Manual stack emission monitoring
Performance standard for organisations

Environment Agency
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Version 7.2

mCERTS
THE ENVIRONMENT AGENCY'S
MONITORING CERTIFICATION SCHEME

Record of amendments

Version number	Date	Section	Amendment
7.1	Jan 11	5.6.8	Added requirement on use of BS EN 1911
		5.9	Revised information on PT schemes
		Annex B	Added a table summarising the use of portable instruments
7.2	Nov 11	5.6.8	Deleted Section 5.6.8 about the conditioning test in BS EN 1911
		5.9	Deleted information on PT schemes. Stated that there are no additional requirements to EN ISO / IEC 17025 in this section
		5.10.4	Added note about reporting sampling and analysis information specified by individual monitoring methods
		5.10.5	Added information about opinions and interpretation in reports
		Annex D	Amended section on “Details of monitoring” in the SSP (removed requirement to state the effect on uncertainties of modifying a technical procedure).
		Annex E	Amended information on numbering reports
			Clarified that a separate appendix is not needed for each emission point
			Clarified information on reporting analytical results

Status of this document

This standard may be subject to review and amendment following publication. The most recent version is available on our website at:

www.mcerts.net

Feedback

If you have any comments on this document please contact Rupert Standring at rupert.standring@environment-agency.gov.uk

Foreword

We set up our Monitoring Certification Scheme (MCERTS) to provide a framework of standards you can use to monitor things that affect the environment. MCERTS covers:

- the standards of performance that your monitoring equipment must meet;
- the level your staff must be qualified to; and
- accrediting laboratories and inspecting sites in line with European and international standards.

The standard we focus on in this document sets out what you must do if you want to get accreditation from us to monitor pollution released from chimney stacks.

You can apply to MCERTS as an individual or as an organisation. This document sets out the performance standard for organisations. You can get a separate document, which focuses on people, from the contact details at the end of this foreword.

Under MCERTS, organisations must be accredited by the United Kingdom Accreditation Service (UKAS) to show they have reached the standard set out in this document. The standard focuses on how you should plan, carry out and report on the monitoring you do.

Planning involves reviewing the site where you want to do the work. This review includes a risk assessment to make sure the work can be done safely.

Skilled people must carry out the work using internationally recognised methods.

You must report on the work you have done, using the format we ask you to.

The benefits of this standard

- The standard makes sure that information on pollution released from chimney stacks is reliable.
- Everybody in the competitive market of monitoring pollution from chimney stacks will be working towards the same standard.
- The standard sends a message that measuring pollution from chimney stacks is an important part of producing reliable information for regulatory purposes.
- By setting quality standards which everybody must work towards, the standard promotes and raises the professional reputation of people and organisations involved in monitoring pollution from chimney stacks.

If you have any questions about what you need to get an accreditation, please contact:

UKAS
21 – 47 High Street
Feltham
Middlesex
TW13 4UN.

Phone: 020 8917 8400
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You can get more information on MCERTS, including the standards related to monitoring pollution from chimney stacks, from our website at www.mcerts.net.

Contents

MCERTS performance standard for organisations carrying out manual stack emission monitoring

Introduction

Manual stack emission monitoring for regulatory purposes includes measurements for:

- determining compliance with numerical limits in permits;
- the calibration of continuous emission monitoring systems (CEMs);
- field testing of CEMs for type approval;
- acceptance trials on new pollution abatement plant or alternative fuel applications; and
- determining emission factors for use in emissions trading and inventory reporting.

Note 1: Stack emission monitoring is a general term used to describe the preparation work prior to a measurement campaign, undertaking the site work, calculating the monitoring results and producing the final report for the client. In most cases the client is a process operator.

The extension of MCERTS to include manual stack emission monitoring is built on proven international standards to ensure good quality monitoring data. The scheme is split into two components – the certification of personnel to the MCERTS personnel competency standard and the accreditation of stack emission monitoring organisations to the MCERTS performance standard for organisations.

The general requirements for the competence of testing laboratories are described in the International Standard EN ISO/IEC 17025. This contains all the requirements laboratories have to meet if they wish to demonstrate that they operate a quality system, are technically competent, and are able to generate technically valid results.

Note 2: Laboratories are referred to as stack-emission monitoring organisations (organisations) throughout this performance standard. This covers both independent monitoring organisations and those which have in-house monitoring teams.

EN ISO/IEC 17025 recognises at paragraph 1.6 Note 1 that it might be necessary to explain or interpret certain requirements in this International Standard to ensure that the requirements are applied consistently.

This MCERTS performance standard provides criteria for the application of EN ISO/IEC 17025 in the specific field of monitoring of emissions from stationary sources (for example, chimney stacks). In producing this MCERTS standard, the guidance for establishing applications for specific fields given in Annex B of EN ISO/IEC 17025 has been followed.

Note 3: European Technical Committee CEN/TC264 “Air quality” published CEN/TS 15675:2007 Measurement of stationary source emissions – Application of EN ISO/IEC 17025:2005 to periodic measurements. This MCERTS standard is aligned with the CEN technical specification.

The structure of this document follows the structure of EN ISO/IEC 17025. This standard does not re-state the provisions of EN ISO/IEC 17025. Monitoring organisations are reminded of the need to comply with all the relevant criteria detailed in EN ISO/IEC 17025.

This standard should be used in conjunction with its companion standard the MCERTS personnel competency standard. This is available on our web-site at www.mcerts.net

1. Scope

The monitoring of stack emissions is often called measurement, testing or sampling. In this document, the term monitoring is used except where the specific meanings of the alternatives are more appropriate.

The manual monitoring of stack emissions can involve taking samples for laboratory analysis, the in-situ determination of flue gas physical parameters such as temperature, pressure and flow rate, and of particulate loadings by isokinetic sampling, and the in-situ periodic instrumental monitoring of pollutants. Its primary use is for regulatory purposes, including measurement for determining compliance with authorised numerical limits, calibrating continuous emission monitoring systems and acceptance trials on new pollution abatement plant.

The monitoring of emissions from stationary sources can be undertaken for a wide range of substances using various methods. Details of methods are provided in our Technical Guidance Note M2.

