Industrial Hygiene

- Jay King, INSafe, Industrial Hygienist
- Bradley M. Freeman, M.S., CIH, CSP, INSafe, Industrial Hygienist

Industrial hygiene is primarily concerned with the control of occupational health hazards that arise as a result of or during work.
Industrial Hygiene

- Identify hazards
- Eliminate hazards or
- Control hazards
  - (reduce to an acceptable risk)
  - at or below:
   - OSHA - PEL, ACGIH - TLV, NIOSH – REL
- Evaluate - good enough or need to do more?

Industrial Hygiene

- Walk–through facility (look for hazards)
- Hazard assessment and equipment selection –
  Personal Protective Equipment - PPE
- Safety Data Sheets - SDS (formerly) MSDS
- Job hazard analysis (JHA) /
- Job safety analysis (JSA)
- JHA / JSA = eliminate or reduce risk
Hierarch of Controls

1. Engineering controls
2. Administration controls
3. Personal protective equipment

Engineering Controls

- Substitute or replace harmful or toxic materials with a harmless one or a less dangerous one
- Add or update ventilation systems
  - Local, general, portable
    - exhaust (suction) or fan (blowing)
- Reduce noise levels
  - Order equipment designed with lower noise levels
  - Acoustic absorption materials around noise source
  - Maintenance, seal doors, seal outlets, Lower air pressure, reduce vibration
    - (Hire or contract a skilled professional or consultant)
Administration Controls

- Job rotation
  - 2 employees work 4 hours \((2 \times 4) = 8\) hours
  - 3 employees work 3.33 hours \((3 \times 3.33) = 8\) hours
  - 4 employees work 2.5 hours \((4 \times 2.5) = 8\) hours
- Job transfer
  - Transferring employees who have reached their upper permissible exposure limits of exposure to an environment where no further exposure will be experienced

Personal Protective Equipment

- OSHA requires the use of personal protective equipment (PPE) to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. Employers are required to determine if PPE should be used to protect their workers.
Personal Protective Equipment

• If PPE is to be used, a PPE program should be implemented. This program should address the hazards present; the selection, maintenance, and use of PPE; the training of employees; and monitoring of the program to ensure its ongoing effectiveness.

Screen and or Sample

• Screening (shorter period of time) sec/mins
  – Hazardous chemicals - detector tube and air sampling pump, direct reading monitor
  – Noise (Sound level meter)

• Sampling (longer period of time) hours
  – Hazardous chemicals - media and air sampling pump, air sampling badges
  – Noise (Dosimeter)
Industrial Hygiene

• What are we looking for during evaluation?
  – Facility knows health hazards
  – Health hazards documented...on spreadsheet
  – Health hazards addressed in JHA / JSA and correct PPE selected and used by employee
  – Frequency of air sampling for health hazards at the site is documented and followed
  – Does facility have control of chemicals coming into facility?

How to Find & Document Health Hazards

• Review MSDS or (SDS)
• Review Processes in all Departments/Areas looking for health & physical hazards
• Review Past Air Sampling Records
• Create Spreadsheets to make it visual (Documentation)
During Walkaround

- Looking for Part A/Part B products
- Brake Cleaners/Carburetor Cleaners
- Spray Booths....Isocyanates/Formaldehyde
- Stainless Steel Welding.....Hex Chrome
- Dust Exposures...Sanding, Cutting, Welding
- Forktrucks....Carbon Monoxide
- Noise Levels....Are employees wearing earplugs correctly?

During Walkaround

- Corrosive Materials...changing out totes... PPE - Chemical goggles / faceshield, gloves, safety shower / eyewash – tested weekly
- Lead Solder & other lead products
- Health Rating of 2 or 3 on labels (older) New - Hazard communication 2012 (GHS) 0 or 1 on labels will become the more hazardous chemicals
During Walkaround

- Preventive Maintenance on all ventilation systems...lab hoods, etc.
- Grinding...metal dust...what metals?

