Airborne Hazards From Gases, Vapours and Dusts

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Air sampling is relevant to almost every industry, from flour dust exposure in a bakery to chemical vapour exposure in a factory. Air Sampling is a vital method of protecting workers from these potential hazards. By consistently measuring the concentration of airborne contaminants workers are exposed to, steps can be taken to ensure that they remain at a safe level, preventing chronic respiratory diseases such as asthma and pulmonary fibrosis.

What is Air Sampling?

Put simply, air sampling is capturing the contaminants in a known volume of air and measuring those contaminants as a concentration.

Before you Start

If you are unsure about how to go about starting your sampling regime, these are five simple questions to ask:

- Who are the most susceptible? Which workers are most likely to come into contact with contaminants?
- Where are the most susceptible? EG in which department are they located?
- When are they most likely to be exposed? EG at what stage of the manufacturing process are they most likely to be exposed?
- What are we looking for? If you don't know which contaminant you are looking for you won't be able to capture and measure it effectively.
- How do we do it? The Methods for Detection of Hazardous Substances (MDHS) are available from the HSE www.hes.gov.uk

How is Air Sampling Carried Out?

The most widely used and preferred method is to connect a battery operated pump worn on a belt to a collecting media positioned in the breathing zone (within 30cms radius of the nose and mouth).

The pump should be capable of drawing air through the media at a constant rate for more than eight hours, even in adverse conditions such as extreme temperatures.

The contaminant is then captured on the media for analysis. Media can be a filter for dusts and particles or a sorbent tube such as charcoal for gases and vapours.

Types of Contaminant

There are two types of contaminant grouped according to their physical properties – dust and particles and gases and vapours. Particles can be further divided into five types as defined below:

Aerosol	Dispersion in air of microscopic particles of solid or liquid
Dust	Solid particulate capable of temporary suspension in air
Fume	Solid particles produced by condensation from the gaseous phases
Smoke	Particles resulting from incomplete combustion of organic matter
Mist	Dispersion of droplets of air

Once measured, the contaminants are expressed as milligrams per cubic metre (MgM3) for particulates and Parts per Million (PPM) for gases. For example, 1PPM of a gas means that 1 unit of the gas is present for every million units of air. The Workplace Exposure Limit (WEL) is the concentration of an airborne substance to which employees may be exposed by inhalation over a set period of time. Measuring in this way ensures that these limits are not being exceeded. (See EH40 2005)

Calibration

Calibration of the airflow through the sampler is important and should be checked before AND after every sample is taken.

Broadly speaking there are two different levels of flow commonly used for personal sampling systems – around two litres per minute for dust sampling and between 10 and 200mls per minute for gases and vapours.

The usual method of flow measurement (calibration) for the higher flow rates has generally been via a Rotameter and for the lower flows, a bubble film calibrator.

There is now a third option and that is to use an electronic calibrator such as the Defender (pictured) series, which is much faster, highly accurate and provides NIST traceable readings.

Help and Advice

If you have never carried out air sampling before, or you are unsure of the safe exposure limits there is a range of help available. One of the best resources for advice on legislation and potential contaminants is the Health & Safety Executive. You can visit them on-line at **www.hse.gov.uk**

Monitoring at Biomass Plants Should be 'Future Proof'

The recent rise in approvals for the construction of renewable energy plants burning biomass has highlighted the need for specified monitoring equipment to be both cost-effective and flexible. **Quantitech** Director Dominic Duggan explains: "Whilst biomass power represents an important part of the Government's strategy to produce energy from renewable sources and to reduce waste to landfill, a debate on the role of such facilities in climate change continues. It is therefore important for monitoring systems to be 'future proof' – to be able to measure new parameters in subsequent years, such as greenhouse gases."

The choice of analyser is often dictated by the number of parameters specified in a site's emissions permit. However, Duggan believes that future monitoring requirements should be taken into consideration, adding, "We have seen a number of biomass projects for which only a small number of parameters have been specified in the emissions permit and this may lead process operators to choose individual analysers for each parameter since that may appear to be the lowest cost option. However, saving small costs in the short term could prove expensive in the medium to long term, particularly since the cost of monitoring equipment is a tiny fraction of the overall budget for a new plant. There are two important issues that should be taken into account.

"Firstly, as time passes, monitoring requirements change and this often involves an additional requirement for new parameters. Secondly, FTIR is the most commonly employed multiparameter technology in the CEMS (Continuous Emission Monitoring System) market, but may be considered prohibitively expensive for biomass incineration. However, Gasmet (a world leading manufacturer of FTIR) has developed an insitu FTIR that represents a cost effective solution to the need for accurate but flexible multiparameter analysis."

The Gasmet™ In-Situ offers an alternative to extractive systems in continuous emissions and process monitoring where multiple compounds are monitored. Typically, concentrations of H_2O, CO_2, CO, NO, NO_2, N_2O, SO_2, HCl, HF, NH_3, CH_4 are continuously monitored with a single Gasmet™ In-Situ. In addition, different VOC's can be measured as individual compounds. There is no need for any span calibrations; only zero calibration with instrument air every 24 hours, so Gasmet claims that the instrument is extremely easy to run.

The Gasmet™ In-Situ has already been employed in biomass and energy from waste plants burning such materials as municipal waste, wood chip, tree bark, peat, coal, heavy fuel oil, short fibre and sludge from paper mills.

Summarising his recommendations on the suitability of insitu FTIR for biomass incinerators, Duggan says, "The greatest advantage of this technique is that the basis of every measurement is a complete spectral analysis of the emission gas. This means that whilst the instrument is able to calculate concentrations of the required parameters, it is also able to analyse new parameters at any time and at no extra cost."