Accreditation of organisations to this performance standard will demonstrate that they meet our MCERTS requirements for regulatory monitoring of stack-emissions from stationary sources.

The MCERTS standard contains both technical and health and safety requirements. Compliance with regulatory and safety requirements on the operation of laboratories is not covered by EN ISO/IEC 17025. However, carrying out stack-emission monitoring is hazardous (for example, working at heights, lifting equipment, exposure to chemicals); and, if correct health and safety practices are not adhered to, the quality of the monitoring is often compromised.

The health and safety requirements are set out to ensure that organisations have a health and safety management system and are following safe systems of work (for example, undertaking risk assessments). UKAS will audit whether these systems are in place – it is not auditing the adequacy of the systems. However, if UKAS assessors observe poor health and safety practice they will inform us.

The Environment Agency have an agreement with UKAS regarding the operation of MCERTS for manual stack emission monitoring. This agreement allows us to use information supplied by UKAS, as part of our regulatory duties.

The Environment Agency may carry out its own inspections and investigations and act upon their findings for organisations accredited to ISO/IEC17025 for the MCERTS performance standard.

2. References

BS EN ISO 14956 Evaluation of the suitability of a measurement method by comparison with a stated measurement uncertainty

EN ISO/IEC 17024 Conformity assessment - General requirements for bodies operating certification of persons

EN ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories

MCERTS Personnel Competency Standard, Environment Agency

Technical Guidance Note M1, Sampling requirements for monitoring stack emissions to air, Environment Agency

Technical Guidance Note M2, Monitoring of stack emissions to air, Environment Agency

Risk assessment guide: industrial emission monitoring, *Source Testing Association*

MCERTS Performance standards and test procedures for CEMs, Environment Agency

BS EN 14181 Quality assurance of automated measurement systems

Method Implementation document for EN 14181, Environment Agency

3. Terms and definitions

Alternative method – a method that has been proved equivalent to a standard reference method.

Competent authority – organisation responsible for implementing environmental legislation (for example, in England and Wales the Environment Agency).

Duct - structure that conveys waste gas.

Emission limit value – the numerical limit on an emission, which may not be exceeded during one or more periods of time.

Field blank – a measurement sample taken at the plant site in an identical manner to the normal samples in the series, except that no gas is sampled.

Job file – file in which details of the stack emission measurement campaign for an individual site are recorded.

Measurement campaign (measurement objective) – scope of work required on a particular site for a specific time period.

Measurement series – one or several measurements of the same measureand carried out at the same sampling plane, and at the same process operating conditions.

Method Implementation Document – document published by the Environment Agency outlining it's interpretation of a method.

Periodic measurement (manual measurement) - determination of a measureand at specified time intervals. The specified time intervals can be regular (e. g. once every month) or irregular. Measurands can include the amount, quantity or physical property of an emission. Measurements are usually made using portable equipment for typically less than 24 hours.

Reference method - measurement method taken as a reference by convention, which gives, or is presumed to give, the accepted reference value of the measurand. These methods are listed in M2.

Note: The method is a standard reference method if it is prescribed by European legislation.

Risk assessment – an assessment of the health and safety hazards and associated risks involved in stack measurement at a specific work location.

Sampling location – a suitable position on the plant where representative samples can be obtained.

Site specific protocol (Measurement plan) - the installation specific application of an organisation's technical procedures. A protocol describes how the measurement method is employed in a given situation.

Site record sheets - sheet on which the laboratory's on-site measurement data and operations are recorded at the time they are made.

Site review – a visit conducted by the organisation before undertaking stack emission measurements to ensure the physical and logistical situation is fully understood before arriving on-site to conduct work. The review provides essential information for determining the site-specific protocol.

Stack - structure through which waste gas is released to atmosphere. Stacks are intended to be of sufficient height to adequately disperse emissions in the atmosphere. Measurement of emissions may be carried out in ducts and stacks.

Stack emission monitoring organisations – organisations that undertake the measurement of emissions to air from stationary sources. This can include work undertaken at the laboratory's permanent facilities, at sites away from their permanent facilities and in temporary or mobile laboratories.

Standard reference method – see reference method.

Technical procedure (operating procedure) – the organisation's detailed written procedures on how to perform a method in line with its quality system.

Testing laboratory - laboratory that performs tests. A testing laboratory may undertake work at permanent facilities, at sites away from their permanent facilities and in temporary or mobile laboratories. The sampling and analysis stages may occur at different locations.

UKAS – the United Kingdom Accreditation Service, the body appointed by the Government to assess and accredit organisations that provide testing services to international standards, for example EN ISO/IEC 17025.

4. Management requirements

a) Ethical requirements

4.1 Stack emission monitoring shall be carried out by an organisation that is free from any commercial, financial and other pressures that might influence their technical judgement. Process operators using in-house monitoring teams shall have management structures that ensure this requirement is met.

b) Auditing

Accreditation is through a programme of laboratory and site based audits carried out by UKAS.

Note: UKAS audits will be complemented by a programme of Environment Agency audits.

Some laboratory and site based audits will be carried out on an “unannounced” basis. Stack emission monitoring organisations shall co-operate, when required, in planning these audits. For unannounced site based audits the organisations, when requested, shall provide information to UKAS, in advance, of the MCERTS accredited work they plan to carry out.

c) Health and safety

4.2 An organisation shall implement a health and safety policy addressing the hazards and associated risks to health and safety in the activities associated with stack emissions monitoring.

d) Subcontracting

4.3 Organisations are permitted to subcontract monitoring activities to another organisation accredited under MCERTS for that work. It is the responsibility of the organisation to ensure that the subcontracted organisation is accredited under MCERTS for the scope of work. If analytical work is subcontracted, it shall be to an organisation that has accreditation to EN ISO/IEC 17025 for the scope of work.

4.4 Where individuals are employed on a subcontracted basis by an organisation, the organisation shall ensure that the individual is certified under the MCERTS personnel competency scheme to the required level.

5. Technical requirements

5.1 General

No additional requirements to EN ISO/IEC 17025.

5.2 Personnel

5.2.1 Monitoring organisations shall use personnel with appropriate MCERTS certification to carry out stack emission measurements.

Note: The MCERTS personnel competency standard defines three levels - an entry level (trainee), Level 1 (technician) and Level 2 (team leader).

