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AIR SAMPLING FOR THE NON-INDUSTRIAL HYGIENIST

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Objectives

- Basic concepts and terminology of air sampling
- Units of concentration
- Exposure limits for air contaminants
- When air sampling is required
- Methods of sampling strategy
- Appropriate use of and types of IH sampling equipment
- Hands on demonstrations

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Basic Air Sampling

What is industrial hygiene?

- Recognize hazard
- Evaluate hazard
- Control hazard



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Chemical

Gases
Vapors
Fumes
Dusts
Fibers
Mists



Physical

Temperature
Noise
Repetitive Motion &
Awkward Postures
Ionizing & Non-
Ionizing Radiation



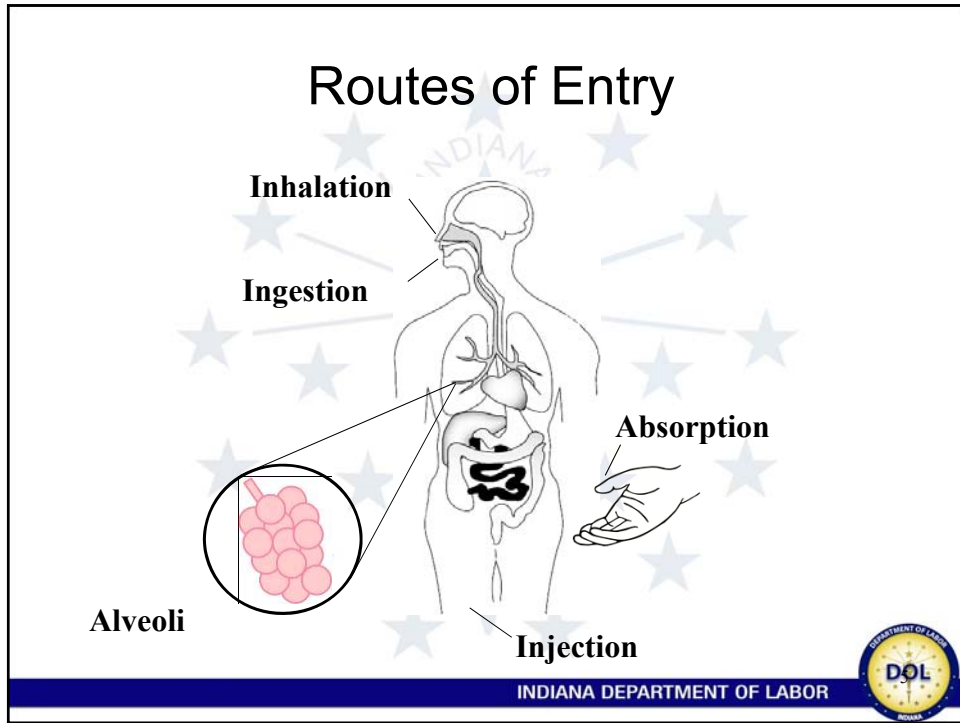
Biological

Fungi (Mold)
Bloodborne Pathogens
Bacteria
Poisonous Plants
Poisonous & Infectious
Animals

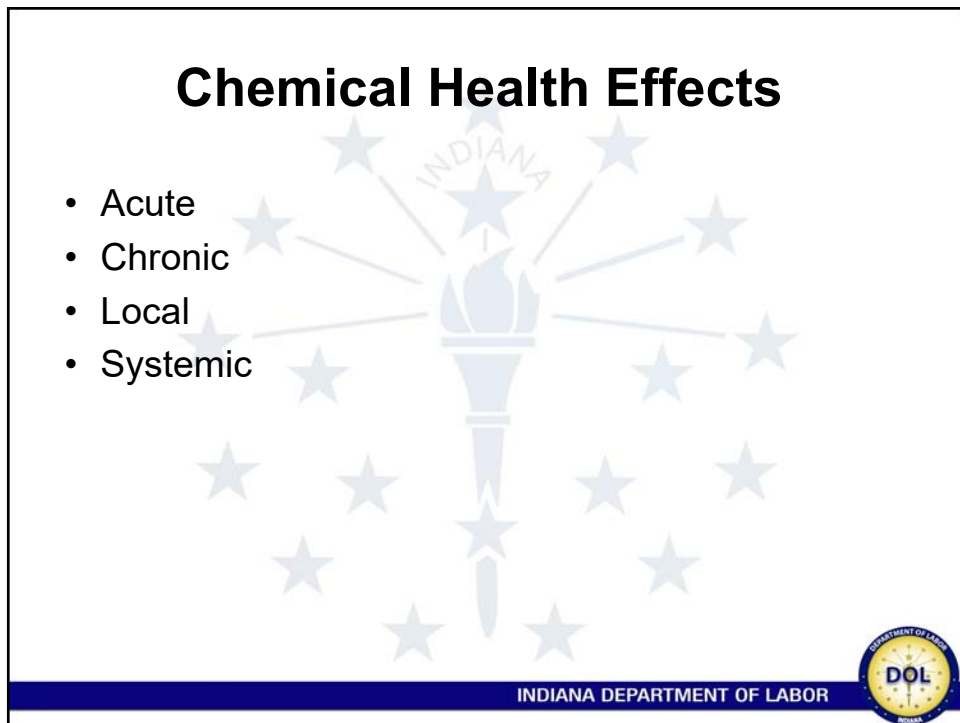
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Units of Concentration

