HAZWOPER TRAINING
FOR THE PROFESSIONAL

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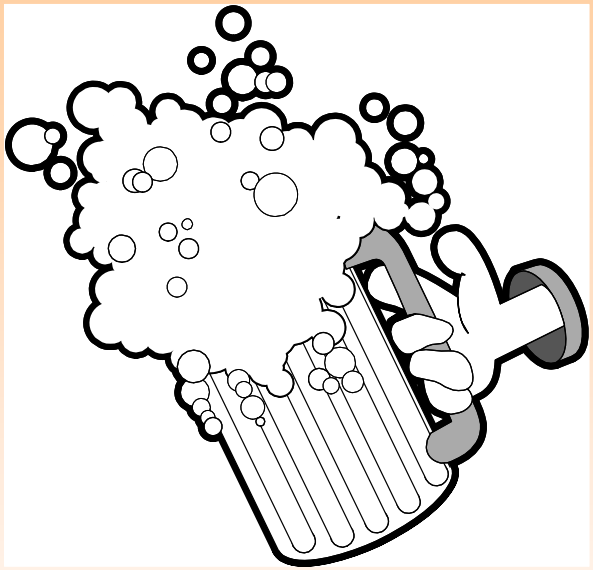
Health Effects

Acute or Chronic? What's the difference?



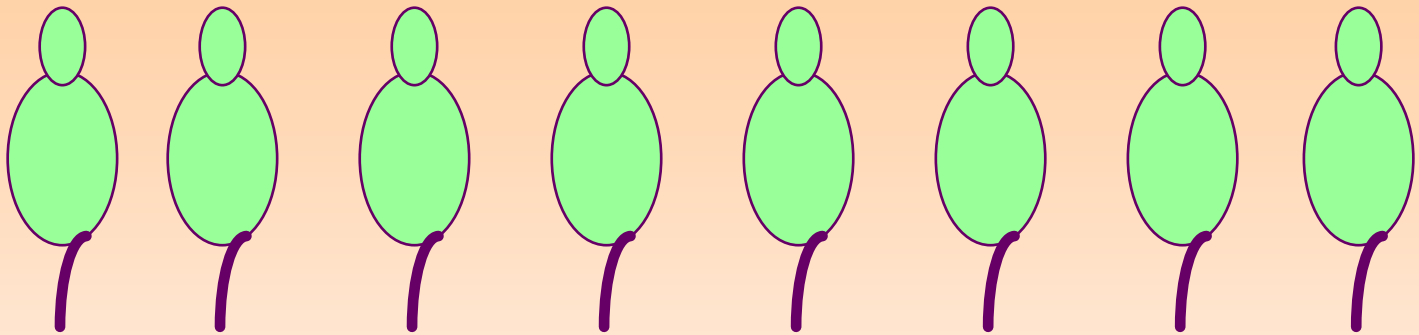
Acute ☐ ***Acute*** ☐

Chronic ☐ ***Chronic*** ☐

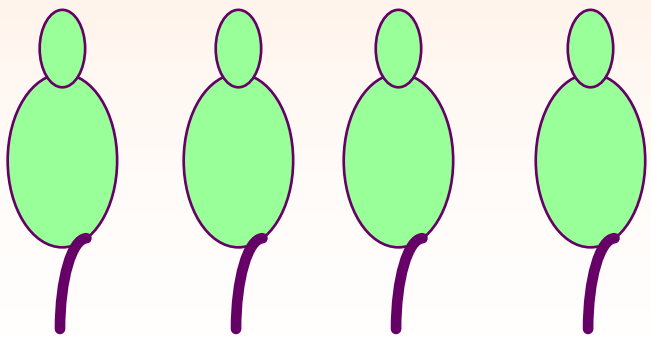
What about lead and asbestos?

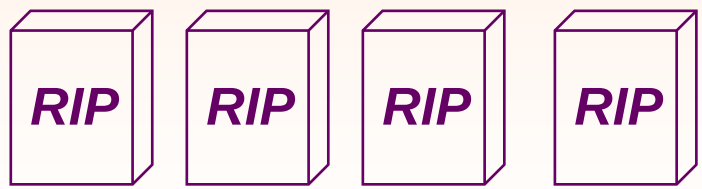
How do they set limits?
Lethal Dose for 50% (LD-50)