5.2.2 Trainees are permitted only to carry out stack emission monitoring under the ***direct*** supervision of a MCERTS Level 2 person.

5.2.3 Trainees shall not carry out or approve site reviews and risk assessments even under direct supervision.

Note: Site reviews, risk assessments, site specific protocols (SSP) and monitoring reports are defined in section 5.7.

5.2.4 Trainees shall not write or approve site specific protocols or monitoring reports.

5.2.5 Personnel who have obtained Level 1 shall carry out stack emission monitoring under the ***general*** supervision of a MCERTS Level 2 person. To provide general supervision the Level 2 must be actively involved in the practical work of monitoring on site. However, they do not have to observe all the work carried out by the team they are supervising.

5.2.6 Level 1 personnel are permitted to carry out site reviews and risk assessments under the direct supervision of a MCERTS Level 2 person. Level 1 personnel are not permitted to approve site reviews, risk assessments, site specific protocols or monitoring reports. Direct supervision means that a Level 2 must accompany the Level 1 while carrying out risk assessments and site reviews. To authorise SSPs and reports produced by a Level 1 the Level 2 must check the completed documents in detail.

5.2.7 Personnel with Level 2 certification, shall lead a stack emission monitoring team, approve site reviews, risk assessments, site-specific protocols and monitoring reports.

5.2.8 Level 2 personnel are responsible for the direct supervision of trainees. Direct supervision of a Trainee requires the Level 2 to observe **all** the site work activities they carry out.

5.2.9 The Level 2 person shall be actively involved in the practical work of monitoring on site and is responsible for the work undertaken by the team.

5.2.10 Personnel with Level 2 certification shall be available on site throughout the monitoring campaign.

5.2.11 When there is more than one Level 2 person on site, the person taking overall responsibility for the work shall be clearly nominated.

Note: The SSP is used to record role responsibilities of personnel.

5.2.12 To lead on-site monitoring work and to approve site reviews, site specific protocols and reports the Level 2 certification shall include technical endorsements relevant to the substance(s) being measured.

5.2.13 A summary of the certification and supervision required to carry out different stack emission monitoring activities is provided in Annex A.

5.3 Accommodation and environmental conditions

5.3.1 Monitoring organisations shall, wherever possible, use sampling facilities/platforms that comply with the requirements of Environment Agency Technical Guidance Note: M1.

5.3.2 Any deviations from a method caused by stack sampling facilities not conforming to the method requirements (for example, access restricted to one port) shall be recorded.

5.3.3 Portable lighting shall be used when appropriate.

5.3.4 Lifts and hoists shall be used where appropriate.

5.3.5 Service requirements, such as electricity supply, shall be considered.

5.3.6 Stack emission monitoring has a high potential for contamination of samples. The organisation shall identify and assess the risk of contamination and a clean area shall be available for setting up equipment and samples, recovering samples, and storing equipment and samples.

5.3.7 Access to and use of areas affecting the quality of the monitoring shall be controlled. The area for equipment set up and the work area shall be cordoned off so that access to the sampling equipment and monitoring operation is restricted. If necessary, a mobile laboratory shall be manned or otherwise secure so access is restricted at all times.

5.3.8 The work area shall be cleared of trip hazards and obstacles. Mobile laboratories and transport vehicles shall be kept clean and free from sources of contamination.

5.4 Test methods and method validation

(a) selection of sampling methods

5.4.1 Monitoring shall be carried out in accordance with monitoring methods selected from Environment Agency Technical Guidance Note: M2.

5.4.2 MCERTS accreditation is applicable to methods in TGN M2 only.

Note 1: Even though a determinand may not be listed specifically in TGN M2, it may fall under a general method, such as speciated VOCs. Under these circumstances MCERTS accreditation can be obtained because it falls under the procedural framework of a CEN standard.

Note 2: The methods in TGN M2 have been selected according to the following hierarchy:

- Comité European de Normalisation (CEN);
- International Standardisation Organisation (ISO).

If the substance cannot be monitored using methods covered by the above then a method from one of the following has been used in M2:

- American Society for Testing and Materials (ASTM);
- British Standards Institution (BSI);
- United States Environmental Protection Agency (US EPA);
- Verein Deutscher Ingenieure (VDI).

5.4.3 M2 lists European reference methods (RMs), where available. It also lists techniques that could be used as an alternative method (AM) to the RM. Annex B of this document provides the framework for the use of instrumental based RMs and AMs.

5.4.4 The methods referred to in operators' permits are usually selected from M2. If an operator's permit refers to a method that is not in M2 the monitoring contractor shall bring this to the attention of the client before carrying out the monitoring work.

Note: If the method in the operator's permit is different to the one in M2, it is usually acceptable for the operator and the Environment Agency to update the permit by agreeing in writing that the method in M2 is used.

5.4.5 Method Implementation Documents (MIDs) provide details on how the preferred methods shall be used for regulatory monitoring.

Note: MIDs are produced, where necessary, by the Environment Agency.

5.4.6 The stack emission monitoring organisation shall use written technical procedures addressing the operation at the stack. The technical procedures shall meet the requirements of the method and the MID, where available.

5.4.7 The monitoring organisation shall obtain accreditation for each method they wish to use.

Note: UKAS will accredit organisations for the technical procedures to ensure they follow the standard methods, MIDs and the requirements of EN ISO/IEC 17025.

5.4.8 When supplementary parameters (i.e. physical ones, such as velocity, temperature and pressure or chemical ones, such as oxygen, carbon dioxide and water vapour) are used in the calculation of a measurement result, the measurement of these parameters shall be MCERTS accredited. If they are not MCERTS accredited, MCERTS accreditation cannot be claimed for the reported measurements.

5.4.9 The methods organisations are accredited to use shall be defined in the organisation's schedule of activities.

b) analysis methods

5.4.10 If the method requires laboratory analysis of samples collected on-site, the monitoring organisation shall either be accredited for the analysis method to EN ISO/IEC 17025 or shall use another laboratory accredited for the method.

5.4.11 If the analysis method is not accredited, the overall monitoring result is not MCERTS accredited. A statement explaining that the result is not accredited shall be included in the monitoring report.

