Choosing Which PEL’s to Update

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Learning Objectives (1):
State the evidence for and against:

- Chronic disease from chemical exposures is a greater cause of occupational mortality than traumatic injury
- Exposure limits are the optimal method for controlling chemical hazards
- Science exists to set protective limits for many chemicals
- Enforcement can be applied to workplaces in compliance with PEL’s that don’t protect
Learning Objectives (2):

• A priority should be given to agents for which exposures exceed health based limits
• Regulating these priority substances is within resources
• Significant and important exposures fall out of a PEL update type process
How Important are Chemical Exposures In Our Workplaces?
90% of Known Work Related Mortality is Chronic Disease Arising From Long Term Chemical Exposure
Ratio of Illness to Injury Mortality

- Injury: 6,200 per year
- Illness: 49,000 per year, range is 26,000 to 72,000
- Ratio Illness to Injury:
  - Low = 4.2
  - Best = 7.9
  - High = 11.6
- Fraction of total which is Illness:
  - Low = 81%
  - Best = 89%
  - High = 92%

Controlling Chemical Exposures
“When you can measure what you are speaking about, and express it in numbers, you know something about it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts advanced to the stage of science.”
TLV – PEL list as a “Boundary Object”
<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS No. (c)</th>
<th>ppm (a)(1)</th>
<th>mg/m(3) (b)(1)</th>
<th>Skin designation</th>
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<tr>
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<td>75-07-0</td>
<td>200</td>
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<td>Acetic acid</td>
<td>64-19-7</td>
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<td>Acetic anhydride</td>
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<td>Acetone</td>
<td>67-64-1</td>
<td>1000</td>
<td>2400</td>
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<td>Acetonitrile</td>
<td>75-05-8</td>
<td>40</td>
<td>70</td>
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<td>2-Acetylaminofluorene; see 1910.1014</td>
<td>53-96-3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Acetylene dichloride; see 1,2-Dichloroethylene.</td>
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<td>Acetylene tetrabromide</td>
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<td>Acrolein</td>
<td>107-02-8</td>
<td>0.1</td>
<td>0.25</td>
<td></td>
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<td>Acrylamide</td>
<td>79-06-1</td>
<td></td>
<td>0.3</td>
<td>X</td>
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<tr>
<td>Acrylonitrile; see 1910.1045</td>
<td>107-13-1</td>
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<td></td>
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<tr>
<td>Aldrin</td>
<td>309-00-2</td>
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<td>0.25</td>
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<td>Allyl alcohol</td>
<td>107-18-6</td>
<td>2</td>
<td>5</td>
<td>X</td>
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<td>Allyl chloride</td>
<td>107-05-1</td>
<td>1</td>
<td>3</td>
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<tr>
<td>Allyl glycidyl ether... (AGE)</td>
<td>106-92-3</td>
<td>(C)10</td>
<td>(C)45</td>
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<tr>
<td>Allyl propyl disulfide</td>
<td>2179-59-1</td>
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</tr>
</tbody>
</table>
Where do we start with controlling exposures?

Any control scheme should be based on an evaluation criterion:

PEL, REL, OEL, TLV, RfC, MRL
“There are known knowns; there are things we know that we know.

There are known unknowns; that is to say, there are things that we now know we don’t know.

But there are also unknown unknowns; there are things we do not know we don’t know.”
### Knowledge Distribution

<table>
<thead>
<tr>
<th>Known</th>
<th>Known</th>
<th>Unknown</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
Alternatives to PEL’s
“No measurement above the PEL, no OSHA violation” defined the IH culture in which I grew up. For some organizations, a TLV or other OEL might be substituted for the PEL, possibly enforceable by policy. Otherwise, the IH, faced with a dangerous condition, would have to think up some workaround to get protection for workers.

Some progressives have proposed abolishing the PELs as obstacles to worker protection. The controlling Court of Appeals opinion, *UAW v. General Dynamics*, is so radically different that it’s largely been ignored for two decades:

Therefore if (as is alleged in this case) an employer knows a particular safety standard is inadequate to protect his workers against the specific hazard it is intended to address, or that the conditions in his place of employment are such that the safety standard will not adequately deal with agreed to start a confined space entry program. In March 1983,
General Duty Clause Takes Precedence over Specific OSHA Standards:

"If an employer knows a particular safety standard is inadequate to protect his workers against the specific hazard it is intended to address, or that the conditions of his place of employment are such that the safety standard will not adequately deal with the hazards to which his employees are exposed, he has a duty under section 5(a)(1) to take whatever measures may be required by the Act, over and above those mandated by the safety standard, to safeguard his workers."