During Walkaround

- Finding health hazards
  – Process and MSDS Review
- Documenting health hazards
- Prioritizing health hazards to evaluate
Expanded Health Standards

- Methylene Chloride, Lead, Cadmium, Formaldehyde, Benzene, Hex Chrome
- During Self-Inspections conduct spot checks in Maintenance--read labels look for these chemicals, verify you have MSDS
- MSDS on computer--search for expanded health standard chemicals by name

OSHA Health Standards

- 1910.1000 Air Contaminants
- 1910.1001-1096 Expanded Health Standards such as asbestos (1910.1001); lead (1910.1025) and bloodborne pathogens (1910.1030)
- 1910.1200 Hazard Communication
1910.1000 Air Contaminants

- Tables Z-1, Z-2, or Z-3
- Hierarchy of controls:
  - Engineering controls
  - Administrative controls
  - Personal protective equipment

1910.1000(a) - Table Z-1

Was derived from the 1968 ACGIH* TLV® booklet

*American Conference of Governmental Industrial Hygienists
1910.1000(a) - Table Z-1

- 8-hour Time Weighted Average (TWA)
- Ceiling (C) Limits
- Skin Designation
- Parts per million (ppm) for gases and vapors from liquids
- Milligrams per meter cubed (mg/m³) for dusts, fumes & mists

1910.1000 TABLE Z-1 (Examples)

<table>
<thead>
<tr>
<th>Substance</th>
<th>8-hr TWA</th>
<th>Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>1000 ppm</td>
<td></td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>50 ppm</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td></td>
<td>1 ppm</td>
</tr>
<tr>
<td>Particulates not otherwise regulated (PNOR)</td>
<td></td>
<td>15 mg/M³,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total dust</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 mg/M³,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respirable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fraction</td>
</tr>
</tbody>
</table>

NOTE: The employer must ensure no employee exceeds any PEL
Table Z-2 was adopted from ANSI* standards

- 8-hour TWAs, Ceilings, Peaks
- OSHA 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

<table>
<thead>
<tr>
<th>Substance</th>
<th>8-hr TWA</th>
<th>Ceiling</th>
<th>Peak</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Disulfide</td>
<td>20 ppm</td>
<td>30 ppm</td>
<td>100 ppm</td>
<td>30 min</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>20 ppm</td>
<td>50 ppm</td>
<td></td>
<td>10 min</td>
</tr>
<tr>
<td>Styrene</td>
<td>100 ppm</td>
<td>200 ppm</td>
<td>600 ppm</td>
<td>5 min in any 3 hrs</td>
</tr>
<tr>
<td>Toluene</td>
<td>200 ppm</td>
<td>300 ppm</td>
<td>500 ppm</td>
<td>10 min</td>
</tr>
</tbody>
</table>
1910.1000 (c) Table Z - 3

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

<table>
<thead>
<tr>
<th>Substance</th>
<th>PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline Silica (Respirable fraction)</td>
<td>$10mg/m^3$ % Sio2 + 2</td>
</tr>
<tr>
<td>Coal dust (&lt; 5% SiO2)</td>
<td>2.4 mg/m$^3$</td>
</tr>
<tr>
<td>Nuisance dust (total)</td>
<td>15 mg/m$^3$</td>
</tr>
<tr>
<td>Respirable dust</td>
<td>5 mg/m$^3$</td>
</tr>
</tbody>
</table>
Overexposure... What is Next?

- Share results & Protect employees with PPE while you work on engineering controls & work practice changes
- Verify Ventilation is working the way designed
- Comply with 1910.134 when using respirators
- Document changes in ventilation and work practices which you make and attach to air sampling records...sometimes changes can make exposure worse
- Educate employees & Re-sample

No Overexposure and dust mask

- 1910.134(c)
- One strap (Bad) vs. two straps (Good)
- Voluntary vs. Required
Building Owner Requirements

- Building and facility owners shall inform employers of employees, and employers shall inform employees who will perform housekeeping activities in areas which contain ACM and/or PACM of the presence and location of ACM and/or PACM in such areas which may be contacted during such activities.
Posting:

Warning signs shall be provided and displayed at each regulated area. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

What to look for on MSDS / SDS:

- Expanded Health Standard Chemicals
- Absorption or Absorbs through skin
- Carcinogen, Asthma like symptoms, Cancer
- OSHA Standard 1910.10XX
- Low PEL or TLV i.e. 5 ppm or below
- Skin Designation...“Skin”
- Health 2 or 2* or 3
- Corrosive, Blindness, Severe Tissue Damage
- Personal Protective Equipment
Review all MSDS / SDS provided
Go online to research chemical name and CAS number
Report out on findings
Would you want this product in your facility?

www.osha.gov
A to Z Index
“C”
Chemical Sampling
Information
Use Search Box on page
How do I know what to sample for?
Why do I need to conduct air sampling?
How often do I need to conduct air sampling?
Can I conduct air sampling and noise dosimetry myself?