5.4.12 Analytical laboratories are allowed to use an alternative sample analysis technique to those specified in standards (exceptions to this are given in clause 5.4.14).

Note: An example of an alternative technique is the use of ion chromatography, instead of ion selective electrode, to measure HF according to ISO 15713.

5.4.13 As a minimum, the alternative technique shall:

- be applicable to air samples
- have equal or better performance characteristics than the analytical method in the standard.

5.4.14 Due to the complexity of analysing metals, dioxins and furans, dioxin like PCBs and PAHs, the analytical laboratory shall use the analytical methods specified in the relevant methods.

c) measuring unusual determinands

5.4.15 Occasionally a monitoring organisation may be required to measure an unusual determinand (i.e. one that is not listed in TGN M2 or covered by a general method in TGN M2).

To measure an unusual determinand the monitoring organisation may select a national method (e.g. US EPA). If a national method is not available they may adapt an occupational method, such as those produced by the following:

- Method for the Determination of Hazardous Substances (MDHS) series published by the Health and Safety Executive (HSE);
- National Institute of Occupational Safety and Health (NIOSH);
- Occupational Safety and Health Administration (OSHA).

If a relevant method cannot be found, the monitoring organisation may adapt general monitoring principles based on the chemical and physical characteristics of the determinand.

MCERTS accreditation cannot be granted for these methods. However, the inclusion of quality assurance and quality control procedures helps ensure the methods are being employed properly.

(d) measurement uncertainty

5.4.16 The organisation shall have procedures in place for providing an estimate of the uncertainties relating to results.

5.4.17 Where a RM has a stated uncertainty this can only be achieved if the requirements of the method are complied with in full. Where a RM is not complied with in full the laboratory shall estimate the uncertainty of the measurement.

5.4.18 In some circumstances it is not possible to precisely follow the requirements of isokinetic methods (i.e. those which require sampling at multiple points in a stack) due to the following factors related to the sample location:

- limited access to the required number of sample lines
- limited access to sample points, which may restrict the number of points that can be used
- poor positioning of the sample plane, which may result in the flow criteria not being met

In these circumstances the estimation of the uncertainty relating to the results of a specific stack emission measurement exercise are complicated and not possible to quantify. The affect of the sample location on the measurement uncertainty shall not be taken into account when reporting the uncertainty. Qualifying remarks explaining the deviations from the standard shall be included in the monitoring report.

Note: EN ISO 14956 provide generic guidance on how to estimate the uncertainty of measurements. For periodic measurements of emissions this guidance can be applied using the following approaches, depending on the situation to estimate the measurement uncertainty:

- repeat measurements on reference materials;
- experimental work, for example, repeatability experiments, paired comparisons and inter-laboratory comparisons;
- estimations based on previous results/data e.g. instrument specifications.

5.4.19 Where a method is used, which does not have a stated uncertainty, the laboratory shall estimate the uncertainty of the measurement using the approach specified in EN ISO 14956.

5.5 Equipment

5.5.1 Procedures shall be in place to ensure that equipment is appropriate to the process-specific environment where it is to be used.

5.5.2 In methods where detailed material specifications are not given, the materials shall satisfy the following requirements:

- be non-reactive to the pollutant being measured;
- not cause any significant positive or negative interference to the measurement process;
- have sufficient strength to withstand the environmental conditions (e.g. vibration, heat, shear forces, flex, and abrasion) associated with the process being measured and the measurement environment.

5.5.3 The identification of equipment shall be in an accessible location for viewing and it shall be etched, stamped, or otherwise permanently fixed to the component.

5.5.4 The history of equipment use shall be traceable, so that possible causes of problems can be determined.

5.5.5 A record sheet for equipment use, which enables potential problems, maintenance procedures and possible sources of contamination to be identified, shall be developed for use with methods.

5.5.6 Safe handling and transportation procedures shall be developed to ensure equipment that has been calibrated shall not be affected during transportation.

5.5.7 In methods where detailed leak check procedures are not given the leak flow shall be below 2 % of the normal flow rate during sampling.

Note: Stack sampling equipment generally comprises several pieces of apparatus (for example, probes, filters, traps, pumps, meters) connected together to form a 'sampling train'. The equipment is connected together on-site.

5.5.8 In methods where detailed procedures are not given for dealing with contamination the following practices shall be followed. Components and equipment exposed to the sample stream shall be thoroughly cleaned and dried, including the sample media area, prior to conducting sampling. If performing multiple runs with the same equipment, the sample train shall be cleaned between runs. Cleaning shall be performed using appropriate methods, tools and solvents to ensure that residue is removed and to prevent contaminating or otherwise affecting the sample. The organisation's technical procedure shall specify the cleaning procedure.

Note: Contamination of samples analysed in a laboratory is assessed by the field blank.

5.6 Measurement traceability

5.6.1 The laboratory shall identify the calibration aspects of its methods that can contribute significantly to the total uncertainty of the measurement result. Where appropriate the calibration of reference material and equipment (e.g. Pitot tubes) shall be traceable to a laboratory accredited under EN ISO/IEC 17025. If this is not possible, the testing laboratory shall satisfy itself of the quality of the reference material and equipment.

Note: Such equipment include:

- instruments to measure physical parameters, such as temperature, pressure, flow, volume (e.g. dry-gas meters, burettes, pipettes), weight (e.g. analytical balances);
- analysers to measure waste gas (e.g. chemiluminescence NO_x analysers, FID analysers, paramagnetic oxygen analysers).

5.6.2 Some items of measurement equipment shall be calibrated periodically, such as Pitot probes, manometers, thermocouples, balances, volumetric flasks, burettes and pipettes.

Note: This periodic calibration can vary from once a month to once a year. Other items of equipment, such as waste gas analysers require calibration as an integral part of each measurement.

5.6.3 Calibration gases shall be traceable, where possible, to ISO 17025 for calibration by third party accreditation from a nationally recognised accreditation body, that is a member of the International Laboratory Accreditation Cooperation (ILAC). The calibration gases shall be labelled with the relevant accreditation logo and number.

Note 1: UKAS is an example of a nationally recognised accreditation body.

Note 2: It may not be possible to obtain ISO 17025 traceable gases for all calibration gases.

