lead-based paint (LBP)**
- **Deteriorating paint/paint chips sources of leaded dust**
- **Dust and soil are the major routes of exposure**
  - * Enters soil through deterioration
  - * Young children ingest through normal hand-mouth activity
  - * Poor diet can increase absorption

# Where is lead paint found?

- ★ Before 1950
  - * Everywhere – inside and outside (all coatings)
- ★ Between 1950-1960
  - * Probably outside, may be inside
  - * Trims, doors, windows, kitchens, bathrooms, etc.
- ★ Between 1960-1978
  - * May be outside, less likely inside

***Before 1978 we assume lead!!!

# United States Restriction of Lead Use

- Late 1950's – Paint manufacturers voluntarily reduced lead content of most paint for residential use.
- 1978 – Consumer Product Safety Commission limits paint for residential use to 600 ppm.
- 2011 – CPSC resets limit for paint for residential use to 90 ppm.
- Lead paint for non-residential use is still sold.

# Consumer Product Safety Commission

- The Consumer Product Safety Commission (CPSC) banned lead paint for use in residential and child occupied buildings. However, lead paint can still be used in industrial settings.

- Currently, in commercial or public buildings that have no child care facilities the OSHA standard would still apply

# Environmental Sampling

- Lead Paint is usually detected with the use of a

  X-Ray Florescence machine or with paint chip analysis
- In NY, paint with 1mg/$^{cm2}$ or 0.5% by weight is considered a lead based coating
- Dust sampling is some times used to assess if there is a high level of lead in settle dust

# Routes of Exposure

- **Ingestion**
  - * normal hand-to-mouth activity (indicate here that workers should use PPE
    - ➤ children are more likely to ingest lead

- **Inhalation**
  - * adults are more likely to inhale lead
  - * usually occupational exposures

# What Happens to Lead in the Body?

- ★ Absorbed
- ★ Distributed
  - * red blood cells
  - * soft tissue
  - * bone
- ★ Eliminated
  - * kidneys
  - * gastrointestinal system (GI tract)
  - * perspiration

# Blood Monitoring

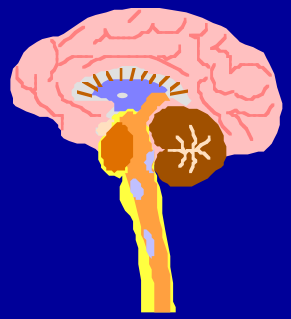
- **The blood lead level is the best initial measurement for evaluating lead exposure.**
- **The blood lead level**
  - *** indicates the amount of lead circulating in the blood stream**
  - *** may be a measure of recent exposure**

# Where is lead stored in the body? For how long?

- ***Blood***
  - 5-10%, half-life ~ 1 month
- ***Kidney***
  - 5-10%, half-life ~ 1 month
- ***Bone***
  - 80-90%, half-life ~ 25 years

# Overexposure Symptoms (Acute)

- Colicky abdominal pain
- Constipation
- Diarrhea
- Brain damage
- CNS
- Irritability
- Fatigue
- Weakness
- Muscle pain
- Vomiting
- Tremors
- Drowsiness
- Restlessness
- Destruction of red blood cells



# Overexposure Symptoms (Chronic)

- Impaired blood formation
- Central nervous system
- Peripheral nervous system
- High blood pressure
- Reproductive system
- Damage to developing fetus

# Adult Reactions to Lead

- 15 µg/dl
  - increase blood pressure
  - joint and muscle aches
- 25 µg/dl
  - reproductive problems
- 40 µg/dl
  - kidney
  - blood formation

# Adult Reactions to Lead

★60 μg/dl

- anemia
- nerve damage
- constipation
- stomach pains
- irritability
- fatigue

- memory and concentration problems
- clumsiness
- drowsiness
- sleep problems

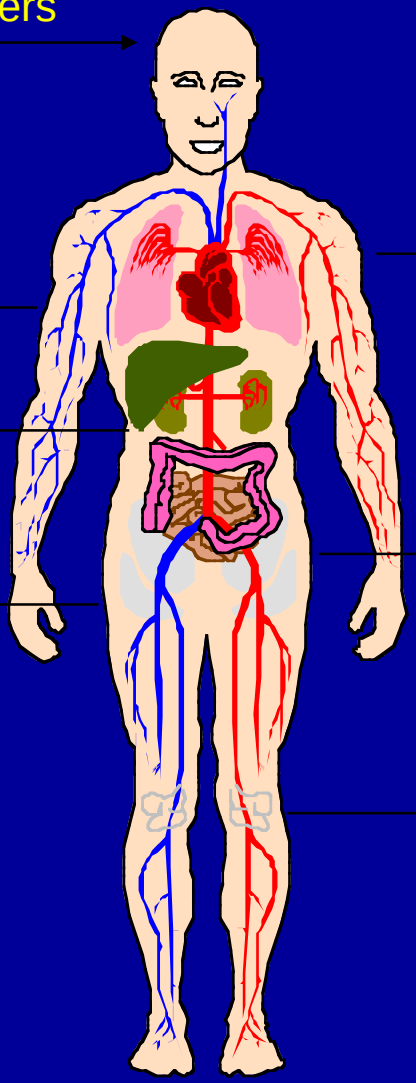
# Adult Reactions to Lead

★**80 μg/dl *and above***

- **blue line on gums**
- **shaking of hands and wrist**
- **wrist and foot drop**
- **hallucinations**
- **brain damage**
- **coma**
- **death**

# Problems Caused by Lead Exposure

Brain Disorders



Hematological Problems

Kidney Problems

Decreased Red Blood Cells

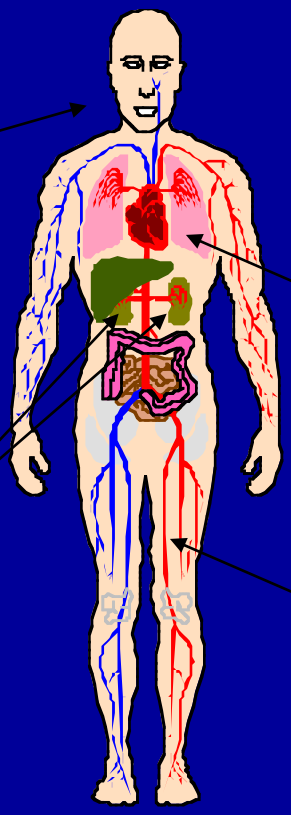
Nerve Disorders

Reproductive Problems

Slower Reflexes

# Body Systems Most Affected

Central nervous system (CNS)



Cardiovascular system (heart)

Kidneys (renal)

Hematopoietic (Blood forming) system

# United States Reduction of Lead in Product

- Lead gasoline ➲ 0.05 grams/gallon
- Soldered cans ➲ banned
- Lead-based paint ➲ reduced to 0.06 % by weight

**Decreased average blood lead levels from 13.7 μg/dL to 3.2 μg/dL**

# For additional safety and health information

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