Ambient Air Emission Monitoring

The science and application of atmospheric emissions monitoring and control covers a very wide technological field. It is therefore important that the technology, science and operating procedures are matched carefully. Failure in any aspect of this process can result in errors in data and cause potentially expensive mistakes.

With technology advancing at a rapid pace in the world of electronics and computing, the science and practice of source testing has continued to improve. Members of the STA are committed to providing a high quality of service and, since its inception; the Association has been striving to achieve this objective.

Reliable source testing is a key element of regulatory control of industrial processes. It can provide evidence of compliance with legislative limits and information on actual releases to the environment.

The Source Testing Association (STA) was established in 1995 and no has a corporate membership of over 200 companies from process operators, regulators, equipment suppliers and test laboratories. Its aims and objectives are;

(i) contribute in the development of industry standards, codes, safety procedures and operating principles;
(ii) encourage the personal and professional development of practicing source testers and students;
(iii) maintain a body of current sampling knowledge;
(iv) assist in maintenance of a high level of ethical conduct;
(v) seek co-operative endeavours with other professional organisations, institutions and regulatory bodies, nationally and internationally, that are engaged in source emissions testing.

The STA has been working very closely with the Environment Agency, who regulates England and Wales, over the last 10 years in the development of Agency's Monitoring Certification (MCERTS) schemes. The MCERTS schemes have been expanded to cover all aspects emission monitoring.

In this issue of IET we will concentrate on the MCERTS scheme for Continuous Ambient Monitors.

Ambient Monitoring in the UK and EC Directives

For the purpose of monitoring and reporting air pollution the UK has been divided into regions (or zones) and urban areas (or agglomerations), in accordance with EC Directive 96/62/EC.

There are sixteen regions defined for reporting levels of air pollution. They match: the boundaries of England's Government Offices for the Regions the boundaries agreed by the Scottish Executive, National Assembly for Wales and Department of the Environment in Northern Ireland.

There are twenty-eight defined urban areas (population greater than 250,000), of which sixteen are used on this site and elsewhere to report the current and forecast levels of air pollution.

Directive 96/62/EC sets a framework for how the UK must monitor and report ambient levels of air pollutants. The UK has been divided into zones and agglomerations within which the pollutants will be monitored. A definition of zones and agglomerations is provided above.

Directive 99/30/EC sets ambient air limit values for nitrogen dioxide and oxides of nitrogen, sulphur dioxide, lead and particulate matter.

Directive 2000/69/EC sets ambient air limit values for benzene and carbon monoxide.

Directive 2002/3/EC sets ambient air limit values for ozone.

There are over 1500 monitoring sites across the UK which monitor air quality and these are organised into networks that gather a particular kind of information, using a particular method. The pollutants measured and method used by each network depend on the reason for setting up the network, and what the data is to be used for. There are two major types - automatic and non-automatic networks. There are currently 4 automatic networks and 11 non-automatic networks, funded by Defra and the Devolved Administrations, across the UK.

Increasingly process operators are being asked to produce ambient monitoring data from their plants and when this is required MCERTS approved equipment should be used.

Environment Agency Monitoring Certification Scheme (MCERTS)

The Environment Agency has established its Monitoring Certification Scheme: MCERTS to deliver quality environmental measurements. The scheme provides for the product certification of instruments, the competency certification of personnel and the accreditation of organisations based on international standards. The term

'organisation' is used generically. It includes commercial 'test houses', laboratories, and industrial operators' in-house monitoring arrangements. MCERTS is progressively being extended to cover all regulatory monitoring activities.

MCERTS - Continuous ambient air quality monitoring systems

MCERTS was extended to continuous ambient air quality monitoring systems (CAMs) to provide a means of demonstrating compliance with the requirements of the Air Quality Framework and Daughter Directives. It has been developed to help industry and other organisations select suitable systems for monitoring ambient air quality and to promote public confidence in air quality data. Including ambient air quality instrumentation in the scheme enables the Agency to gather more reliable information on the environmental impacts of regulated industries and to fulfil its regulatory obligations in this area.

MCERTS for ambient air quality monitoring systems covers instrument systems that measure nitrogen monoxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM10 and PM2.5), lead, cadmium, arsenic, nickel and mercury, benzene and polyaromatic hydrocarbons (PAHs).

The instruments are tested against a range of performance criteria in line with the forthcoming CEN standards to give users of the monitoring equipment confidence in their robustness and ability of delivering accurate and reliable data.

The main instrument performance characteristics against which a CAM is assessed by a combination of laboratory and field testing are:

- response time, consisting of rise lag time, rise time, fall lag time and fall time (where applicable);
- laboratory repeatability standard deviation;
- zero and span drifts;
- accuracy of sample collection in the case of certain particulate CAMs, and in the case of all CAMs that monitor metals and polycyclic aromatic hydrocarbons (PAHs)];

- detection limit;
- averaging of short-term fluctuations in determinand concentration (where applicable);
- linear fit;
- cross-sensitivity to interfering substances;
- NOx converter efficiency test (where applicable);
- carry-over (where applicable);
- flow accuracy and stability (where applicable);
- influence of atmospheric sample
- pressure and temperature;
- susceptibility to physical disturbances (where required);
- field performance of the CAM against a reference method where this is available, and/or against another CAM field repeatability;
- long-term zero and span drift;
- availability (maintenance interval).

The European Standards under development.