Note 3: The uncertainty budget for calibration gases are normally specified in individual monitoring standards, such as CEN reference methods.

Note 4: Examples of occasions when calibration gases are required are the annual calibration/functional checks carried out on portable monitoring instruments.

5.6.4 A stack emissions monitoring laboratory may use calibration gases to prove that "working" gases (i.e. those used on site for span check verification) meet the uncertainty budgets specified for span gases in the relevant standards. These working gases must be traceable, through the laboratories ISO 17025 accreditation, to the accredited calibration gases.

5.6.5 When monitoring is undertaken requiring analysis of samples, field blanks shall also be analysed and reported. Many standards specify the procedure for field blanks. For methods where the taking of field blanks is not addressed the information in Technical Guidance Note: M2 shall be followed.

5.6.6 Where a method does not specify a minimum criteria for the field blank value, the field blank shall be less than 10% of the emission limit value.

Note: The field blank is expressed in the same units as the emission limit value (mg/m^3). To calculate the field blank value the analytical laboratory result (i.e. a mass) is divided by the typical volume sampled during the measurement campaign.

5.6.7 When measuring gases using a manual technique, such as BS EN 1911, an absorber efficiency check shall be carried out for at least one test at each stack location per sampling campaign. The absorber efficiency check is passed if less than 5% of the measured pollutant is in the last impinger of the sample train.

The absorber efficiency check becomes less effective as the concentration of the pollutant in a stack gas decreases. Therefore, passing the absorber efficiency test shall only be required if the final measurement result is greater that 30% of the emission limit value.

Note: The following recommendations help ensure the absorber efficiency is met:

- keep the absorbers below 20°C
- addition of an extra absorber containing absorber solution
- add an appropriate use before date to the absorber solution
- use a low flow rate (e.g. 2 – 3 l/min) to improve the absorption of the target determinand in the absorber solution

5.7 Sampling

a) Site review

5.7.1 A site review is an on site visit that shall be carried out prior to producing a site specific protocol (SSP). The review is carried out so that the stack emissions monitoring personnel understand the physical and logistical situation on-site. The site review would normally be carried out once only. However, if the monitoring regime at the site changes significantly it may need repeating. The review provides essential information for determining a SSP.

Note: provided the site has a MCERTS compliant SSP available, this can be used by a monitoring organisation, which is new to the site, to develop their own SSP. Under these circumstances it may not be necessary to carry out another site review.

5.7.2 A person certified to MCERTS Level 2 with the appropriate technical endorsements shall be responsible for carrying out the site review. This person, however, need not be a member of the monitoring team that carries out the actual stack emissions monitoring.

Note: A person certified to MCERTS Level 1 is permitted to conduct a site review but only under the direct supervision of a Level 2 person (see MCERTS personnel competency standard).

5.7.3 The site review is carried out at an earlier date to the sampling, so that there is time to prepare the SSP and for any remedial actions to be carried out by the monitoring organisation and/or the client commissioning the monitoring.

5.7.4 Site reviews shall be documented.

b) Risk assessment

5.7.5 An assessment of the hazards and associated risks involved in stack emission monitoring shall be undertaken and documented during a site review and before every measurement campaign. The risk assessment shall be reviewed before starting work each day.

5.7.6 The risk assessment shall contain, as a minimum, the information included in Annex C.

c) Site-specific protocol (measurement plan)

5.7.7 Following a site review a site specific protocol (SSP) shall be produced to detail the application of the technical procedures to a specific site. The SSP shall be documented.

Note 1: The SSP is kept by the operator as a record of how monitoring is carried out on their site.

Note 2: A copy of the SSP may be requested by the regulator.

5.7.8 Information from previous SSPs shall be used by a monitoring contractor when developing a new SSP. Agreement shall be sought from the client if technical changes are made to a previous SSP.

Note: Reviewing previous SSPs ensures that the monitoring is carried out consistently, even if the monitoring organisation changes.

5.7.9 A person certified to MCERTS Level 2 with the appropriate technical endorsements shall approve the SSP.

Note: A person certified to MCERTS Level 1 is permitted to produce an SSP but only under the direct supervision of a Level 2 person (see MCERTS personnel competency standard).

5.7.10 Agreement shall be sought from the client if a standard method in an organisation's technical procedure requires modifying due to site specific conditions.

5.7.11 The monitoring organisation should ensure the client agrees to the SSP prior to commencement of the measurement. Sufficient time shall be allowed, between the submission of the SSP to the client and the commencement of the measurement campaign, to enable the client to understand the SSP and to put in place any recommendations or changes required by the SSP. The laboratory shall retain documentary evidence that the client has agreed to the SSP.

5.7.12 The stack emission monitoring organisation shall, where available, use the operator's permit in order to prepare the SSP.

Note 1: Most monitoring for environmental compliance is carried out to meet requirements specified in an operator's permit.

Note 2: The operator is expected to provide the permit to the monitoring organisation in order for them to prepare the SSP.

5.7.13 The SSP shall contain, as a minimum, the information included in Annex D.

5.7.14 The SSP shall be updated, when required.

Note: It may be necessary to update the SSP following changes to the operator's permit or to the monitoring contractor's procedures. For example, the monitoring contractor's procedures may change due to the publication of a new monitoring standard. Depending on the significance of these changes it may be necessary to repeat a site review before updating the SSP.

d) Job file

5.7.15 A file shall be used to record details of the stack emission measurement campaign.

5.7.16 A file shall contain, as a minimum, the following:

- site-specific protocol;
- risk assessment;
- list of equipment used;
- reference to equipment history for the measurement campaign;
- reagents and sample media used;
- record of deviations from site-specific protocol;
- measurement record sheets;

d) Site record sheets

5.7.17 The organisation shall have procedures for recording monitoring data and operations relating to stack emission monitoring. Site record sheets shall be used to record this information.

