Hazards of inorganic lead

ES&H Section
Objectives

- What is lead?
- Sources of lead at Fermilab
- Health effects
- Exposure Limits
- Exposure Determination
- Engineering and Administrative controls
- Personal Protective Equipment
- Hygiene Facilities and Practices
- Lead Work Area and Housekeeping
- Medical Surveillance and Removal
- Recordkeeping
What is Lead?

- Heavy, ductile, bluish-white solid element
- Comes in many forms (lead acetate, lead chloride, lead chromate, lead nitrate, lead oxide, lead phosphate, and lead sulfate)
- Properties
  - high density
  - softness
  - low melting point
  - resistance to corrosion
  - opacity to gamma and x-rays
Sources of Lead at Fermilab

- Bricks
- Wool
- Plates/Sheets
- Slabs

- Paints
- Batteries
- Solder
- Ceramics
Health Effects

- Absorbed by inhalation and ingestion
- Most enters the bloodstream; can accumulate in bone and organs
- Some excreted, some stored
- Acute exposures to high levels - seizures, coma, cardio-respiratory arrest
- Chronic exposure to low levels - anemia, damage to nervous, urinary, blood, bone and reproductive systems.
Symptoms of Lead Poisoning

- Weakness
- Reproductive difficulties
- Nausea
- Fine tremors
- Gingival lead line
- Hyperactivity
- Sleeplessness
- Paralysis if wrist, ankles
- Facial pallor

- Headaches
- Poor appetite
- Dizziness
- Irritability/anxiety
- Constipation
- Excessive tiredness
- Numbness
- Metallic taste in mouth
- Muscle and joint pain
Exposure Limits

- OSHA
  - Permissible Exposure Limit (PEL)
    - 50 ug/m3 (0.05mg/m3)
    - 8 hour time weighted average
  - Action Level
    - 30 ug/m3 (0.03mg/m3)
    - 8 hour time weighted average
    - triggers medical, PPE, training
Exposure Determination

- Professional Judgement
  - Based on similar type work
  - Required to conduct air monitoring if no such data exists
- Compliance Program (including Hazard Analysis)
- Personal Exposure Monitoring
  - The following may result in exposures > Action level
    - Abrasive blasting, welding, cutting, and torch burning on lead containing paint (LCP)
    - Demolition of structures with (LCP)
    - Manual scraping, sanding of (LCP)
    - Spray painting LCP
    - Moving lead - bricks & sheet (FERMILAB required not OSHA)
Exposure - lead bricks

- PEL - 0.05 mg/m³
- AL - 0.03 mg/m³

- 1200 bricks - 0.31 mg/m³
- 1000 bricks - 0.56 mg/m³
- 500 bricks - 0.12 mg/m³
- 400 bricks - 0.03 mg/m³
- 200 bricks - 0.04 mg/m³
- 100 bricks - 0.03 mg/m³
**Engineering/Administrative Controls**

- Required if exposure is above PEL
- Include
  - Local Exhaust ventilation
  - Wet surface
  - Containment/HEPA vacuum
  - Paint or use other barrier coating to cover surface
  - **NO** - dry sweeping, using non-HEPA vacuum, etc.
Personal Protective Equipment

- If exposure above the AL
  - Respirator (PAPR if requested)
  - Coveralls with booties and hood
  - Clean off dust on clothing prior to removing respirator
Hygiene facilities and practices

• Clean face and hands after leaving work area
  – Contaminated clothing and equipment should not leave work area
  – Shower
  – Separate clothing facilities
Lead Work Area and Housekeeping

- Restricted Access
  - Label
    - Areas where exposure may exceed action level
    - Lead-containing materials
- No smoking, no food or beverages
- Area kept as clean as possible
  - Clean daily
  - Collect lead debris and contaminated items in closed container for hazardous waste disposal
  - Fermilab Standard - 0.05 mg/dm2 surface concentration
## Surface Lead Contamination Levels and Probability of not Exceeding Standards

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<th>P(%)</th>
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WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING
Danger
Lead
No eating, smoking or drinking
Contact SSO prior to working in area
Medical Surveillance and Removal

- Required if you are exposed to lead above the AL for any one day

- Will not protect you if:
  - high lead level in body acquired over the years
  - non-occupational exposures
  - have condition that aggravated by exposure (kidney disease, anemia)
  - Variations in absorption rates
Medical (con’t)

• Exposure above AL more than 1 day but less than 30/year
  – initial blood test
  – follow-up test

• Exposure above AL for 30 or more days/year
  – complete medical exam
  – periodic blood test (6 months)
Blood Test

- Blood Lead - test circulating levels of lead in blood
- Zinc Protoporphyrin (ZPP)
  - measures adverse metabolic effect of lead
Blood Test - Blood Lead

- Acceptable - < 40ug/100g of whole blood (WB)
- If > 40 ug/100g WB
  - Retest every 2 months
- If > 60 ug/100g WB (2 tests)
  REMOVE FROM LEAD WORK till blood lead < 40 ug/100g WB (2 tests)
  - OSHA requires medical removal protection
    - same hourly rate of pay
• If you are dissatisfied with Fermilab Medical - can select a second physician for independent analysis
Additional Information

- Report any signs or symptoms immediately
- Right to a copy of air sampling and medical test results
- For further information:
  - OSHA 1926.62/ OSHA web site
  - Fermilab ES&H Manual 5052.3
  - Reference Books
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