Topics

• Construction - Importance of Airborne Health Hazards

• Why Measure Them?

• Ways to Measure
  - Dust
  - Vapours

• In–House Air Sampling Option (DIY)
H&S Headlines

- Scaffold fall
- Ceiling collapse injures worker
- Falls off roof
- Severe electrical burns
- Crush death
- Hit by steel girder

Health Hazards - Headlines?

- Asbestos

- Others
Airborne Hazards

- **Injuries (SAFETY)**
  - Fatal Injuries Total: 133
    - 11 per month
  - Fatal Injuries Construction Industry: 44
    - 3.6 per month

- **Occupational lung disease and cancer (HEALTH)**
  - Deaths Total: 12,000
    - >1000 per month (36 PER DAY)
  - Construction Industry alone: 40% of all Reported Occupational Cancers
Other Industries (Health)

• Welding, Soldering, Metal Work
  – 1 in 10 of 30,000 reported breathing/lung problems caused/made worse by work

• Bakers
  – 80 times more likely to develop occupational asthma

Long Latency Period

• Welding Fumes - 18 Years to develop Asthma
Construction Airborne Hazards

• **DUST**
  - (Asbestos)
  - Respirable Crystalline Silica
  - Wood Dust
  - General Dust
  - Metals

• **CONTROLS**
  - Dust Suppression
  - Cleaning
  - RPE

• **STAFF EXPOSURE MEASUREMENT**

  Despite:
  - HSE Workplace Exposure Limits
  - Defined, Simple Sampling Methods
  - Many Benefits

**WHY MEASURE EXPOSURE?**
QUESTIONS

• How can I be sure my staff are not overexposed to Airborne Hazards?
• What Evidence/Records do I have of their actual exposure?
• How do I decide the Need for & Level of Controls required?
• How can I measure their Effectiveness?

EXPOSURE MEASUREMENT - BENEFITS

• Records - Evidence
• Informed Decisions based on Facts - not Assumptions
• Potential Cost Savings
• Protection of Staff and Company
Reasons for Workplace Air Sampling

• Health Protection

• Compliance with Government Legislation
  – COSHH: Control of Substances Hazardous to Health
  – EH40: HSE Workplace Exposure Limits
  – CLAW: Control of Lead at Work Regulations
  – CAR: Control of Asbestos Regulations

• Protection from Compensation Claims

• Process Control Measures
Reasons for Not Doing Sampling

• Jobs too Variable
  – Answer: *Worst Case Scenario*

• Assessment / Controls in Place are Enough
  – Answer: *How can you be sure?*
  
  COSHH/ EH40 - Workplace Exposure Limits (WELs)

• Safety is the Priority
  – Answer: *Deaths due to Airborne Workplace Exposure cf Injuries*

• Not Practical for Construction Workers
  – Answer: *Why? All other Industries inc Heavy Industries do it*

Any Sampling/Measurement - Better than None
Airborne Hazards - Controls

- Prevention
- Suppression
- Containment
- Protection

Is Control Required and How Much?
Are Controls Effective Enough?
Exposure Limits in the Workplace

• **EH40:2005**
  – WEL (Workplace Exposure Limit)
  – 8 Hour (Time Weighted Average)
  – 15 min (Short Term Exposure Limit) Vapours

• Includes
  – Dust
  – Wood Dust (*hard & soft wood*)
  – Respirable Crystalline Silica
  – Metals
  – VOCs / Solvents (various)
What is Air Sampling?

• Air is passed through a filter, tube or other collecting media
• Hazard Presence/Level detected by
  – Direct Reading
    *(Dust)*
  
or
  – Colour Change of Media
    *(Vapours)*
  
or
  – Laboratory Analysis
    *(Dust, Silica, Metals, Vapours)*
Passive Sampling

- Dust and Vapours
- Diffusion
- Semi-quantitative
- Indicator e.g. surveys
- Immediate results (Dust Monitors, Gastec/Drager Tubes)

Grab Sampling

- Vapours only
- Small sample volume
- Semi-quantitative
- Not Time-Based Exposure
- Indicator e.g. surveys
- Immediate results (Gastec/Drager Tubes)
Active Sampling

• Dust and Vapours
• Sampling Pump + Sampling Head
• Quantitative - *Known Flow Rate + Time*
• Most Accurate / Meaningful

Immediate Results
*Dust Monitors*

Samples to Laboratory
*HSE Methods*
Sampling Train

- Pump
- Connecting tube
- Sampler

Active Sampling

- Setup Sampling Train
- Calibrate Flow Rate - *Before* Sampling
- Fit Sample Train to Operator
- Check Flow Rate - *After* Sampling
- *Read / Download Results (Dust Monitors)*
  
  Or

- *Send Sample to Laboratory*
- Review Results
Personal vs Static Sampling

30 cm hemispherical breathing zone around the nose and mouth

Sampler (Sampling Head)

Workplace Exposure Limits (WELS) based on PERSONAL SAMPLES

MUST be taken in the BREATHING ZONE
Particulates (Construction)

- General Dust
- Wood Dust
- Fibres - Silica, Asbestos
- Fumes - Welding (metals/metal oxides)
- Metals - Grinding, Cutting, etc
- Diesel Particulates
Particulates (Other Workplaces)