Mice, rats, hamsters



Exposure to chemical or dust through lungs or skin for natural life

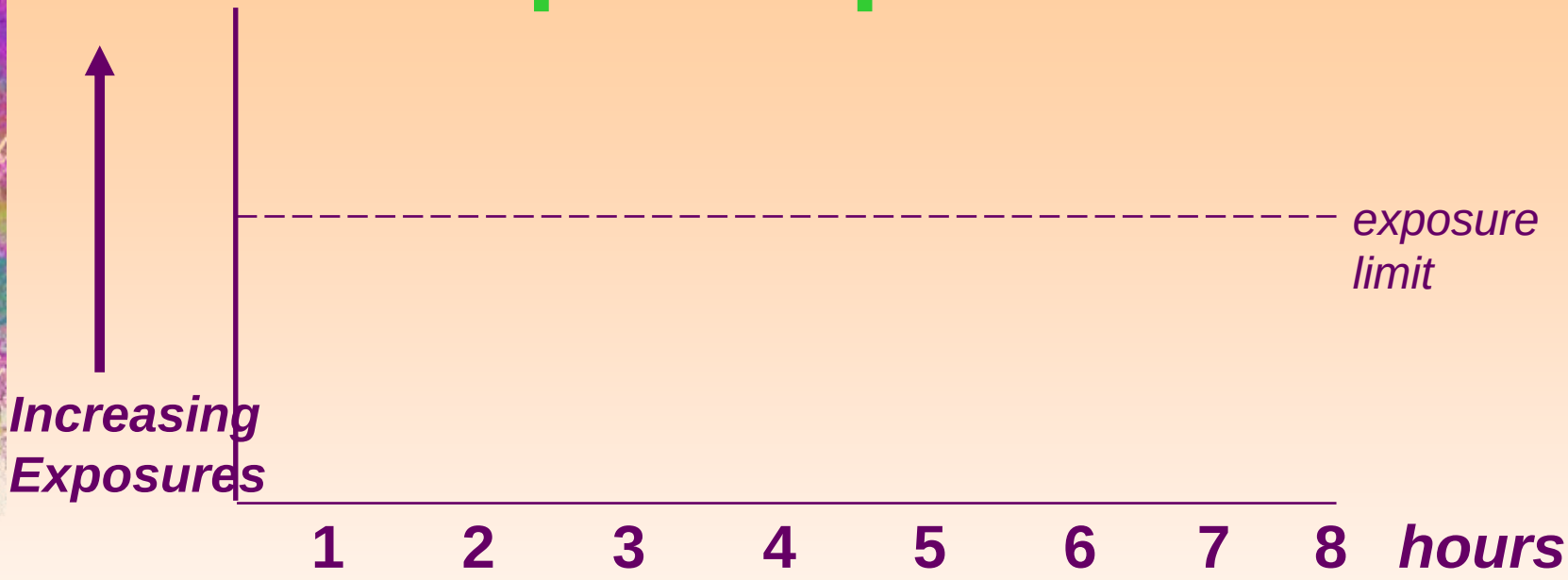




Setting Exposure Limits

- Any problems using LD50s for workers?
- What additional steps could you take?
- What additional information might be available?
  - _____
  - _____
  - _____

The concept of exposure limits



Much sampling is based on 8 hour time-weighted averages

Exposure Limit Exercise

- PEL =
- TLV =
- STEL =
- IDLH =
- "C" =
- TWA =
- "S" =

Bonus points: what is the difference between TLV and PEL?

Permissible Exposure Limits Quick Check

	Chemical	PEL (parts per million)
____	Acetone	1000
____	Acetic acid	10
____	Ammonia	50

List in the order of most toxic to least toxic.

Four Important Skills for Air Monitoring

You must be able to:

- Select the right instrument
- Check it to make sure it is working okay - calibration
- Use it properly
- Correctly interpret the results

TYPES OF INSTRUMENTS

- Direct-reading
  - Gives reading immediately
  - Also called real-time
- Indirect-reading
  - Two steps
  - Samplings
  - Must be sent to a lab for analysis

Exploded View of a sampling cassette

Is everyone familiar with these?

