

2013 Designated the Year of Air Quality

As many countries fail to meet air quality targets and large numbers of premature deaths still result from air pollution, Jim Mills, a particulate monitoring specialist and Managing Director of Air Monitors, explains why 2013 should be a pivotal year.

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In November 2011 Janez Potočnik, European Commissioner for the Environment, expressed his determination to make 2013 the 'Year of Air'. He acknowledged that there has been substantial improvement in air quality in recent decades but in the light of the environmental/climate issues surrounding air quality and the large number of premature deaths resulting from air pollution, he says: "The challenge for all of us is to address the shortcomings of existing regulations in a decisive and co-ordinated way. This will require the goodwill of policy-makers at all levels – European, national, regional and local – as well as other stakeholders such as the automotive and oil industries."

The European Environment Agency's 2011 report on air quality reflects air quality improvements for a number of key parameters, with concentrations of sulphur dioxide and carbon monoxide falling by about half in the decade ending in 2009. However, the report also shows that in 2008, levels of nitrogen oxide, ozone and particulate matter have risen, fuelling concerns about overall air quality, especially in urban areas.

According to the Commission, some 500,000 people die prematurely in the EU 27, mainly due to exposure to high levels of fine particulate matter (atmospheric microparticles or 'dust' of a diameter of less than 2.5 micrometres), which originates from residential heating, transport (diesel cars and trucks, ships and planes), agriculture, industrial processes and power production.

Particulates

Particulate pollution continues to be a major problem, despite the considerable progress that has been made in the reduction of larger particulates such as PM10. This is due, in no small part, to the standard monitoring methodologies that have been adopted because particulates are generally monitored as the PM10 or PM2.5 fraction, whereas it is widely acknowledged that the finer particles (< 1 micron), are able to penetrate deeper into the lungs and are responsible for the most severe health effects.

Black Carbon

A further problem associated with tiny particles is their ability to act as "sponges" carrying small amounts of toxic species such as PAH's and Dioxins which are adsorbed onto Black Carbon particles and transported deep into the body. PM10 and PM2.5 monitoring measurements provide a total figure for everything with mass in the sample and thereby assume that all particles are of equal significance. In reality this is not the case because some of the particles are benign from a human health perspective or are not anthropogenic so are of less interest from an air quality management perspective.

It is fortunate that the fine particles (from the combustion of fossil fuels) that are of most interest are Black Carbon and can be measured with an Aethalometer, which employs an optical method to only measure those fine particles which are black. Importantly, an Aethalometer can provide a real-time readout of the mass concentration of 'Black' or 'Elemental'



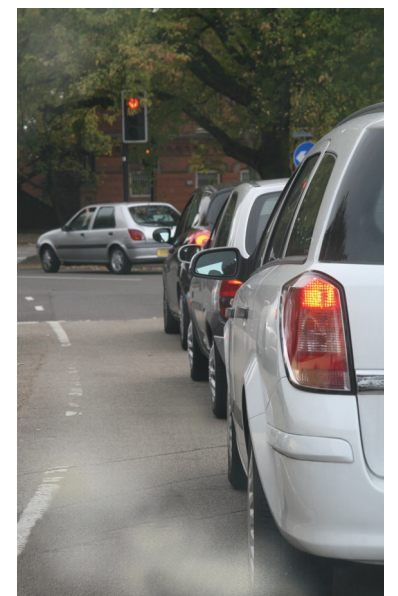
Black Carbon can be monitored with an Aethalometer

carbon aerosol particles in the air which means that live data can be used to manage the main contributor of urban Black Carbon: road traffic. However, while the importance of Black Carbon is becoming widely acknowledged, air quality monitoring standards need to be adapted so that Black Carbon monitoring is included in all national ambient monitoring stations.

A further consideration with Black Carbon is its role in climate change because, after carbon dioxide, it is believed to be the second largest contributor to current global warming. Black Carbon increases global warming by absorbing sunlight, darkening snow and influencing the formation of clouds; its effects are most noticeable at the poles, on glaciers and in mountainous regions – all of which are exhibiting the greatest effects of climate change.

Black Carbon stays in the atmosphere for a relatively short period of time – from days to weeks, before falling to ground as a result of dry deposition or precipitation. This is an important consideration in global strategy to combat climate change because CO₂ stays in the atmosphere for many decades, so emissions reductions will take a long time to have an effect, whereas efforts to reduce Black Carbon could have a much faster beneficial impact on global warming.

In June 2011, a UN Environment Programme (UNEP) study estimated that 'near-term' global warming could be quickly reduced by 0.5 degrees Celsius with a reduction in Black Carbon emissions and that this would have an even greater benefit in the Arctic where it could reduce warming by 0.7 degrees.



Global action

The importance of short-lived pollutants was recognised by the eight richest industrialised nations which agreed to take emissions reduction measures for short-lived climate pollutants, including Black Carbon, methane, ground-level ozone and hydro fluorocarbons at the recent G8 meeting in Maryland USA.

The Camp David Declaration of May 2012 included the following:

'Recognizing the impact of short-lived climate pollutants on near-term climate change, agricultural productivity, and human health, we support, as a means of promoting increased ambition and complementary to other CO₂ and GHG emission reduction efforts, comprehensive actions to reduce these pollutants, which, according to UNEP and others, account for over thirty percent of near-term global warming as well as 2 million premature deaths a year. Therefore, we agree to join the Climate and Clean Air Coalition to Reduce Short-lived Climate Pollutants.'