D.C. Court of Appeals, UAW v. General Dynamics
13 OHSC 1201, April 14, 1987
Making A Difference:

Identify agents for which prevailing exposure levels are “known” to pose a significant risk
Lists of Lists

- OSHA, CalOSHA, REL, TLV®, MAK, WEEL
- 473 Agents with PEL’s
  - (includes 6(b) chemicals)
- 484 Agents with OEL’s but no PEL’s
- 16 Agents with 6(b) standards

Source: NIOSH
Not Your Grandmother’s Exposure Limits

Setting Priorities for a Possible PEL Update

BY FRANK MIRER
Advanced Authoritative Risk Assessments

• EPA IRIS
  – 540 Substances
  – Reference Concentrations (RfC)
  – Cancer Slope Factors

• ATSDR
  – 399 Substances
  – MRL’s
    • Acute
    • Intermediate
    • Chronic
OSHA PEL
“Chat”
Input received through Web Forum for identifying hazardous chemicals for which OSHA should develop exposure reduction strategies.

Note: Comments that were inappropriate or completely off topic have not been included.

8/16/2010
It is recommended that all chemicals included in the 1/19/1989 OSHA revision of PEL values be included in this effort. As stated by OSHA, and quoted below these values were and still are justified. Worker safety is still a concern when working with the current outdated values for these chemicals. OSHA must be better prepared to implement new PEL values knowing that they will likely be challenged in the court system as were the 1989 values.

“OSHA is amending its existing Air Contaminants standard, [1910.1000] including Tables Z-1, Z-2, and Z3. This amendment is limited to making more protective 212 Permissible Exposure Limits (PEL) listed in these Tables; setting new PEL’s for 164 substances not currently regulated by OSHA; and maintaining other PEL’s unchanged. Changes include revision of the PEL; inclusion of Short Term Exposure Limits (STEL) to complement 8 hour time weighted average (TWA) limits; establishment of skin designation; and addition of ceiling limits as appropriate. All of the revised PELs are included in a single new Table Z-1-A which also includes the existing OSHA PELs under the Transitional Limits Columns. This rule effective 3/1/89; start-up date with any combination of controls is 9/1/89; start-up date for compliance with preference for feasible engineering controls is 12/31/92 or in certain circumstances

8/16/2010
1) Strontium chromates


125 Comments

8/16/2010
Styrene is a chemical that has a much lower limit (TLV) of 20 ppm set by ACGIH compared to OSHA’s PEL of 100 ppm on an eight hour time weighted average. Considering it is a Group 2B Carcinogen I think the levels should at least match the TLVs.
Working List:

- Acetone
- Anesthetic gases
- 1-bromopropane
- Carbon monoxide
- Chemotherapeutic agents
- Diesel exhaust
- Glutaraldehyde
- Isocyanates
- Manganese
- Mercury
- N-hexane
- Perchloroethylene
- Styrene
- Toluene
- Welding fumes
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- Mercury
- N-hexane
- Perchloroethylene
- Styrene
- Toluene
- Welding fumes
<table>
<thead>
<tr>
<th>Establishment</th>
<th>City</th>
<th>State</th>
<th>Zip</th>
<th>Date Sampled</th>
<th>SIC</th>
<th>NAICS</th>
<th>Lab Number</th>
<th>Type</th>
<th>Time Imis</th>
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<td>30-Jul-1985</td>
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</table>
Working List:

- Acetone
- Anesthetic gases
- 1-bromopropane
- Carbon monoxide
- Chemotherapeutic agents
- Diesel exhaust
- Glutaraldehyde
- Isocyanates
- Manganese
- Mercury
- N-hexane
- Perchloroethylene
- Styrene
- Toluene
- Welding fumes
What levels of exposure do we have the evidence to limit exposure to?
## Toluene (OSHA sampling page)

<table>
<thead>
<tr>
<th>Exposure Limit</th>
<th>Limit Values</th>
<th>HE Code</th>
<th>Health Factors and Target Organs</th>
</tr>
</thead>
</table>
| **OSHA Permissible Exposure Limit (PEL) - General Industry**  
See 29 CFR 1910.1000 Table Z-2  
(See also ANSI Z37.12-1967) | 200 ppm TWA  
300 ppm Ceiling  
500 ppm Peak (10 minutes) | HE7     | Central nervous system depression, causing fatigue, headache, confusion, paresthesia, dizziness, and muscular incoordination |
|                                                     |                               | HE15    | Irritation of the eyes, mucous membranes, and upper respiratory tract                             |
| **OSHA PEL - Construction Industry**  
See 29 CFR 1926.55 Appendix A | 200 ppm (750 mg/m³) TWA     | HE7     | Central nervous system depression, causing fatigue, headache, confusion, paresthesia, dizziness, and muscular incoordination |
|                                                     |                               | HE15    | Irritation of the eyes, mucous membranes, and upper respiratory tract                             |
| **OSHA PEL - Shipyard Employment**  
See 29 CFR 1915.1000 Table Z-Shipyards | 200 ppm (750 mg/m³) TWA     | HE7     | Central nervous system depression, causing fatigue, headache, confusion, paresthesia, dizziness, and muscular incoordination |
|                                                     |                               | HE15    | Irritation of the eyes, mucous membranes, and upper respiratory tract                             |
| **National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL)** | 100 ppm (375 mg/m³) TWA  
150 ppm (560 mg/m³) STEL | HE7     | Fatigue, weakness, confusion, headache, dizziness, drowsiness                                     |
|                                                     |                               | HE8     | Unconsciousness                                                                                   |
|                                                     |                               | HE15    | Irritation of the eyes, respiratory tract, and skin                                               |
| **American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2007)** | 20 ppm (75 mg/m³) TWA  
A4; BEI | HE5     | Female reproductive system damage and pregnancy loss                                               |
|                                                     |                               | HE7     | Central nervous system impairment and visual impairment                                             |
| **CAL/OSHA PELs** | 10 ppm (37 mg/m³) TWA  
500 ppm Ceiling  
150 ppm (560 mg/m³) STEL | HE5     | Female reproductive toxicity, spontaneous abortion                                                 |
|                                                     |                               | HE7     | Impaired color vision, impaired hearing, decreased performance in neurobehavioral analysis, changes in motor and sensory nerve conduction velocity, headache, and dizziness |
Manganese Fume (mg/M$^3$)