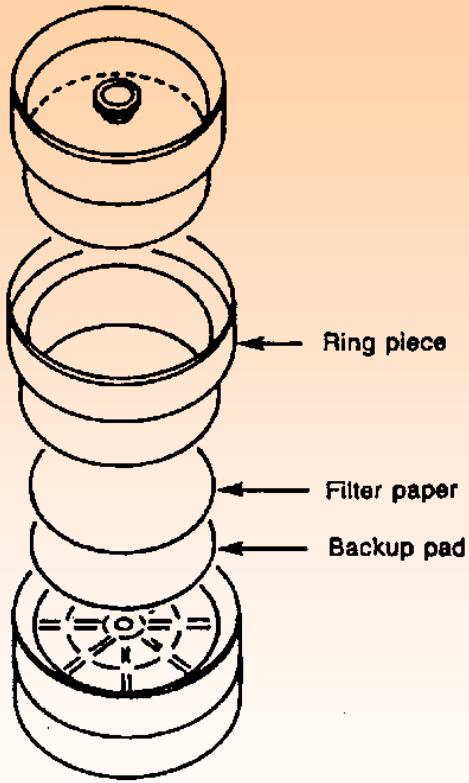


Figure I:1-11. Exploded view of three-piece cassette shows placement of backup pad.

Sampling for Organic Vapors usually involves Charcoal tubes

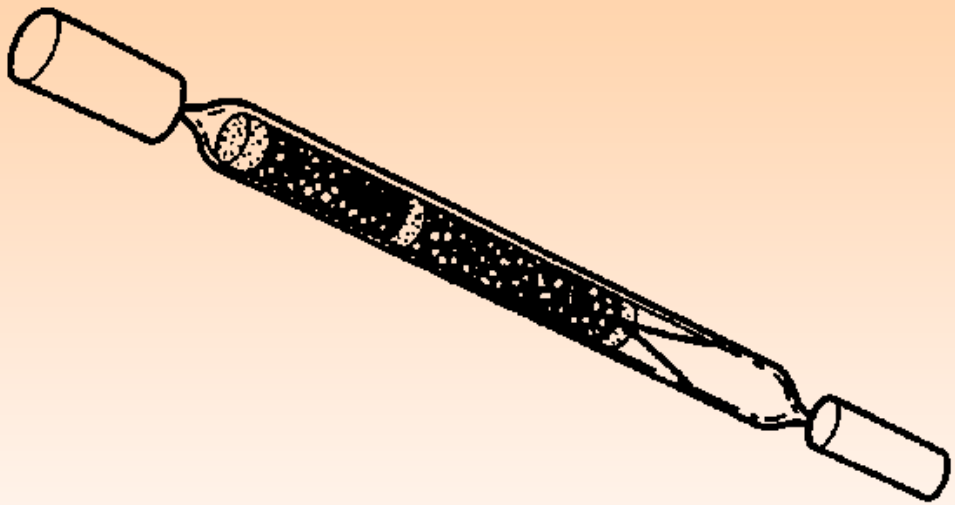


Figure I:1-3. A charcoal or "C"-tube with glass-sealed ends and NIOSH-approved caps before sampling.

Passive monitors are being used more often

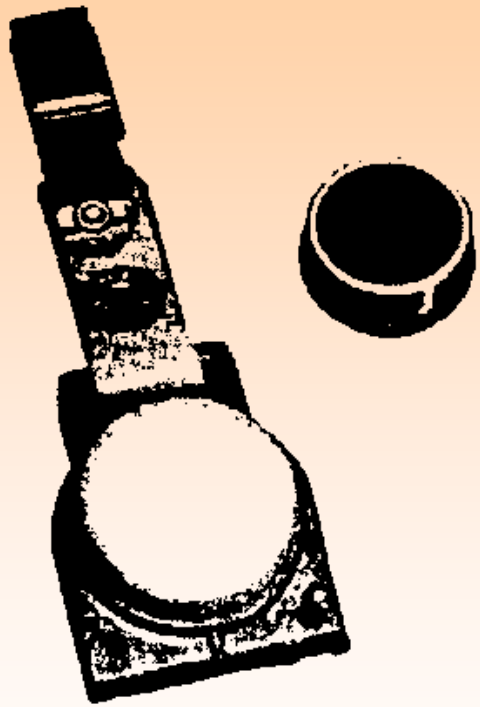


Figure I:1-6. Vapor badge with a clothing clip.

Calibration is essential!