5.7.18 Site record sheets shall include, as a minimum, the following:

- date;
- name of the monitoring team members making the records;
- measurement procedure used;

- identification of the equipment;
- sampling location (including diagrams as necessary);
- environmental conditions, for example, atmospheric pressure;
- details of measurement start and finish times;
- for manual methods, details of sampling, for example, dry gas metre readings, solution volumes, pressure and temperature readings;
- for instrumental methods, the output or indicated readings of the analyser;
- for manual methods, the sample details, for example, sample bottle or sorbent tube identification label;

5.8 Handling of test items

5.8.1 A chain of custody record shall be maintained from the collection of samples, to sample storage, to sample analysis. The record should detail the person who has possession of the samples and the location of the item.

5.8.2 The stack shall be identifiable by a specific reference number or description.

5.9 Assuring the quality of test results

No additional requirements to EN ISO/IEC 17025.

5.10 Reporting of results

5.10.1 A standard report format shall be used.

Note: The standardised report provides sufficient detail to allow an audit trail back to the on-site measurement and process plant operating conditions.

5.10.2 The results of all monitoring shall be reported by the monitoring organisations to their clients. This requirement includes results showing non-compliance as well as compliance with emission-limit values.

5.10.3 Any deviations from the site specific protocol or the monitoring method /technical procedure(s) used shall be included in the report.

5.10.4 The report shall contain, as a minimum, the information included in Annex E. The report shall also contain information specified in individual monitoring methods.

Note: monitoring methods may specify information related to both sampling and analysis.

5.10.5 Reports detailing results of regulatory compliance monitoring shall not contain opinions or interpretations:

- about the effect monitoring deviations have on the application of the method
- on whether the results demonstrate compliance or not with emission limit values.

Note: the competent authority assesses the significance of monitoring deviations and whether results are compliant or not.

5.10.6 If requested, a copy of the report shall be provided to the competent authority. The report shall be available in an electronic format.

Annex A - Certification and supervision required to carry out different stack emission monitoring activities under MCERTS accreditation

Table 1: Certification and supervision required to carry out different stack emission monitoring activities under MCERTS accreditation

Certification	Activity	Supervision required
Trainee	Carry out site work	Under **direct** supervision of a Level 2
Level 1	Carry out risk assessments	Under **direct** supervision of a Level 2
	Carry out site reviews	Under **direct** supervision of a Level 2
	Produce SSPs	Level 2 must authorise completed SSP
	Carry out site work	Under general supervision of a Level 2
	Produce monitoring reports	Level 2 must authorise final monitoring report
Level 2	Carry out risk assessments	None but must comply with MCERTS accreditation
	Approve risk assessments	
	Carry out site reviews	
	Approve site reviews	
	Produce SSPs	
	Approve SSPs	
	Carry out site work	
	Supervise site work	
	Produce monitoring reports	
	Approve monitoring reports	

Note 1: The Level 2 must hold Technical Endorsements relevant to the monitoring required (this applies to carrying out the risk assessment, planning the work, carrying out the site work and producing the report).

Note 2: Direct supervision of a Trainee requires the Level 2 to observe **all** the site work activities they carry out.

Note 3: Direct supervision means that a Level 2 must accompany the Level 1 while carrying out risk assessments and site reviews.

Note 4: To authorise SSPs and reports produced by a Level 1 the Level 2 must check the completed documents in detail.

Note 5: To provide general supervision the Level 2 must be actively involved in the practical work of monitoring on site. However, they do not have to observe all the work carried out by the team they are supervising.

Annex B - Use of portable instruments in manual stack emissions monitoring

Note: CEN instrumental RMs are not available for the measurement of sulphur dioxide or for the use of FTIR. TGN M21 provides an Environment Agency approved method for the instrumental measurement for sulphur dioxide. TGN M22 provides an Agency approved method for the use of FTIR. The term RMs in this Annex includes TGN M21 and M22.

B.1 Use of instruments for EN 14181 calibration (QAL2 and AST)

Instrumental measurement systems used to carry out QAL2 and AST parallel reference measurements shall be MCERTS certified to EN 15267-3 for the appropriate determinand and certification range for the application (an instrument is considered to have a suitable certified range when the certified range is not more than 1.5x the daily average ELV for incineration processes and not more than 2.5x the daily average ELV for large combustion plant and other types of process).

Note 1: In general, the lower the certified range, the better the performance of the CEM is likely to be. This is because the majority of performance standards are expressed as a percentage of the range

Note 2: Information on MCERTS certified instruments is available from www.mcerts.net.

Note 3: Further information is available in MID EN 14181.

B.2 Use of instruments for compliance monitoring

1) Use of MCERTS certified instruments

An instrument that is MCERTS certified to EN 15267-3 for the appropriate determinand and certification range (see B.1 for information on certification ranges) is suitable for compliance monitoring.

If an MCERTS certified instrument does not have a suitably low certification range for use at a particular application, it is acceptable to lower the certified range by proving the instrument meets the performance criteria, specified in the RM, over the lower range. This shall be done using an ISO 17025 accredited laboratory that has demonstrated to UKAS that it has suitable procedures in place to do this type of work.

If an instrument, which has had its range lowered, uses an alternative technique to the RM, the stack emission monitoring organisation shall demonstrate that the alternative technique works on the intended process application. This shall be achieved in one of the following ways:

- carrying out field tests, under ISO 17025 accreditation, to compare the instrument against the reference method; or
- carrying out tests, using an appropriate stack simulator test rig, under ISO 17025 accreditation, to compare the instrument against the reference method.

If a stack simulator test rig is used it shall be capable of replicating the process conditions for the intended application.

As a minimum the tests shall meet the requirements of CEN TS 14793.

The accredited method shall specify the types of process the instrument may be used on.

The laboratory performance and field tests only need to be carried out on one instrument, as the MCERTS product certification verifies that each instrument is manufactured to the same standard.

2) Use of instruments that are not MCERTS certified to EN 15267

An instrument that is not MCERTS certified may be used, provided it is proven to meet the performance criteria of the RM. This shall be done using an ISO 17025 accredited laboratory that has demonstrated to UKAS that it has suitable procedures in place to do this type of work. If the instrument uses an alternative technique to the RM, it shall also demonstrate that the alternative technique works on the intended process application. This shall be achieved in one of the following ways:

- carrying out field tests, under ISO 17025 accreditation, to compare the instrument against the reference method

- carrying out tests, using an appropriate stack simulator test rig, under ISO 17025 accreditation, to compare the instrument against the reference method

As a minimum the test rig / field tests shall meet the requirements of CEN TS 14793.

