

OSH-1: Industrial Hygiene for the Non-Industrial Hygienist

Lindsay Cook – The EI Group Inc.

2008 MCIC Environmental, Health and Safety School

Industrial Hygiene Basics for the Non-Industrial Hygienist



Lindsay Cook CIH, CSP
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Industrial Hygiene Is.....

- Anticipation
- Recognition
- Evaluation
- Control
- Communication

**Of Environmental Conditions That May
Adversely Affect Employees, Or The Ability to
Effectively Perform Their Jobs**

The Industrial Hygienist....

*Protects The Health of Workers By
Assessing Potential Chemical,
Biological and Physical Agent
Exposures and Controlling the
Environmental Conditions So That
the Risk of Exposure Is Minimized.*

Chemical Effects



Beneficial Effects

Pharmacology

Harmful Effects

Toxicology

Chemical Effects

Toxicity + Hazard

= Exposure

Dose Response Relationships

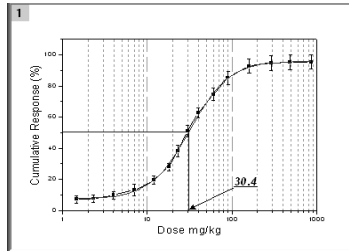
**As the Dose of a Toxic Chemical Is
Increased -**

- The Percentage of the Exposed Population That Show a Toxic Reaction Will Increase
- The Effect On An Individual Becomes More Severe

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The Dose Response Curve



Routes Of Exposure

How Toxins Enter the Body...

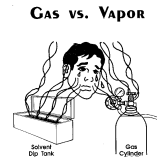
- Absorption
 - Dermal (Skin)
 - Ocular (Eyes)
- Inhalation (Lungs)
- Ingestion (Mouth)
- Parenteral (Injection)

Functional Classification of Effect

- Irritant
 - Primary
 - Secondary
- Anesthetic
- Sensitizer
- Systemic Effects
- Asphyxiant
 - Simple
 - Chemical (*Anoxic, Anemic*)

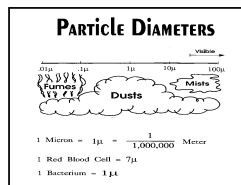
Physical Classifications

- Gases
 - Exist As a Gas In Normal State
 - Expand To Fill Available Space
- Vapors
 - Gaseous Form of Material
 - Normally a Liquid Or Solid



Physical Classifications

- Dusts
 - Grinding
 - Crushing
- Fumes
 - Solid Particles
 - Generated By Condensation
 - Formed From Vaporized Solid



Physical Classifications

- Mists
 - Liquid droplets
 - Condensation of Gases
 - Liquid agitation
- Smoke
 - Complex Aerosol
 - Many Components



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Measurement Units

ppm – Parts (Volume) Contaminant Per Million Parts Air

mg/M³ – Milligrams (Weight) Contaminant Per Cubic Meter of Air

Exposure Concepts

PEL – Permissible Exposure Limit
“Legal Limit” Set By OSHA

TLV – Threshold Limit Value
Recommended Level For “Most” Employees
“Most” of the Time

OSHA Standards

- 29 CFR 1910, Subpart Z
Toxic and Hazardous Substances
 - Standard Tables
Z-1, Z-2, Z-3
 - Substance Specific Standards
 - Horizontal vs. Vertical Standards
-

Industrial Hygiene Sampling



- “Grab” Sampling
Detector Tubes
Direct Reading Instruments



- “Pump and Tube”
Let's Move Some Air!



- Passive Dosimetry



Exposure Concepts

TWA - Time Weighted Average
Typically Eight Hours

STEL – Short Term Exposure Limit
15 Minute TWA

Ceiling Limit
Level Not To Be Exceeded At Any Time During the Shift

Time Weighted Average

Average Exposure Concentration Over A Shift

$$E = \frac{C_1T_1 + C_2T_2 + \dots + C_nT_n}{T_1 + T_2 + \dots + T_n}$$

C = Concentration
T = Sample Time

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Sample Calculation

Sample 1 = 300 ppm 2 Hours

Sample 2 = 100 ppm 6 Hours

$$= \frac{300(2) + 100(6)}{6 + 2}$$

$$= 150 \text{ ppm (8 Hour TWA)}$$

Don't Forget....

- Noise 1910.95
- Respirators 1910.134
- Ventilation 1910.94
- Radiation 1910.97

Traditional Control Hierarchies



- Elimination
- Substitution
- Engineering
- Administrative
 - PPE
 - Job Rotation



The Expanding Profession

- Asbestos, Lead Based Paint
- Ergonomics
- Indoor Air Quality
- Mold
- Homeland Security

Current Topics of Interest

- Nanotechnology
- Control Banding
- OSHA's Risk Assessment Proposal

What Is A Nanometer, Anyway?

One Billionth (10^{-9}) of a Meter!

Researchers are examining -

- How might workers be exposed to nano-sized particles?
- How do nanoparticles interact with the body's systems?
- What effects might nanoparticles have?



1 nm!



222 million nm!

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A New Approach - Control Banding

Band No.	Range of exposure concentrations	Hazard group	Control
1	>1 to 10 mg/m ³ dust >50 to 500 ppm vapor	Skin and eye irritants	Use good industrial hygiene practice and general ventilation.
2	>0.1 to 1 mg/m ³ dust >5 to 50 ppm vapor	Harmful on single exposure	Use local exhaust ventilation.
3	>0.01 to 0.1 mg/m ³ dust >0.5 to 5 ppm vapor	Severely irritating and corrosive	Enclose the process.
4	<0.01 mg/m ³ dust <0.5 ppm vapor	Very toxic on single exposure, reproductive hazard, sensitizer	Seek expert advice.

*Exposure to any concentration of a sensitizer requires expert advice.

Questions?

Everything You Ever Wanted To Know About Industrial Hygiene, But Were Afraid To Ask!

THANKS!