Problems that happen when sampling
Problems with putting pumps on people
Different types of media
How to calibrate a pump
Problems with using detector tubes
When to use detector tubes
Problems with using detector tubes around people (sharp glass ends)
Different types of tubes
Read all instructions to know number of pump strokes, color of change, and interferes of other chemicals

---

Noise – 1910.95

- Find 1910.95 in 1910 CFR
- PEL = 90 dB
- Action Level = 85 dB
- A scale = way human ear hears
- C scale = flat scale
- Always use A scale (slow response) to measure noise – 1910.95(c) (1)
Hearing Conservation Program

- Monitoring (d)
  - Develop & Implement Monitoring Program---(written IH program)
  - Noise Mapping with Sound Level Meter (A scale on slow response)---looking for areas in facility at or above 85 dbA
  - Noise Dosimetry—conduct in areas 85 dbA and above
  - Employee notification of noise readings

Hearing Conservation Program

- Standard Threshold Shift 1910.95(g)(10) “As used in this section, a standard threshold shift is a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear”
  - 1904.10 “Basic requirement. If an employee's hearing test (audiogram) reveals that the employee has experienced a work-related Standard Threshold Shift (STS) in hearing in one or both ears, and the employee's total hearing level is 25 decibels (dB) or more above audiometric zero (averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS, you must record the case on the OSHA 300 Log.”
Hearing Conservation Program

- Hearing protectors (i) “Employers shall make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors shall be replaced as necessary.”
  
  **NOTE:** If you want to conserve employees hearing, they need to wear hearing protection correctly.

Hearing Conservation Program

- Training Program (k)
- Access to information and training materials. (l) “The employer shall make available to affected employees or their representatives copies of this standard and shall also post a copy in the workplace.”
Noise Dosimeter

- Problems that happen when noise sampling
- Problems with putting dosimeters on people
- What is windsock? Why use windsock?
- How to calibrate a dosimeter?

Sound Level Meter

- How to use the sound level meter?
- Why use windsock? (blocks noise made from the wind)
- Slow vs. Fast Response
- A Scale (humans hear) vs. C Scale (flat scale)
- How to calibrate sound level meter?
Industrial Hygiene Consultants

• Don’t be afraid to ask questions...“Why....” and “Explain this part of report to me....”
• Interview IH Consultants before hiring them
• Ask for and check references from other sites before hiring IH consultants
• If reports do not contain all Documentation ask IH consultant for the information so you have complete report (audit IH reports)

Maintain I.H. Program

• Pre-Use Analysis
• Management of Change
Preventative Maintenance and Ventilation Systems

- Ensure all ventilation systems are being PM and check air flow velocities
- Spray Booths
- Dip Tanks
- General Room Ventilation
- Welding Ventilation

Lasers

- We are seeing more Class 4 Lasers
- Laser Safety Officer (LSO) training required for Class 3 and Class 4; (LSO) training not required for Class 1 & 2
- Lockout Procedures/JSA
- What tasks are operators and maintenance performing on lasers?
- Eyewear is required for Class 3B and Class 4 Lasers or Laser systems when engineering and administrative controls are inadequate, check the maximum exposure (MPE) level (i.e. with the nominal hazard zone)
OSHA Technical Manual

- Personal Sampling for Air Contaminants
- Occupational Skin Exposure
- Technical Equipment: Onsite Measurements
- Polymer Matrix Materials: Advanced Composites
- Ventilation Investigation
- Heat Stress
- Noise & Hearing Conservation
- Chemical Protective Clothing
- Respiratory Protection

Sampling Forms

- Air Sampling Sheet
- Noise Sampling Sheet
- Direct Reading Sample Sheet
Compliance Program for Expanded Health Standard Chemicals

• See & use (example) in OSHA 1910.1025(e)(3) Compliance Program

• Recommendation: Write Policy/Procedure for all Expanded Health Standard Chemicals in your facility

Documentation of I.H. Reports

• Documentation...page 30 of VPP Policies and Procedures
  – Description of the work process
  – Controls in place
  – Sampling Time
  – Exposure Calculations
  – Duration (How long has process being sampled been set up the same way (i.e. engineering controls, administrative controls)?
  – Route of Exposure
  – Frequency of Exposure
  – Number of Exposed Employees
  – Communication of results to employees and management
  – Use of Results
• INSafe
• (317) 232-2688
• [link](http://www.in.gov/dol/insafeconsultation)

• Jay King (317) 232 – 2674
• Brad Freeman (812) 876 - 4904