The accredited method shall specify the types of process the instrument may be used on.

Once the test rig / field tests have been completed satisfactorily they can be applied to all instruments of the specific model tested.

Once the technique has been proven in the field the stack emission monitoring organisation shall demonstrate that **each** instrument they use meets the laboratory performance criteria specified by the RM.

3) Summary of instrument use

Table B1 provides a summary of the approach used to demonstrate that portable instruments are suitable for stack emissions monitoring.

Table B1: Approach to demonstrating instruments are suitable for use

	Carry out performance characteristic checks in a laboratory, prior to first use on all instruments used[1]	Carry out lack of fit test following a major repair and annually on all instruments[2]	Carry out process and range specific field test comparisons with a reference method prior to first use on one instrument[3]
MCERTS certified instrument at an appropriate range[4,5]		✓	
Instruments using the reference method technique[6]	✓	✓	
Instruments using an alternative technique	✓	✓	✓

[1]Reference methods specify performance checks, such as response time, detection limit, zero drift, span drift etc.
[2]Besides lack of fit, the reference methods may specify other tests, such as a NO_2 converter efficiency test in EN 14792.
[3]These tests must be carried out in accordance with CEN/TS 14793
[4]The certification range must meet the ELV multiplier rule (see section B1)
[5]Only this category of portable instruments may be used for EN 14181.
[6]The relevant CEN instrument based reference methods and associated techniques are included in the index of methods in M2. These are BS EN 14792 - oxides of nitrogen by chemiluminescence, BS EN 15058 - carbon monoxide by non-dispersive infra red spectrometry and BS EN 14789 - oxygen by paramagnetism.

Annex C - Health and safety

1. Relevant safety guidance includes Environment Agency Technical Guidance Note: M1 and the Source Testing Association *Risk assessment guide: industrial emission monitoring*.

2. The monitoring organisation shall implement procedures to minimise health and safety risks during site work. The procedures shall include:

   - using a risk-management approach to site work;
   - compliance with care of substances Control of Substances Hazardous to Health (COSHH);
   - site-safety induction training;
   - safe systems for lone and remote working.

3. Equipment used on-site by the organisation shall meet all the necessary safety standards required. Monitoring personnel shall use appropriate lifting equipment. As a minimum personnel shall wear safety glasses and steel toe-capped footwear conforming to appropriate standards while undertaking stack-emission monitoring.

   Note: Equipment used on-site by the monitoring organisation also includes any of the operator's equipment they may use (for example, lifting equipment).

4. Appropriate control measures (for example, safe working procedures, local exhaust ventilation and personal protective equipment) shall be detailed in the organisation's technical procedure for the relevant methods.

5. The monitoring organisation shall undertake and document a risk assessment specific to the required work and sampling location. This shall be undertaken in three stages:

   - as part of a site review;
   - before pre-sampling preparation in the laboratory;
   - before on-site monitoring.

6. The site review risk assessment shall include a section that shall be completed before entering the area of work. This shall be used by the monitoring organisation to find out standard site safety information such as fire alarms and procedures, chemical hazard alarms and procedures, intrinsically safe working areas, hygiene regulations and the like. This information may be covered in a formal site induction or a permit to work system. On sites where these are not available, it is the responsibility of the person certified to MCERTS Level 2 (team leader) to obtain the information.

7. The monitoring organisation's risk assessment shall confirm that the site/process operator has the following elements in place before undertaking stack emission work:

   - a safety policy covering work on site in accordance with the requirements of the Management of Health and Safety at Work Regulations;
   - a safe sample platform and work area.

8. Monitoring personnel visiting or working on a site for the first time shall attend a site induction if provided by the site operator. Attendance at an induction shall be recorded on the risk assessment for each member of the monitoring team.

9. The risk assessment shall include an assessment of the level of risk from each of the various hazards present and as a minimum shall include:

- general site hazards – site traffic, fire and emergency, mechanical operations, chemical operations;
- physical hazards at the stack – lifting, falling, burns, electricity, compressed gases;
- chemical hazards at the stack – exposure to substances from flue gases, exposure to substances used in monitoring tests;
- weather and environment – temperature extremes, wind, rain, lightning, snow and ice, sunburn;
- chemical hazards at the laboratory – exposure to chemicals used for equipment and sample preparation.

10. The risk assessment shall also include:

    - a COSHH assessment of exposure to workplace substances (both laboratory and on-site);
    - information on the composition and pressure of the gas in the stack to be monitored and the process characteristics;
    - identification of the control measures are required to reduce exposure to an acceptable level.

11. Organisations that undertake lone working on-site shall incorporate safety procedures into the risk assessment (for example, use of personal alarm, regular contact with site personnel).

12. The risk assessment shall clearly show the hazards for each working area (for example monitoring position, stack and the like).

13. The risk assessment shall quantify the risk. The level of risk shall be that recorded at the time of assessment, not the level that would be the case if control measures were put in place.

14. The operator shall be shown the risk assessment and be given the opportunity to comment on it. For in-house teams, a representative of the operator not directly involved in the work shall be shown the risk assessment. Typically, this could be the environmental manager or safety manager.

15. Work shall not commence until the organisation's risk assessment confirms that the risks are acceptable, or control measures have been put into place (including those that are the responsibility of the operator) to reduce the risk to an acceptable level.

16. Before work commences, the risk assessment shall be communicated by the Level 2 person (team leader) to other members of the monitoring team. All team members sign the risk assessment to confirm they have seen and understood its content.

