Summary

Emissions monitoring from stationary sources within Europe is about to experience a major transformation. Changes in European legislation governing the monitoring and reporting of airborne emissions will radically change the way in which people approach the issues of buying, installing, validating and operating emissions monitoring products. These changes are in progress now, they will continue to be phased in over the next few years and are likely to continue to have an impact on the market for many years to come. This is probably the most significant change to impact the emissions monitoring business since automated monitoring began in Europe.

Background

The development of the European Community has brought with it the requirement for harmonisation and consistency throughout the community. This is resulting in the formation and enforcement of new pan-European directives on many issues, including the area of pollution monitoring, prevention and control. These directives are legally binding on all member states and hence signal an end to the historical differences in the way controls have been implemented and enforced in individual member countries.

The Driving Force and Road Ahead

Within Europe, airborne emissions from incinerators, power plants and solvent-using processes are controlled by various EU directives. The number and scope of these types of directives will increase with time. Parliaments of member states will be required to produce and submit emissions inventories to Europe. National ’competent bodies’ (e.g. the Environment Agency in the case of the UK) will interpret and enforce the requirements of the directives and the standards they specify.
What Does It Mean In Practical Terms?

The first implication of the changes is that emission limits for particular types of plant will be consistent throughout Europe, save for a few exceptional cases.

Highly significant for the ‘would be’ purchaser of monitoring equipment is that the directives dictate that monitoring will be performed according to certain standards. The aim of these standards is to ensure that the accuracy, relevance and quality of data presented to Europe by member states is consistent, allowing sensible comparison. These standards will result in significant change in the way that ‘emissions monitoring’ equipment is purchased, commissioned and operated.

The directives state an order of precedence regarding the application of standards. Where available, CEN standards will be used. If no CEN standard is available, then other standards can be used. The most significant new CEN standard is EN14181 - Quality Assurance of Automated Measuring Systems. Automated Measuring System (AMS) being the new European term for CEMS (continuous emissions monitoring system).

EN 14181 – QA of Automated Measuring Systems

EN14181 was approved by CEN on 3rd November 2003 and officially released in July 2004; it is now in force!

A Change of Culture

In years gone by, most European states with the notable exception of Germany went about the supply, installation, commissioning, operation and maintenance of monitoring systems in a fairly relaxed manner, with little in the way of regulation. In most instances this permitted just about any sensible instrument to be installed, with ongoing calibration and maintenance etc. left as a matter for negotiation between the operator and local enforcement officer. Those days are fast disappearing; EN14181 will mean that:

- All emissions monitoring instruments will need to hold some form of approval e.g. TUV, MCERTS etc.
- It will be necessary to demonstrate mathematically that instruments will be suitable for each and every application prior to sale/installation.
- Formal and expensive post commissioning validation will be required.
- The long established fundamental principle of calibrating instruments against certified calibration gases will be replaced by that of calibration against Standard Reference Methods (SRM’s)
- Operators will be required to implement a quality assurance system to prove ongoing compliance. Validation exercises will be required both annually and five yearly for large combustion plants and 3 yearly for waste incineration plants.
- Maintenance activities will be controlled by the QA programme, no more quick fixes while no one is looking and all activities will need to be properly documented, in the QA dossier.
Scope

EN14181 describes the entire framework for emissions monitoring required by European Directives. It begins by detailing a ‘desktop’ assessment method to determine whether monitoring equipment is suitable for a particular application, prior to purchase. It then extends through installation, commissioning, operation and maintenance for the entire life of the plant. In some areas it specifies the requirements in depth itself, in other areas it refers to other standards for further detailed information. This document is the single most significant source of change in this new era.

It is split into four main sections, as follows:

- **QAL 1** – Desktop verification of suitability for any specific application.
- **QAL 2** – In-depth commissioning and independent validation.
- **QAL 3** – Ongoing quality assurance programme.
- **AST** – Annual Surveillance Test, an ongoing re-validation programme.

(QAL stands for ‘quality assurance level’)

The Main Points!

**QAL 1 - pre-sale!**

Under EN 14181, before an AMS can be installed it must first be proven to be suitable for the intended application; this process is called QAL 1.