UK air quality

In common with most of Europe, the air quality improvements of recent decades have stalled and the UK is failing to meet many domestic and European air quality targets. The main parameters of concern are Nitrogen Oxides (from vehicles and electricity

generation), Ozone (formed by a reaction between nitrogen oxides and organic gases) and Particulates (from combustion sources).

In 1952 over 4,000 Londoners (above the 'normal' mortality rate) are believed to have died as a result of the Great Smog and this led to the introduction of the Clean Air Act of 1956. However, in 1992, the Department of Health set up a Committee on the Medical Effects of Air Pollutants (COMEAP) which concluded that up to 24,000 deaths were still being 'brought forward' in the UK in 1995/1996 due to the effects of air pollution.

More recently, the UK Parliament's Environment Audit Committee published a report which highlights the UK's poor performance on air quality, but Defra disagreed with many of the report's recommendations. In February the Committee's Chair, Joan Walley MP wrote to Rt Hon Caroline Spelman MP, the then



The new 'AQMesh', allows air quality to be monitored in almost any location

Secretary of State, at Defra saying "It is particularly disappointing to note that Defra will not be undertaking any significant work to engage with the public about the risks to health from air pollution and action that people can take to reduce these." In Mrs Spelman's reply she said: "The Public Health Outcomes Framework announced in January provides an important opportunity for this and we are working with the Department of Health colleagues to embed air quality as a priority for Directors of Public Health and to promote awareness and engagement on air quality locally. Moreover as was stated in the response, the Government already provides significant funding to local authorities to engage with business and the public to promote air quality in innovative ways. This approach presents a sustainable route to better understanding of air quality and of the action needed to reduce exposure."

Public awareness

Local Authorities monitor ambient air quality and publish data for the benefit of the public. However, as a result of public sector cutbacks environmental health professionals are focused on maintaining performance whilst implementing cost savings. Nevertheless, there are a number of opportunities for improvement; air quality needs to be higher on the political agenda and this can only be achieved if more people are aware of the problems, so we have to find ways to make it simpler for people to access easy to understand data. Happily, technology has advanced considerably and it will soon be possible to install ambient monitoring stations that are much smaller, several times lower in cost and yet still able to provide accurate parts per billion ambient air quality data.

Because it is so small, and can be bolted to a lamp post, this new technology, known as 'AQMesh', allows air quality to be monitored in the locations that need to be monitored rather than where equipment can be conveniently positioned. The AQMesh 'pods' are completely wireless, using battery power and GPRS communications to transmit data for the main air polluting gases to 'the cloud' where sophisticated data management will generate highly accurate readings as well as monitor hardware performance.

Traditional ambient monitoring stations have often been criticised because their physical location may limit their ability to provide representative data, so the ability to site low cost AQMesh pods in multiple locations, close to vehicles, passengers and pedestrians, will be a tremendous advantage.

'What gets monitored, gets managed'

Marcus Pattison, one of the organisers of AQE 2013 (the air quality and emissions monitoring event) is a firm believer in the critical importance of monitoring for driving improvements. He says "The



Traditional ambient monitoring station

air quality progress that we have seen in recent decades has largely resulted from our ability to set targets and monitor our performance against them and this is why the Environment Agency, local authorities and the Source Testing Association are the driving forces behind events such as AQE 2013."

AQE 2013 (www.AQEshow.com) will be the world's largest event to focus specifically on air quality monitoring and 2013 will be the seventh in this series of specialist air monitoring events. Taking place at the International Centre in Telford, UK, on 13th and 14th March, the event will be comprised of: a Conference providing updates on legislation, monitoring standards and technologies; Workshops providing practical advice and case studies, and an Exhibition featuring almost all of the world's leading providers of monitoring equipment and services.

AQE 2013 will focus on industrial emissions and stack monitoring of regulated processes including the emissions to air of smaller processes which are controlled by local authorities, in addition to several new aspects of air quality protection.

Marcus Pattison is obviously delighted that Janez Potočnik has designated 2013 as the 'Year of Air' because "It creates a 'perfect storm' of activity in air quality; the new Industrial Emissions Directive is now in place, public awareness of air quality issues is growing and the Commissioner's work will help to ensure progress, so I believe that AQE 2013 will be a timely event, making a powerful contribution to 2013 becoming the Year of Air."



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Mars Rover Curiosity Equipped with Pressure and Humidity Sensors

As NASA's Mars Curiosity rover is examining the soil in the Gale Crater to see if it ever offered conditions favourable for supporting life, Vaisala's (Finland) pressure and humidity sensors onboard the rover are also hard at work. The sensors are on Mars as a part of instrumentation designed by the Finnish Meteorological Institute (FMI), and they are used to gather pressure and humidity readings in the extreme environmental conditions of the Martian atmosphere.

Vaisala has provided the project with standard Vaisala HUMICAP humidity sensors and specially customised Vaisala BAROCAP pressure sensors. First introduced in 1973, Vaisala HUMICAP was the world's first thin-film capacitive humidity sensor and a radical innovation that changed humidity measurements for good. Similarly, Vaisala BAROCAP was developed in early 1980s as a new pressure-sensing technology based on silicon processing.

Both sensor technologies are used widely in Vaisala's own humidity and pressure sensing products and systems. Thanks to their superior long-term stability and accuracy as well as their ability to tolerate dust, chemicals and otherwise harsh environmental conditions, the technologies are especially suitable for demanding industrial applications used by a wide range of industries from power and steel to life science and building automation.