- PPM – Parts Per Million
- MG/M³ – Milligrams per cubic meter
- UG/M³ – Micrograms per cubic meter
- F/CC – Fibers per cubic centimeter

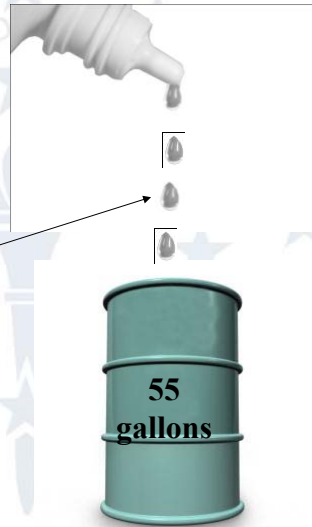
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Parts Per Million (ppm)

*Four (4) eye drops in a
55 gallon drum is
equivalent to 1 part per
million (1 ppm).*



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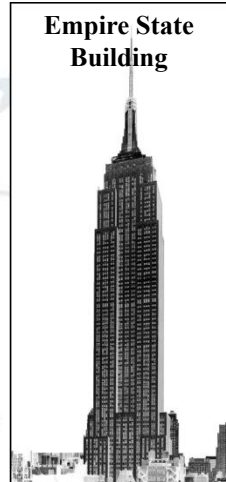
Milligrams per Cubic Meter of Air



Example:
One (1) packet of artificial sweetener is 1,000 milligrams

One (1) packet of artificial sweetener in the volume of the Empire State Building is equivalent to 0.001 milligram per cubic meter of air.

(1 μg (microgram)/ m^3)



Approximate Volume = 1,000,000 m^3

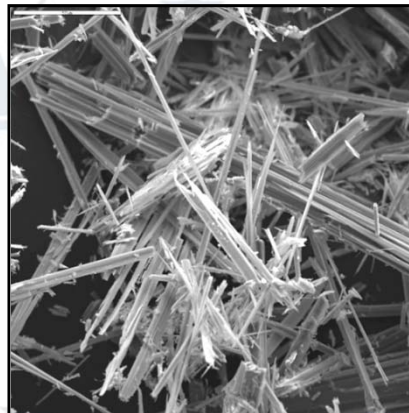
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Fibers per Cubic Centimeter (f/cc)

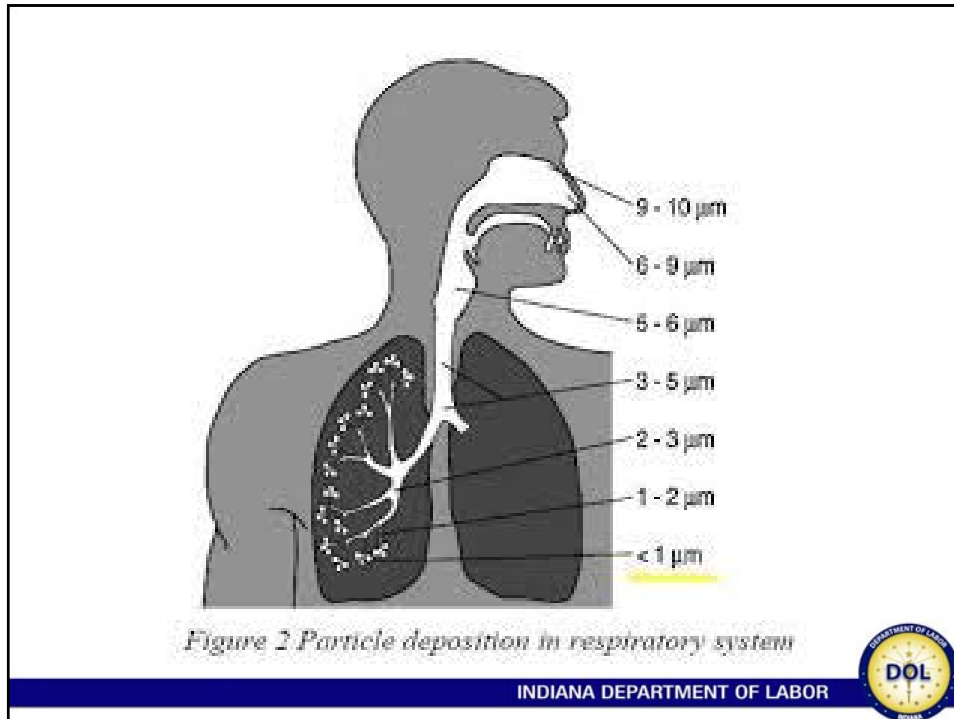
Fiber – Means a particulate form of asbestos, 5 micrometer (μm) or longer, with a length-to-width ratio of at least 3 to 1.