In order to demonstrate QAL 1 compliance, the ‘uncertainty’ of the measurement must be compared with ‘uncertainty budgets’ set in the relevant directive. In order to calculate the measurement uncertainty it is necessary to know certain information about the application. More importantly however it is necessary to have detailed performance data relating to the product. This data must have been gained both in laboratory and field trials. This virtually insists that the AMS has completed some form of performance testing e.g. TUV or MCERTS.

See appendix A for a list of uncertainty budgets.

**QAL 2**

Installation

Part of the system validation will be to ensure that the sample point provides a representative sample. Hence before installation commences it will be necessary for traverses of the stack to be made and the results assessed to confirm whether or not the sampling location provides a representative sampling location.

Commissioning & Validation

Commissioning will essentially continue as previous, however the implications of commissioning mistakes or oversights will be far more significant. This will increase the need for a comprehensive commissioning program undertaken by experienced professionals.

Following normal commissioning will come full-scale validation, called QAL 2. This process will involve teams of specialists and equipment from independent test laboratories for periods from 1 week to 1 month and involve the plant changing operating conditions to suit the tests. This is likely to be very expensive and should the tests indicate that the AMS does not meet the requirements, corrective action and full re-validation would be required, again potentially a very expensive outcome.

The process will require close co-operation of the Operator, the supplier of the AMS and the independent test laboratory. Given the magnitude of the task and the significance of failure, QAL 2 represents a significant management task. Clear boundaries, co-operation and good communication between all parties will be the key to success.
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QAL 3 - Ongoing Operation And Maintenance

The QAL 3 section of EN 14181 governs the ongoing quality assurance of the AMS and the data it generates. This essentially requires that the owner operate a quality assurance program to ensure the accuracy and reliability of data is acceptable. It covers all aspects of documentation, maintenance and calibration. In addition to having quality systems in place to manage spare parts, maintenance activities and record keeping etc., it also requires compliance with a number of operational criteria. The key criteria and actions being:

<table>
<thead>
<tr>
<th>Monitoring Requirement</th>
<th>Corrective Action</th>
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<tbody>
<tr>
<td>Monitor analyser drift</td>
<td>Perform corrective action, calibrate analyser and reset drift monitoring.</td>
</tr>
<tr>
<td>Analyser zero drift exceeds limit</td>
<td></td>
</tr>
<tr>
<td>Analyser span drift exceeds limit</td>
<td></td>
</tr>
<tr>
<td>Confirmation of plant operation within the valid calibration range</td>
<td>Repeat QAL 2 within 6 months if criteria exceeded.</td>
</tr>
<tr>
<td>Compliance criteria:</td>
<td></td>
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<tr>
<td>No more than 40% of values in a week exceed the range or</td>
<td></td>
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<tr>
<td>No more than 5% of values per week for 5 weeks in a year</td>
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Any and all maintenance activities will fall under the ongoing quality assurance programme. Maintenance staff will have to be particularly careful of the actions that they take. Everything must be justified and documented; documentation will be required to account for both 'before and after' situations. Unconsidered action could turn out to be very costly.

Local Interpretation

Whilst EN14181 is a European standard and should be applied uniformly across Europe there is a good chance that there will be limited regional differences. The process of issuing standards is that individual member states will adopt the CEN standards such as EN14181 as national standards without alteration. In addition member states will most probably issue Method Implementation Plans (MIPs) detailing exactly how the standards will be implemented in each country. It is in these MIPs that subtle differences may occur. Whilst the MIPs cannot change the basic fundamentals of the standards they do have the power to apply an alternative interpretation to the original intent of the standard.

Timescales

At this stage it is unclear as to how quickly the new regulations will be enforced and it will almost certainly vary from country to country. However it is clear that each member state will come under increasing pressure from Europe to ensure compliance. The EU is currently taking legal action against several member states for failure to meet implementation deadlines.
Appendix 1 – Directive Uncertainty Budgets

The table below shows EU directive uncertainty budgets, expressed as percentages of the emission limit values. The 95% confidence intervals of measured values must not exceed these allowances.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Carbon Monoxide – CO</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Sulphur Dioxide – SO₂</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Nitrogen Dioxide – NO₂</td>
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<td>20</td>
</tr>
<tr>
<td>Total Dust</td>
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<td>30</td>
</tr>
<tr>
<td>Total Organic Carbon - CₓHᵧ</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Chloride – HCl</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Fluoride - Hf</td>
<td>40</td>
<td></td>
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