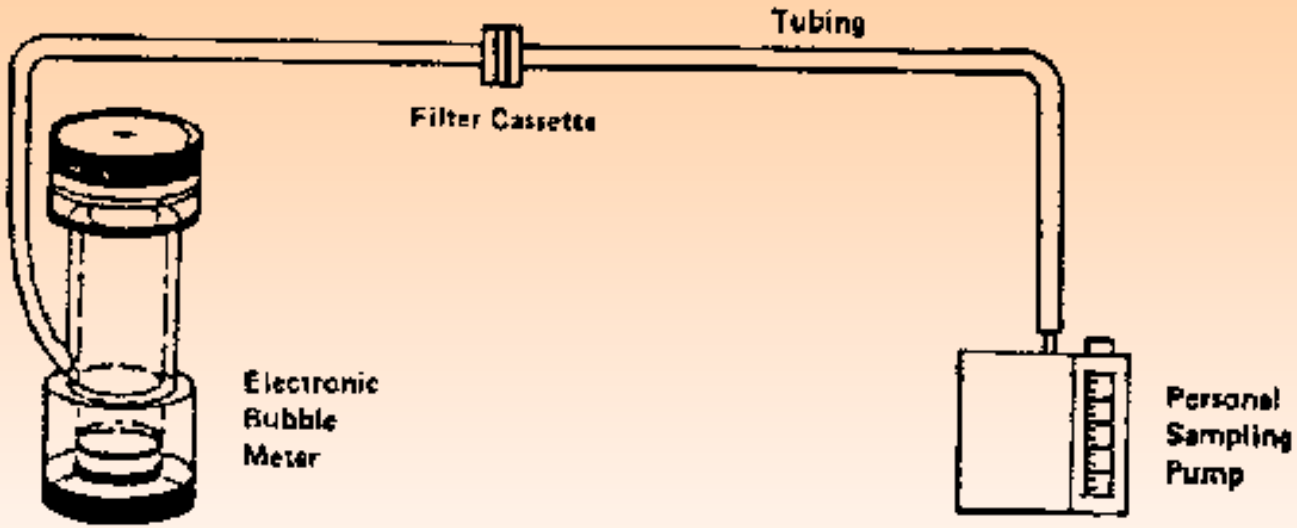


Figure I:1-8. For calibration, the cassette is attached to an electronic bubble meter.

Demonstration Time
DryCal Calibrator

Try to answer these questions during the demo:

1. Is this a primary or secondary standard? What is the difference?

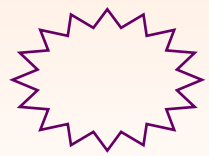
2. What does NIST-traceable mean?

3. Why is a cassette needed in line?

Three Key Concepts for Real-time Instruments

#1 INTERFERENCES

- **Positive interference results in the instrument reading higher than actual amount**
- **Negative interference can lower the reading - BIGGER PROBLEM**

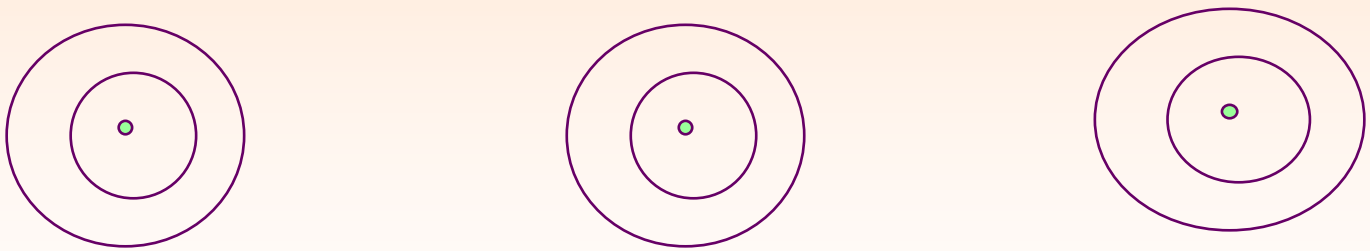


2ND KEY CONCEPT
Instrument Response Time

- Period between the time the measurement starts and when a reliable reading is obtained
- Usually 30-60 seconds, but can be 2 or 3 minutes - have to know your instrument

3RD KEY CONCEPT
Accuracy vs. Precision

- Accuracy is how close a measured value is to the true value
- Precision is a measure of variability



OXYGEN METER

- First reading is for oxygen
- Actually measuring partial pressure of oxygen
- Field calibration at 20.95%
- Alarms set at 19.5% and 23.5%
- Sensor life can be reduced by CO2 and extremes of temperature

COMBUSTIBLE GAS MONITORS

- Nonspecific
- Factory-calibrated for single gas and will *only* be accurate for that gas
- Calibration correction charts are important but specific for a manufacturer
- Oxygen enriched atmospheres can also cause problems

HEALTH HAZARD CONSIDERATIONS

- One percent reading = 10,000 ppm
- Carbon disulfide
  - LEL is 1.3% which = 13,000ppm
  - PEL is 20ppm
  - Will a worker have a health problem before there is a fire?