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Exposure Limits – Air Contaminants

- OSHA – Occupational Safety and Health Administration - Permissible Exposure Limits (PELS)
- NIOSH – National Institute for Occupational Safety and Health – Recommended Exposure Limits (RELS)
- ACGIH – American Conference of Governmental Industrial Hygienist – Threshold Limit Values (TLVs)

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OSHA Permissible Exposure Limits

- **Time Weighted Average (TWA)**
 - Average employee exposure over an 8-hour period
- **Action Level (AL)**
 - Exposure level at which some OSHA regulations set to protect employees takes effect
- **Ceiling Limit (C)**
 - Maximum allowable level.
- **Short Term Exposure Limit (STEL)**
 - Level that must not be exceeded when averaged over a specified short period of time - usually 15 minutes

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1910.1000

Derived from
1968 ACGIH*
TLV® booklet



*American Conference of Governmental Industrial Hygienists

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1910.1000 Examples

Substance	8-hr TWA	Ceiling
Acetone	1000 ppm	
Carbon monoxide	50 ppm	50 ppm
Hydrogen Chloride		5 ppm
Particulates not otherwise regulated (PNOR)	15 mg/M ³ Total Dust 5 mg/M ³ Respirable Fraction	

NOTE: The employer must ensure no employee exceeds any PEL

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1910.1000(b) – Table Z-2

Substance	8-hr TWA	Ceiling	Peak	Notes
Carbon Disulfide	20 ppm	30 ppm	100 ppm	30 min
Hydrogen Sulfide		20 ppm	50 ppm	10 min
Styrene	100 ppm	200 ppm	600 ppm	5 min in any three hours
Tolulene	200 ppm	300 ppm	500 ppm	10 min

NOTE: The employer must ensure no employee exceeds any PEL

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1910.1000(c) - Table Z-3

Adopted from the American Conference of Governmental Industrial Hygienist's (ACGIH) mineral limits



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1910.1000(c) - Table Z-3

Substance	PEL
Crystalline Silica (Respirable fraction) 1910.1053 / 1926.1153	50 ug/M ³
Coal dust (< 5% SiO ₂)	2.4 mg/M ³
Nuisance dust	15 mg/M ³
Respirable dust	5 mg/M ³

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How to Find 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)
- Prioritizing health hazards to evaluate

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Facility Health Audit

- 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

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During Walkaround

- Corrosive Materials...changing out totes... PPE
 - Chemical goggles / face shield, gloves, safety shower / eyewash – tested weekly
- Lead solder & other lead products
- Health Rating of 3 or 4 on “diamond” labels (NFPA)
- Health Rating of 0 or 1 on GHS labels (2012)

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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

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Types of Instruments

- Pumps - send samples to lab
- Direct reading - electronic
 - Instantaneous
- Detector tube - read stain from chemical reaction
 - Cylinder or bellows pump
 - Passive tube - usually dosimeter

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Pump Sampling

- Wide variety of media for many contaminants
- Very accurate - + or - 5 % typical
- Must wait for results

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Direct Reading Instruments

- Instant results - printout or display
- Can be expensive
- Must replace sensors
- Can be delicate
- Hybrids - chip readers. Chemical / electronic

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Detector Tubes / Badges

- Instant results
- Inexpensive pumps
- Badges – usually TWA sampling
 - Wait for results from lab
- Usually not the best accuracy - 25 to 35 % typical
- Tube usually specific for contaminant
- Tubes degenerate by time

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Sampling Media



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Miscellaneous to Observe

- Calibrate before and after
- Intrinsic safety
- Suitability for method, accuracy, conditions, etc.
- Often less expensive to rent

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Sampling Guidelines

- Manufacturer
- OSHA health standard may specify
- www.osha.gov
- www.cdc.gov
- acgih_pubs@pol.com

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Summary

- Looking for health hazards
- Chemical health effects
- Routes of entry
- Units of concentration
- Exposure limits
- Screening versus sampling
- Types of sampling instruments
- Sampling guidelines

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Questions?

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