Annex D – Site specific protocol

A site-specific protocol (SSP) shall contain the following in the order specified below:

Part 1

Contact details, monitoring dates and personnel

- operator name
- operators address and contact information
- permit number (including permit variation number, if applicable)
- installation name
- name of operator's contact
- date and report number of previous monitoring campaign
- planned date of monitoring campaign
- name and address of the monitoring organisation
- name, role during monitoring campaign, MCERTS registration number, certification level and technical endorsements held of the persons who will be involved in the monitoring campaign (the date when the certificates expire is to be included)

Note 1: Part 1 is updated before each monitoring visit

Part 2

Monitoring objectives

- the overall aim of the monitoring campaign
- the substances to be monitored at each emission point
  - emission limit value
  - reference conditions at which the results are expressed
  - details of monitoring method(s) to be used for each substance
- the overall uncertainty of the method(s)

Process conditions

- the type of process
- a description of the process
- if batch process whether the whole of the batch is to be sampled or the details of the part of the batch sampled
- the fuel type and feedstock
- the normal load, throughput or continuous rating of the plant
- any unusual occurrences that take place during the process
- what type of abatement system is fitted (if applicable)
- what type of CEM system is installed and details of the data information system (if applicable)
- the process details that need to be collected over the monitoring period

Sample location

- dimensions of the stack(s) and monitoring facilities
- a description of the location of the sampling plane for each release point
- for each sampling plane, a description of the type of sampling port (accessibility, correct size, sufficient number, properly located)
- for each sampling plane, a summary of the number, arrangement and orientation of the sample line(s), and the number of sampling points per line
- access to the stack
- adequate work area at the sampling positions
- availability of required utilities (electrical, lighting, water)
- a Pitot tube traverse of the velocity profile*
- temperature and moisture of the stack gas*
- homogeneity test*
- restrictions on using equipment, e.g. intrinsically safe areas
- physical restrictions to using required apparatus
- appropriate measurement equipment for the application
- for each sampling location, a summary of compliance with BS EN 15259 / EA TGN M1 (e.g. flow criteria, homogeneity, access to sample line(s) and sample point(s)

*Note 2: Historical information from previous measurement reports may be used. A note of the reports date and ID number shall be included in the site review.

Details of monitoring

- expected emission values
- the equipment used for each substance monitored
- the sampling duration and number of samples for each measurement, including blanks
- for manual methods, the proposed sample flow-rate, volume and minimum sampling times
- for instrumental methods, the proposed span-gas concentration
- the measurement concentration range and lower detection limit
- for manual methods requiring a separate chemical analysis stage, details of the analytical method, the laboratory carrying out the analysis
- any modifications to the technical procedure, with justifications
- an explanation why any substance(s) in the monitoring objectives will not be monitored
- an explanation why any substance(s) will not be monitored in accordance with the monitoring method

Note 3: Part 2 is updated when there are changes to the monitoring. It may be necessary to update the SSP following changes to the operator's permit or to the monitoring contractor's procedures. For example, the monitoring contractor's procedures may change due to the publication of a new monitoring standard. Depending on the significance of these changes it may be necessary to repeat a site review before updating the SSP.

Annex E – Stack emission monitoring report

A stack-emission monitoring report shall include the following information on each page:

- a unique reference in the following format:
  - permit number (including permit variation number, if applicable)
  - operator and installation name
  - year of the monitoring visit
  - sequential numbering system, if applicable (e.g. biannual, quarterly)
- a version number and
- a page number, which shall be written as “page x of y”

The report shall contain the following information in the order specified:

Part 1: Executive Summary

Cover sheet
- MCERTS logo, UKAS accreditation symbol and registration number of the monitoring organisation
- title
- permit number (including permit variation number, if applicable)
- operator name
- installation name
- dates of the monitoring visit
- contract number or reference
- name and address of the client organisation (if applicable)
- name and address of the monitoring organisation
- date of the report
- name, MCERTS registration number, certification level and technical endorsements held of the person approving the report for the monitoring organisation and
- the signature of the person approving the report

Contents
The content sheet shall describe the contents of both parts of the report.

Monitoring objectives
- the overall aim of the monitoring campaign
- the substances to be monitored at each emission point and
- any special requirements

Monitoring results
- emission point
- substances to be monitored
- emission limit value expressed in the terms and units defined in the permit
- periodic monitoring result in the same terms as the emission limit value
- uncertainty associated with the result at a 95% confidence level
- units for the emission limit value, the periodic monitoring result and the uncertainty
- reference conditions at which the results are expressed
- date of monitoring
- start and end times for the monitoring
- name and reference number of monitoring method used
- accreditation for use of the method, such as MCERTS, UKAS and
- process status at the time of monitoring, such as load and feedstock

Operating information

- whether process was continuous or batch process
- whether the whole of the batch was sampled or the details of the part of the batch sampled (if applicable)
- what fuel was used during monitoring (if applicable)
- what feedstock used during monitoring (if applicable)
- the normal load, throughput or continuous rating of the plant
- what type of abatement system and whether operating and
- the periodic monitoring results and the results obtained for the corresponding period by the operator's CEMS

Monitoring deviations

- an explanation why any substance(s) in the monitoring objectives was not monitored
- an explanation why any substance(s) were not monitored in accordance with the monitoring method and
- any other issues relevant to the monitoring results

Part 2: Supporting information

Note 1: Part 1 and 2 of the report shall be reported to the client as a combined report

Appendix 1

- name, role during monitoring campaign, MCERTS registration number, certification level and technical endorsements held of the persons who carried out the monitoring campaign
- the substance(s) monitored, the reference number of the standard method used and the reference to the Technical Procedure used by the monitoring organisation and
- a reference to the equipment check lists used on the monitoring campaign.

Further appendices (for each emission point)

- diagrams showing the dimensions of the stack and the monitoring facilities
- flow criteria measurements, such as measurements for temperature, pressure and stack gas velocity
- gas homogeneity test results
- gas measurements, such as oxygen and carbon dioxide
- water vapour measurements
- sampling measurements, such as stack gas temperature and velocity during sampling
- instrumental gas analyser site calibration measurements including zero and span gas concentrations
- instrumental gas analyser results
- information on sample analysis, including the name of the analytical laboratory, the accreditation for the use of the analytical method, the date of the analysis and any specific analytical requirements specified by the reference method*

Note 2: It is not a requirement to include the analysis report from the analytical laboratory, provided the relevant information from the analysis report is included.

- the manual monitoring method results calculations, including concentrations and mass emissions (if required) and
- uncertainty calculations for each reported result, including:
    - a list of parameters that affect the measurement uncertainty
    - uncertainty sources (in order of significance)
    - combined uncertainty for sources

- expanded total uncertainty as a percentage of the total measurement
- expanded total uncertainty in units of measurement
- expanded total uncertainty as a percentage of the ELV (expressed at a 95% confidence interval)