Occupational Hygiene Review

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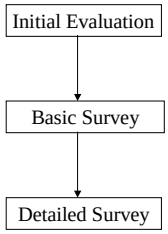
Occupational Hygiene

- Anticipation / Recognition
- Evaluation
- Control

OH Surveys



Initial Appraisal

- Obtain information
- Observe process
- Simple qualitative tests
  - dust lamp
  - smoke tubes
  - indicator tubes etc.
- Use experience and professional judgment to evaluate risks

Basic Survey

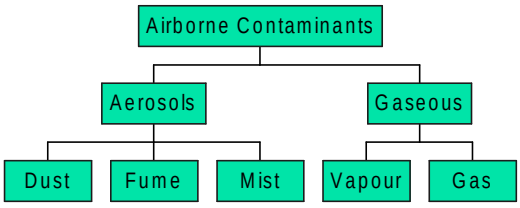
- Similarly exposed groups (SEGs)
- "Worst case" sampling
- Background samples
- Checks on control measures

Detailed Surveys

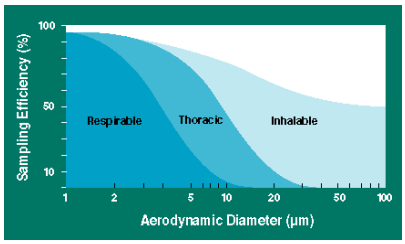
- Large number of samples
- Different shifts etc.
- Statistical analysis of results

Sampling for Chemical Agents

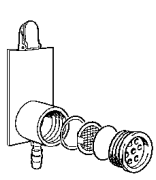
Airborne Contaminants



Aerosol Sampling



Total Inhalable Dust



7 hole head

IOM head

Filter cassette

Operate at 2 litres/minute

Respirable Dust

- Crystalline silica, talc, cadmium sulphide
- Cyclone elutriator
- Membrane filter
- Flow rate
  - 2.2 litres/minute
- Analysis
  - gravimetric
  - XRD

Fibre Sampling

- Cowled, open face sampling head
- Flow rate
  - 1 to 4 litres /min (personal)
  - Up to 16 litres/min (clearance)
- Gridded cellulose ester filter
- Filter cleared with acetone vapour
- Fibres counted under microscope

Analytical Methods - Particulates

Contaminant	Method
Total inhalable or respirable	▪ gravimetric (MDHS 14)
Metals and metal compounds	▪ atomic absorption spectroscopy (AA) ▪ inductively coupled plasma - atomic emission spectroscopy (ICP-AES) ▪ X-ray fluorescence (XRF)
Crystalline silica (and some other minerals)	▪ X-ray diffraction (XRD)
Asbestos and MMMF	▪ optical microscopy ▪ electron microscopy

Gravimetric Analysis

- Handle only with tweezers
- Condition filters
- Eliminate / minimise effects of
  - humidity
  - static
- Minimise losses due to
  - sample handling
  - internal losses
  - filter damage
- Use field blanks
  - 1 per 10
  - minimum of 3

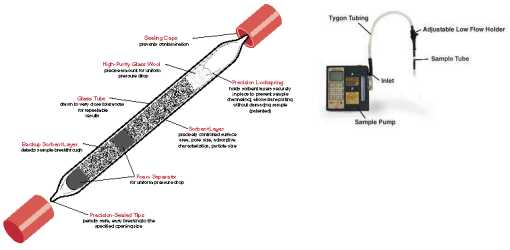
Sampling for Gases and Vapours

- Adsorption
- Absorption
- Treated filters
- Diffusive sampling
- Direct reading instruments
- Indicator tubes

Colorimetric Indicator Tubes

- Advantages
  - quick
  - easy
  - instant result
- Disadvantages
  - accuracy
  - not personal sampling
  - specificity

Adsorption Tubes



Adsorption Tubes

- Carbon, Silica gel, Porous polymers
- Flow rate
  - 50 to 200 ml/min
- Select flow rate based on
  - expected contaminant concentration
  - sampling period
- Backup layer in tube
  - analysed separately

Adsorption Tube Analysis

- Desorption
  - chemical
  - thermal
- Gas chromatography
- Detector
  - flame ionisation detector (FID)
  - mass spectrometer

Passive Sampling

- Does not use pump
- Uptake by passive diffusion

Absorption

- Bubblers
  - fritted end
- Impingers
  - open end
  - originally designed for particulate sampling
- Gas dissolves or reacts with liquid sorbent
- Difficult to use for personal sampling

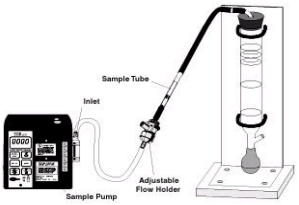
Examples of Liquid Sorbents

Gas / Vapour	Sorbent	Analysis
Aldehydes	MBTH	Spectrophotometry
Amines	H Cl in isopropanol	Spectrophotometry
Ammonia	Dilute sulphuric acid	Spectrophotometry
Chlorine	Methyl orange	Spectrophotometry
Formaldehyde	Water	Chromatropic acid
Nitrogen dioxide	Napthyl ethylanadiamine	Colour reaction
Ozone	Potassium iodide	Titration
Sulphur Dioxide	Tetrachloromercurate	Spectrophotometry
Isocyanates	1-methoxyphenyl-piperazine in dry toluene	HPLC

Calibration

- Primary flow measurement devices
  - bubble flow meter
- Secondary flow meters
  - rotameters
- Electronic devices
  - soap bubble
  - dry-cal piston

Bubble Flow Meters

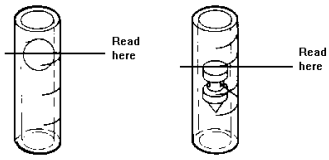


Electronic Flow Meters

Dry-cal

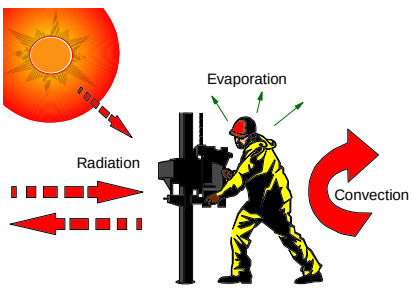
Electronic bubble flow meter

Rotameters



Physical Agents

Thermal Environment



Evaluation of Heat Stress & Strain

- Environmental Factors
  - air temperature
  - radiant heat
  - humidity
  - air velocity
- Human Factors
  - work rate
  - clothing
  - fitness / susceptibility

Measurement

- Air temperature
  - standard thermometer
- Radiant heat
  - globe thermometer
- Humidity
  - whirling hygrometer
- Air velocity
  - kata thermometer

WBGT Index

Indoors

$WBGT = 0.7\ T_{nwb} + 0.3T_g$

Outdoors

$WBGT = 0.7\ T_{nwb} + 0.2\ T_g + 0.1T_a$

TLVs – Unacclimatised Workers

	Workload			
	Light	Moderate	Heavy	V.Heavy
Continuous Work	27.5	25	22.5	-
75% work / 25% rest	29	26.5	24.5	-
50% work / 50% rest	30	28	26.5	25
25% work / 75% rest	31	29	28	26.5

Values in degrees C

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