Training solutions

The STA is committed to furthering the development of source testers and students. Its training capability has grown since the first course began in 1997, and thousands of people have since been involved. Here we outline the spectrum of courses on offer across the UK

The term training refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies. It forms the core of apprenticeships and provides the backbone of content at technical colleges. In addition to the basic training required for a trade, occupation or profession, observers of the labour-market recognise today the need to continue training beyond initial qualifications: to maintain, upgrade and update skills throughout one's working life.

The STA is committed to encourage the personal and professional development of practising source testers and students and provide training courses on various aspects of emission monitoring.

The training capability has grown over the years following requests from its members to provide independent and impartial training courses. The first course, working at heights, started in 1997 after the unfortunate fatality of a stack tester. This course, which is based on the STA Risk Assessment Guide: Industrial-emission Monitoring, has been updated at regular intervals to take into account new health and safety legislation. More than 2,000 delegates have been on the course since its inception.

In 2009, the STA will be offering courses at three centres in the UK: Hitchin, Ripon and Edinburgh, and can also offer on-site training at members' premises. Current courses include:

Risk Assessment – Industrial Emission Monitoring

The course covers all aspects of the *Yellow Book* and includes case studies of recent H&S incidents, application of risk assessment procedures, COSHH, safe lifting, impact of weather conditions, electricity and correct use of Personal Protective Equipment (PPE). The course is presented in six modules:

1. The Principles of risk assessment
2. General site hazards
3. Physical hazards
4. Chemical hazards on site
5. Chemical hazards in the laboratory
6. Weather, Environment and Welfare

Regulatory Monitoring Requirements for Process Operators

The purpose of the course is to provide an understanding of the Environment Agency's MCERTS scheme as part of the requirement of the Environment Agency Operator Monitoring Assessment (OMA) scheme. This will increase process operators' awareness of their role in managing emissions monitoring and so improve their OMA audit score. Course content includes:

- Background to Environmental Regulations including IPPC
- Description of the OMA scheme
- The role of MCERTS schemes in stack-emission monitoring
- Introduction to major pollutants
- The nature of emission limits, including reference conditions and units of measurement
- An understanding of the principles of stack-emission monitoring
- An appreciation of the importance of correct sampling location for stack emission monitoring
- The practicalities of planning and executing stack-emissions monitoring campaigns including the importance of risk assessments
- Quality checks to ensure robust monitoring data

On Site Auditing

A requirement of the OMA scheme is for process operators to carry out periodic auditing of stack-emission monitoring. On-site auditing refers specifically to checking that the personnel carrying out monitoring do so in accordance with the agreed site-specific protocol (SSP) and documented procedures. The aim of this one day training course is to provide a basic understanding of stack-emission monitoring to enable process operators, regulators and environmental consultants to audit stack sampling contractors. Course content includes:

- Ethical requirements for independence and environmental awareness
- Use of MCERTS certified personnel
- Selection of appropriate methods following international standards
- Method Implementation Documents
- Estimation of measurement uncertainty
- Use of appropriate equipment
- Description of standard reference methods
- Planning of a sampling measurement campaign: site review; risk assessment; site-specific protocol
- Reporting of results
- Participation in proficiency-testing schemes

Planning and Sampling in Emission Monitoring

This course is aimed primarily at application, service and commissioning engineers. The purpose of the course is to cover the requirements for Planning and Sampling in Stack- Emission Monitoring, particularly relating to the application of MCERTS-approved equipment. Course content includes:

- An understanding of the nature of the common pollutants, their properties and effects
- An appreciation of the legislative context within which industrial processes are required to operate; the nature of emission limits, reference conditions and units of measurement
- Knowledge of the principles of standard equipment and the practicalities of equipment operation
- An understanding of the principles of stack-emission monitoring using continuous systems and extractive techniques (including standard reference methods); the importance of sample handling and conditioning
- Awareness of Environment Agency Technical Guidance Notes, including M1 – Sampling Requirements for Stack-Emissions Monitoring; and M2 – Monitoring of Stack-Emissions to Air
- An appreciation of the importance of good sampling location for stack-emission monitoring and identification of appropriate locations
- The practicalities of planning and executing stack-emissions monitoring campaigns including the importance of Risk Assessments
- The role of the Environment Agency MCERTS schemes in stack-emission monitoring
- An awareness of the parameters included in the MCERTS performance standard for Continuous Emissions Monitoring Systems

BS EN14181 quality assurance of an AMS

BS EN 14181—Stationary Source Emissions: Quality Assurance of Automated Measuring Systems (AMS) (CEM systems) is one of the most significant and demanding standards to be developed by CEN and it has far reaching consequences for regulators, equipment manufacturers, test houses and, most importantly, process operators.

