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Practical Industrial Hygiene for Construction
AGC of New York – December 2014

Practical Industrial Hygiene for Construction
• At the conclusion of this presentation participants should be able to:
  – Recognize common chemical and physical hazards
  – Describe the four steps of the survey process
  – Discuss types of health hazards in the workplace
  – Describe the hierarchy of hazard controls
  – Begin to develop a survey strategy for their own operations

Industrial Hygiene is:

**Hazard in the work environment**
• Chemical hazards
• Physical hazards
• Biological hazards
• Ergonomic hazards

**Physical hazard**
• A factor within the environment that can harm the body without necessarily touching it.
Common physical hazards
- Noise
- Temperature extremes (heat/cold)
- Non-ionizing radiation
- Ionizing radiation
- Lighting extremes
- Vibration

Chemical Hazards
- A chemical that is capable of causing an immediate reaction, a long-term response, or both. Health hazards can affect the whole body or a particular organ.

Common chemical hazards in construction
- Organic solvents
- Metal fumes
- Hexavalent Chromium - Cr(VI)
- Dust and Particulates
- Silica
- Lead
- Asbestos
- MMMF
- Asphalt Fumes

Anticipation and recognition of hazards
- Types of harmful agents:
  - Chemical - dust, fibers, fumes, gases, vapors
  - Physical - heat stress, noise, radiation
- Routes of exposure to employees:
  - Inhalation
  - Ingestion
  - Injection (compressed air)
  - Skin absorption

Exposure Pathway Model

Risks of exposure to hazards
- Exposure to hazards can result in two types of health effects:
  - Acute or immediate response
  - Chronic or long-term response
- Health effects can include:
  - Injury/illness
  - Occupational disease
  - Disability
  - Death
Examples of health hazards

- Acute health hazards:
  - Dermatitis - skin rash
  - Headache or dizziness - gases or vapors
  - Burns - thermal, radiation or chemical

- Chronic health hazards:
  - Hearing loss
  - Allergies - respiratory or skin sensitivity
  - Lung disease - cancer

Recognition of hazards

- Work environment factors:
  - Employee job tasks
  - Description of manufacturing process
  - Length of time employees are exposed
  - Length of work shift (8 hrs, 10 hrs, 12 hrs)
  - Amount of chemical or physical hazard present
  - Safe work practices and engineering controls
  - Personal protective equipment

Hazard recognition clues

- Visible dust
- Visible fumes
- Paint overspray
- Odors
- Employee complaints/symptoms
- Presence of engineering controls
- Use of personal protective equipment (PPE)
- Occupational disease claims

Sampling strategy

Major reasons for sampling

- Identify exposures
  - Presence or lack of a particular contaminant
  - Baseline concentration
  - TWA determinations
  - Evaluate effectiveness of controls
- Regulatory purposes
- Investigative purposes
- Clearance purposes

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Regulatory purposes

- Required by OSHA
- Required by states
- Specific sampling requirements for chemicals
- Chemical hazard communication
- Chemical hygiene plan (labs)

Investigative purposes

- Chemicals released during production
- Complaints
- Suspect problem—odor, haze, smoke
- Cause of injury or illness
- Employee claim

Clearance purposes

- Verify area free of contaminant
- Clear area from PPE control

Air sampling strategy development

- Defining exposures within the work environment
- Tools for designing a strategy

Defining exposures

What chemical and physical agents are present?
What are the health effects of excessive exposure to the agents?
What are the OELs for each agent?
How are workers or groups of workers involved with each agent (Job Task Analysis)?
What operations/activities pose the greatest potential for exposure to each agent?

Tools for designing a strategy

- Model exposure pathways
- Monitoring methods
AIHA Qualitative Risk Assessment Matrix Tool

- Health effect rating:
  - TLV/PEL
  - Toxicity information
- Exposure rating:
  - Number of employees exposed
  - Amount of chemical used
  - PPE and workplace controls
- Use these to determine the health risk

Types of sampling methods

- Personal breathing zone:
  - TWA: full-shift or task duration sample, dose
  - STEL: short-term exposure personal sample
- Area: fixed location, background level, worst case
- Surface: wipe sample contamination

Personal breathing zone sample
General area sample

Occupational Exposure Limits

- **PELs** - Permissible Exposure Levels (OSHA)
- **TLVs** - Threshold Limit Values (ACGIH)

**Others:**
- **RELs** - Recommended Exposure Levels (NIOSH)
- **WEELs** - Workplace Environmental Exposure Level (AIHA)
- **MAC** - Maximum Allowable Concentration (Germany)

OELs - application to the workplace

- OELs designed to protect a "healthy" workforce
- OELs not designed for general population
- OELs vary by toxicity and health effects:
  - Full-shift exposure limits:
    - 8 Hr. time weighted average
    - PEL, TLV, REL
  - Short-term exposure limits:
    - 15 - 30 min. sample
  - Ceiling exposure limits:
    - Direct reading
    - 15 - 30 min. sample

OSHA PELs

- Promulgated 1970 OSHA Act
- Based on 1968 TLVs
- Subpart Z 1910.1000 Tables Z1-Z3
- Expressed as:
  - TWAs, STELs for specific standards, Action Levels (ALs) for specific standards and Ceiling (C) values
- General Industry, Construction, Maritime

OSHA PELs (cont.)

- Thirty regulated substances
- Exposure limits legally enforced
- State OSHA plans may have specific air contaminant standards (ex: CA, TN, MI)
ACGIH TLVS and BEIs

- May be revised after two years
- May be lower than PELs
- Includes more substances than PELs
- Are supported by documentation
- Are expressed as:
  - TWA, STELs,
  - Ceiling Values,
  - Skin Notation
  - Carcinogen Designation
- BEIs - Biological Exposure Indices

PEL vs. TLV

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>PEL</th>
<th>TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper fume</td>
<td>0.1 mg/m³</td>
<td>0.2 mg/m³</td>
</tr>
<tr>
<td>Manganese fume</td>
<td>C 5 mg/m³</td>
<td>0.02 mg/m³</td>
</tr>
<tr>
<td>1,6 Hexamethylene diisocyanate</td>
<td>No OEL</td>
<td>0.005 ppm</td>
</tr>
<tr>
<td>Toluene</td>
<td>200</td>
<td>20</td>
</tr>
<tr>
<td>Total Particulates</td>
<td>15 mg/m³</td>
<td>10 mg/m³</td>
</tr>
</tbody>
</table>

Exposure range of values (example)

Exposure Limits vs. Variation in Concentration

Novel workshifts

- Greater than an 8-hour work shift
- 10-hours, 12-hours, overtime
- Most toxicity studies based on 8-hours
- Brief and Scala study

Control of hazards

- Hierarchy of controls:
  - Engineering:
    - Elimination
    - Enclosure
  - Isolation
  - Substitution
  - Ventilation

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Control of hazards

• Hierarchy of controls (continued):
  – Work practices and procedures (administrative):
    • Work schedule rotation
    • Modified job tasks
  – Personal protective equipment:
    • Respiratory protection
    • Goggles or safety glasses
    • Clothing

Basic sampling train

Cassettes for gas and particulate monitoring
• PVC – poly vinyl chloride
• NCO – open faced for isocyanates
• 25 mm cassette filters also are used for some chemicals including gases and fibers

Sorbent tubes for vapor monitoring
• Tubes may contain:
  – Charcoal
  – Silica gel
  – Specialized collection beads
  – Coated material

Pump calibration with cyclone

Cyclone placement on employee
Hands-on Training