- General Dust
- Wood Dust - *Mills, Furniture, Workshops, Paper*
- Fumes - *Solder, Rubber, etc*
- Metals - *Electroplating, Grinding, Cutting, etc*
- Fibres - *Asbestos, Mineral, Ceramic, Silica*
- Flour/Grain Dust - *Mills, Bakeries*
- Rubber Process Dust - *Tyres, Valves etc*
- Diesel Particulates - *Vehicle Depots, Mines etc*
- Mining - *Salt, Coal, etc*
- Cotton, Wool Dust
Relative Size of Particles

- Respirable dust to 12 micron
- Inhalable dust to 100 micron
Inhalable Dust

• Size Distribution BS EN 481:1993

• Up to 100 micron AED

• Affects ALL the respiratory system

• Partially visible

• Workplace Exposure Limits
  - Dust
    10 mg/m³  8 Hours
  - Hard Wood & Soft Wood Dust
    5 mg/m³  8 Hours
Respirable Dust

- Size Distribution BS EN 481:1993
- Up to 12 micron AED
- Penetrates Deep into the Lungs
- Invisible
- Workplace Exposure Limit (WEL)
  - Dust
    4 mg/m³  8 Hours
  - Respirable Crystalline Silica
    0.1 mg/m³  8 Hours
What is mg/m³?

1 Milligram per Cubic Metre (mg/m³) is equivalent to one teaspoon of flour spread over a football field to a height of one metre.
HSE Methods - Active Sampling

- MSDS - Method for the Determination of Hazardous Substances
  - MDHS 14/4 - *Inhalable & Respirable Dust*
  - MDHS 101 - *Respirable Crystalline Silica*
  - Various MDHS's - *Metals*

Survey Methods

- Direct Reading - *Particulate Monitors*
  - Inhalable / Respirable Dust
  - Passive / Active
  - Personal or Static
Survey Methods - Particulates

Direct reading - time-based picture of the situation

• Area Mapping
  – Hotspots
  – When
  – Who

Cleaning

Construction

Processes

TIMES!
Air Sampling - Particulates

Sampling Heads (containing a Filter)

- IOM Inhalable Dust
- Metals
- Cyclone Respirable Dust
- Silica
- Cowled Fibres
- Asbestos
- Mini Sampler Welding Fume
- Components (Metals)
Active Sampling - Particulates

- Sampling Media - *Filter*

- High Flow Rate - 2 & 2.2 *litres/min*

- Lab Analysis - *gravimetric, microscopy, ICP, XRD*

- Air Volume = Flow Rate x Time

- 8 Hour TWA, 15 Min STEL

- Also Direct Reading Monitors
Vapours (Construction)

• Organic Chemicals - VOCs (Solvents), etc

• In Commercial Products

  Cleaning, Glues, MDF, Paints, Paint Strippers, insulation, etc

  e.g. Formaldehyde (MDF)
  Dichloromethane (Paint Strippers)
  Xylene, 1-Butanol, etc (Paints/Glues, etc)

• Isocyanates

• Two pack Polyurethane Paints

• Coatings, Foams, Flooring
Vapours (other Workplaces)

- **Organic Chemicals** – *solvents / VOCs, etc*
  - Benzene, Toluene, Formaldehyde, Methanol, etc

- **Inorganic Chemicals** - *mineral acids*
  - Hydrochloric Acid, Nitric Acid, Sulphuric Acid

- **Gases**
  - Nitrous Oxide, Chlorine, Chloroform, etc

- **Isocyanates**
Vapours - Exposure Limits (WELs)

- Parts per Million (ppm)
- Wide Range
  - Vapours
  - Limits

- Examples
  - Formaldehyde  8 Hour TWA: 2 ppm, 15min STEL: 2 ppm
  - Xylene       8 Hour TWA: 50 ppm, 15min STEL: 100 ppm
  - Dichloromethane 8 Hour TWA: 100 ppm, 15min STEL: 300 ppm
What is a ppm?

1 PPM is about the same as the contents of a party balloon in the volume of 50 three bedroom houses.
HSE Methods - Vapours

• MSDS - Method for the Determination of Hazardous Substances

  e.g. MDHS 88 (Passive Sampling)  
  MDHS 96 (Active Sampling)

• Specific

  e.g. MDHS 78 (Formaldehyde)
Passive/Grab Sampling - Vapours

Passive Sampling Badges

Colour Change Tubes
Active Sampling - Vapours

Sorbent Tube with Holder & Cover

Cassette & Holder (containing treated filter)
Active Sampling - Vapours

- **Sampling Media** - *Sorbent Tube or Treated Filter*

- **Low Flow Rate** - 20-200 ml/min (*sorbent tubes*)

- **Lab Analysis** - *wide range*: GC, HPLC, IC, etc

- **Air Volume** = Flow Rate x Time

- **8 Hour TWA, 15 Min STEL**
Workplace Air Sampling - Options

- Consultant
- DIY
- Both

DIY Benefits

- Cost Savings
- Flexibility
- Involvement / Ownership
- Additional Skills / Experience
Measurement Requirements

• Equipment, Accessories

• Guidance/Support
  - Equipment Supplier
  - Laboratory
  - HSE, etc

• Competence (Training)
Summary – Construction Industry

• Importance of Airborne Health Hazards

• Why, What and How to Measure

• DIY Benefits
Airborne Hazards Exposure Measurement is Key to:

- **Staff Health Success**
- **Company Health Success**

**SO**

*Move Towards the Right H & S Balance Now*