- OSHA PEL – 5
- NIOSH REL- 1
- ACGIH TLV® - 0.02
- CalOSHA PEL - 0.2
- EPA RfC- 5 x 10$^{-5}$
- ATSDR MRL- 0.04 (chronic)
Silica
<table>
<thead>
<tr>
<th>Substance</th>
<th>mppcf (^a)</th>
<th>mg/m(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica: Crystalline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartz (Respirable)</td>
<td>(\frac{250}{%SiO_2+5})</td>
<td>(\frac{10}{%SiO_2+2})</td>
</tr>
<tr>
<td>Quartz (Total Dust)</td>
<td>(\frac{30}{%SiO_2+2})</td>
<td></td>
</tr>
<tr>
<td>Cristobalite: Use (\frac{1}{2}) the value calculated from the count or mass formulae for quartz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tridymite: Use (\frac{1}{2}) the value calculated from the formulae for quartz.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amorphous, including natural diatomaceous earth</td>
<td>20</td>
<td>(\frac{80}{%SiO_2})</td>
</tr>
<tr>
<td>Silicates (less than 1% crystalline silica):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OEL for Silica defined in 1927

Public Health Reports (Bulletin 187)
<table>
<thead>
<tr>
<th></th>
<th>Current general industry PEL (0.1 mg/m³)</th>
<th>Proposed PEL (0.05 mg/m³)</th>
<th>Action Level (0.025 mg/m³)</th>
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</thead>
<tbody>
<tr>
<td>Lung Cancer: (10-cohort pooled analysis)</td>
<td>22–29</td>
<td>18–26</td>
<td>9-23</td>
</tr>
<tr>
<td>Silicosis</td>
<td>11</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>NMRD w/o Silicosis</td>
<td>72</td>
<td>36</td>
<td>18</td>
</tr>
</tbody>
</table>
Left off the Lists:

- Diesel Particulate Matter
- Particles NOC
- Metalworking fluids
- Wood dust
BACKGROUND: Diesel engine exhaust (DEE) has recently been classified as a known human carcinogen.

OBJECTIVE: We derived a meta-exposure–response curve (ERC) for DEE and lung cancer mortality and estimated lifetime excess risks (ELRs) of lung cancer mortality based on assumed occupational and environmental exposure scenarios.

METHODS: We conducted a meta-regression of lung cancer mortality and cumulative exposure to elemental carbon (EC), a proxy measure of DEE, based on relative risk (RR) estimates reported by three large occupational cohort studies (including two studies of workers in the trucking industry and one study of miners). Based on the derived risk function, we calculated ELRs for several lifetime occupational and environmental exposure scenarios and also calculated the fractions of annual lung cancer deaths attributable to DEE.

RESULTS: We estimated a lnRR of 0.00098 (95% CI: 0.00055, 0.0014) for lung cancer mortality with each 1-μg/m³-year increase in cumulative EC based on a linear meta-regression model. Corresponding lnRRs for the individual studies ranged from 0.00061 to 0.0012. Estimated numbers of excess lung cancer deaths through 80 years of age for lifetime occupational exposures of 1, 10, and 25 μg/m³ EC were 17, 200, and 689 per 10,000, respectively. For lifetime environmental exposure to 0.8 μg/m³ EC, we estimated 21 excess lung cancer deaths per 10,000. Based on broad assumptions regarding past occupational and environmental exposures, we estimated that approximately 6% of annual lung cancer deaths may be due to DEE exposure.

CONCLUSIONS: Combined data from three U.S. occupational cohort studies suggest that DEE at levels common in the workplace and in outdoor air appear to pose substantial excess lifetime risks of lung cancer, above the usually acceptable limits in the United States and Europe, which are generally set at 1/1,000 and 1/100,000 based on lifetime exposure for the occupational and general population, respectively.
GOOD JOBS
SAFE JOBS

Give Workers a Voice for a Change

WORKERS MEMORIAL DAY • APRIL 28 • AFL-CIO