DETECTOR TUBE CONSIDERATIONS

- Good for a quick check
- Can't rely on them for protection!
- They are not accurate or precise
- NIOSH Certification
  - + or - 25% at 1-5 times PEL
  - 35% at levels one-half the standard

DETECTOR TUBE CONSIDERATIONS

- Shelf- life
- Time per stroke
- Leak and flow testing
- Remote sampling
  - detector tube must be placed on the end of the tube not the other way around

Watchman Multigas Monitor

Limitations:

- Can't measure combustibles if oxygen is low or enriched
- Can't measure some combustibles: oil mists, coal dust

Personal vs. Area Sampling

- Personal
  - sampling device worn
  - close as possible to breathing zone (within one foot of head)
- Area
  - strategically placed in a fixed location
    - evaluate background concentrations
    - locate sources of exposure
    - evaluate effectiveness of control measures

Grab vs. Integrated Sampling

- **Grab Sampling**
  - measures over a short period of time
  - usually less than 5 minutes
- **Integrated Sampling**
  - used to estimate a worker's 8-hour or 15-minute exposure

Airborne Sampling

- Solids
  - dusts
  - fumes
  - smoke
  - fibers
- Liquids
  - mists
  - fogs
- Gases
  - toxic

Standardized Sampling Methods

- *Manual of Analytical Methods*
  - NIOSH
- *Methods of Air Sampling*
  - American Public Health Association
- *Chemical Information Manual*
  - OSHA

Results

- Normally reported as grams, milligrams, ppm, or number of fibers
- Calculated to mg/m^3, ppm, fibers/cc

Sample Calculation (Dust)

- 1 gram = 1000 milligrams
- 1 liter = .0001 m^3
- Flow rate of sampling pump = 2.9 liters/min
- Sampling time = 420 minutes
  - $2.9 \frac{\text{liters}}{\text{min}} \times 420 \text{ min} = 1218 \text{ liters}$

Sample Calculations (Dust) cont'd

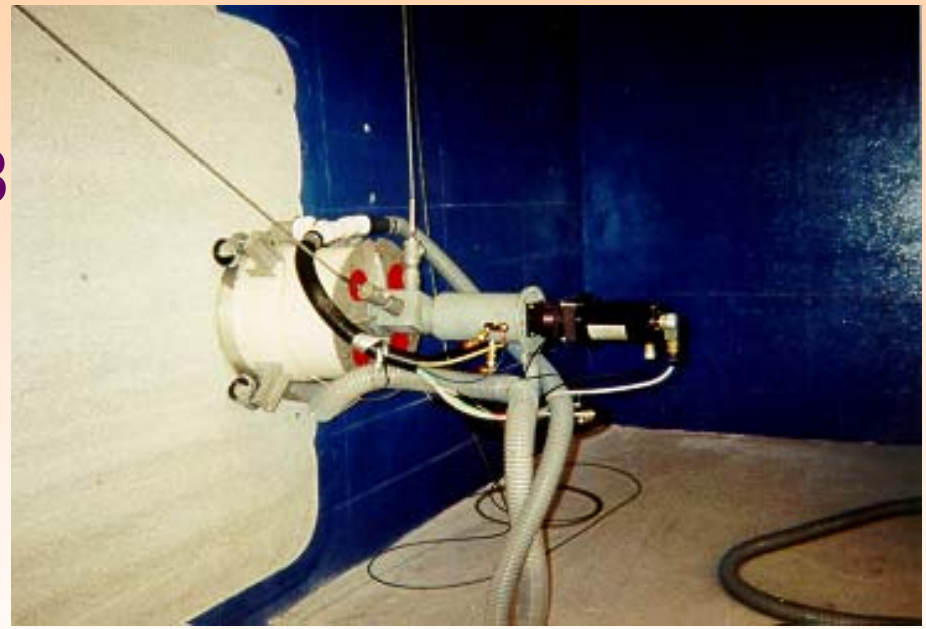
- **Sample weight = .0003 gram**
  - **.0003 gram x $\frac{1000 \text{ milligrams}}{\text{gram}}$ = .3 milligrams**
  - **1218 liters x $\frac{.0001 \text{ m}^3}{\text{liter}}$ = .1218 m^3**
  - **$\frac{.3 \text{ mg}}{.1218 \text{ m}^3}$ = 2.46 mg/m^3**

Calculation

- Sampling pump flow rate = 1.95 lpm
- Sampling time = 140 minutes
- Sample weight = .41 gram

Calculation

- Sampling pump flow rate = 2.05 lpm
- Sampling time = 293 minutes
- Sample weight = .01 gram



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