There have been various schemes and approval of instruments in some European Counties for a number of years for example TUV approval in Germany, MCERTS in UK ,

approval and testing of equipment by INERIS, France and CESI, Italy. The CEN (Comite European de Normalisation) technical committee (TC) 264, which looks after air quality issue, formed a working group (WG22) in 2001 to develop a standard for a European certification scheme for automatic measurement systems for ambient and stack mounted equipment. The standard will be published in four parts;

Part 1: General Aspects covers;
1. Roles and responsibilities
2. Certification procedure

Part 2: Minimum requirements for product quality assurance, initial assessment and post certification surveillance covers;
1. Management responsibility
2. Resource management
3. Product realisation
4. Measurement, analysis and improvement
5. Assessment

Part 3: Performance criteria and test procedures for automated measuring systems for monitoring emissions from stationary sources covers;
1. General requirements
2. Performance criteria common to all AMS for laboratory testing
3. Performance criteria common to all AMS for field testing
4. Performance criteria specific to measured components General test requirements
5. Test procedures for laboratory tests
6. Requirements for field tests
7. Test procedures common to all AMS for field tests
8. Test procedures for particulate AMS

Part 4: Performance specifications and test procedures for automated measuring systems for monitoring ambient air quality covers;
1. General requirements for ambient AMS systems
2. General requirements for laboratories
3. Type approval of AMS
4. Performance characteristics and performance criteria of for ambient air gas monitoring AMS
5. Performance characteristics and performance criteria of AMS for ambient air particulate matter (pm10 and pm2.5)

It is anticipated that part 3 will be published in 2007 with parts 1, 2 and 4 following in 2008.

The Environment Agency is working towards implementation of the various parts of the standards as and when they are published. This will mean modification to the MCERTS schemes for CEMS and CAMS. *For more information refer to Environment Agency web site www.mcerts.net*

Contacts for Scheme Operators and Technical Support for the MCERTS Schemes

For general information visit www.mcerts.net

MCERTS air schemes for:
- Continuous emissions monitoring systems
- Portable systems for air emissions monitoring
- Continuous ambient air quality monitoring systems
- Manual stack emission monitoring Scheme operators;

SIRA Environmental Ltd
www.sira.co.uk
Telephone +44 (0) 1322 520500
UKAS for Manual stack monitoring organisation accreditation
http://www.ukas.com/
Tel +44 (0) 20 89178400
Technical support

Source Testing Association
www.s-t-a.org
Tele +44 (0) 1462 450705

MCERTS water schemes for;
- Continuous water monitoring equipment
- Portable water monitoring equipment
- Self-Monitoring of effluent flow Scheme operator;

SIRA Environmental Ltd
www.sira.co.uk
Telephone +44 (0) 1322 520500
Technical support

WRC
www.wrcplc.co.uk
Tele +44 (0) 1793 865000

MCERTS - Chemical testing of soils
Scheme operator

UKAS
http://www.ukas.com/
Tel +44 (0) 20 89178400

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Continuous NH_3 Monitoring in Swiss National Air Quality Network

Omnisens Trace Gas Analyser TGA300 are photoacoustic based devices designed and optimized for continuous and automated ammonia measurement at sub-ppb level with high temporal resolution. These combined featured are crucial for the survey of NH_3 at national and international level and for understanding its role in the formation of ambient fine particulate matter (PM2.5). The time resolution and the intrinsic high dynamic range (0 to 6ppm) allow monitoring the contribution of farming activities like manuring whilst the excellent resolution (0.1ppb) is ideal for the measurement of ambient levels resulting from local emission and transboundary pollution, and for the validation of the associated theoretical models.

In 2002, EMPA, a Swiss institute responsible for air quality monitoring, and **Omnisens** started a successful collaboration in view of providing analyzers suitable for an automated network. Following a year test phase, the instruments were gradually deployed in the so called NABEL network, made of 16 fully automated stations spread over the Swiss territory, featuring urban and agricultural areas up to the alpine summits. TGA310 are currently installed at representative locations in the network. These activities are complemented by a dense network of passive samplers measuring NH_3 as two weeks average values.

Apart from continuous measurement of NH_3 in Switzerland, TGA310 provided important scientific results. For instance a correlation between NH_3 concentration and road traffic was demonstrated and, at rural sites, the NH_3 concentration was found to be in thermodynamic equilibrium with the aerosol phase during most time of the year.

Building on the Swiss experience, TGA310 are now gradually deployed in Europe and Japan.

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Trace Gas Detectors

Pranalytica (USA) announces the availability of trace gas sensors for the detection of acrolein (C_3H_4O; CAS Number: 107-02-8). The Chemilux™-Acrolein sensor uses Pranalytica's proprietary and patented tunable laser based O-Nose™ technology to provide sub-ppb (1 ppb of acrolein corresponds to 2.31 Ìg/m³) detection sensitivity for the toxic gas in a measurement time of less than one minute. The O-Nose™ technology assures minimal interference from many other gaseous components found in urban atmosphere thus provides a very low false positive detection capability.

Acrolein is used primarily as an intermediate in the manufacture of acrylic acid and is also used directly as an aquatic herbicide and algaecide in irrigation canals. It is found in gaseous form in the products of combustion of tobacco, cooking oils, fossil fuels and gasoline. It is produced during fires and is a toxicant to firefighters. Urban acrolein levels as high as 20 Ìg/m³ (~9 ppb) have been reported. Acrolein levels in inside air, especially if tobacco smoking is permitted, can be even higher.

Human odor threshold for acrolein is 370 Ìg/m³. NIOSH recommended exposure limit (8-10 hour time-weighted average exposure) for acrolein is 250 Ìg/m³ (i.e., 108 ppb). Pranalytica's Chemilux™-Acrolein sensor can provide more than adequate level of margin for assuring human safety in work as well as urban environments.

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