In the implementation of the standard the Agency has developed a Method Implementation Document (MID) and a Technical Guidance Note. The purpose of the training is to provide guidance in the application of the various parts of the standard. There are practical examples of how to handle the data and establish the calibration function. Course content includes:

- Background: Directives, legislation and implementation
- QAL1 and MCERTS: Definition and understanding
- QAL2 and SRMs: Definition and scope of the Standard Reference Methods (SRM); importance of quality measurements
- Roles and responsibility: As required by QAL2 and the annual surveillance tests (AST)
- QAL3: How this is carried out and the audit requirements
- Practical examples: Using example data to establish a calibration function; meeting the reporting requirements of BS EN14181

Uncertainty in emission monitoring

There seems to be nothing more uncertain in the emission monitoring industry than calculating uncertainty. It is a requirement of accreditation to ISO17025. It is a requirement from the regulators in regard to the European Directives and it is a requirement from clients who want to know how good the numbers are.

The one day training course expels some of the myths around this very difficult topic and provides participants with the tools to understand and provide a consistent approach to uncertainty figures based on STA guidance. Course content includes:

- What is uncertainty?
- How does it arise?
- Why is it important?
- Expressing uncertainty of measurement
- Error versus uncertainty
- Basic statistics on sets of numbers: Average; spread – standard deviation; and exercise – calculation of standard deviation
- Where do errors and uncertainties come from?
- General kinds of uncertainty in measurement: Random or systematic; distribution, normal, uniform or rectangular distribution; what is not a measurement uncertainty?
- How to calculate uncertainty of measurement: Type A and Type B evaluations; calculation steps

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MCERTS Personnel competency

When the MCERTS scheme for personnel was introduced in 2002 the membership requested that the STA provide a series of courses to assist personnel with the examination process. The first was a series of one-day revision courses designed to give the candidate an awareness of the knowledge that was required to enter into the examination process. These one-day courses are still being run and cover:

- level 1: Technician
- level 2: Team leader
- TE1: Particulate monitoring
- TE2: Trace element sampling
- TE3: Gaseous monitoring by manual methods
- TE4: Gaseous monitoring by instrumental methods

As new people entered the industry the development of full training courses became a requirement and the STA now offers a 2-day, level 1 training course and a 4-day, level 2 training course. The course contents are shown below:

Level 1: Technician

This course is for personnel with little or no experience in emission monitoring or who are at the trainee level of MCERTS and wish to progress to Level 1. This course is designed to provide an introduction in emission monitoring and to train the delegate to MCERTS Standard Level 1. The course duration is based on two days.

Course Syllabus

Introduction to major pollutants

Principal pollutants prescribed for monitoring and their properties. The following pollutants are included: CO, CO_2, O2, SOx, NOX, HCl, TOC, particulate matter, dioxins, PCBs and PAHs.

- Typical sources; factors affecting formation; typical emission concentrations; typical ambient concentrations; properties affecting sampling and analysis; and, environmental and health effects of air pollution

Principles of emissions monitoring

Principles of stack-emission monitoring and the reasons it is carried out. This includes:

- Purpose of monitoring for regulatory compliance; an overview of legislation on emissions to air, IPC, PPC, European directives and the MCERTS scheme; the nature and use of emissions limits; monitoring requirements, including sampling protocols, standard methods, MCERTS Method Implementation Documents, instrument specification and approval, principles of quality assurance and control; and, the importance of representative sampling

Units and reference conditions

- Temperature, pressure, velocity, mass, volume; concentration and mass-based units; inter-conversion of ppm and mg/m^3; reference conditions and normalisation; conversion of wet gas composition to dry gas; conversion to standard temperature and pressure; and, conversion to reference levels of O_2

Operation of equipment

General requirements for correct operation of measurement equipment and have an understanding of common faults and their effects. This includes:

- Use of CEMs
- Instrument theory, including flow measurement theory of pitots, orifice plates, dry gas meters, rotameters, differential pressure devices; temperature measurement, theory of measurement including thermocouple and other devices; pressure measurements devices and theory of operation; and, heater technology
- Practical knowledge, including handling of basic technical equipment; training in the handling of instruments; and, practical demonstration of the different applications of sampling

Introduction to extractive manual sampling

The candidate should demonstrate general knowledge of the equipment used for sampling particulates, multi-phase emissions and gases/vapours. This includes:

- Principle of operation
- General arrangement of the sample train, including: sample (hot) box or oven; cold box or ice bath; umbilical cord; and, control unit
- General methodology for determination of substances, including: particulates; dioxins and PCBs; PAHs; trace metals including mercury; gases/vapours using manual and instrumental techniques; and, water vapour and presence of droplets
- Preparation of sampling equipment, including: filter preparation; polymeric resin trap preparation; glassware preparation; probe liner preparation; nozzle preparation; preparation of sampling train and leak check; and, example arrangements of sampling trains

Principles of manual stack-emission monitoring

- Special characteristics of particulates
- The need for and principle of isokinetic sampling
- Effects of water droplets
- Sampling plane and sampling points
- Measurement of stack gas velocity and pressure
- Calculation of flow rate (orifice plate, manometer)
- Calibration of instrumental techniques
- Sample conditioning and sample integrity

Level 2: Team leader

This course is designed to provide training for the progression from level1 to level 2. The course duration is based on four days which includes a visit to an industrial site.

Course syllabus

Monitoring legislation, standards and methods

Legislation relevant to monitoring, the applicable standards, and the different monitoring techniques for gaseous pollutants. This includes:

- Knowledge of appropriate methods for emission monitoring
- What to do if no standard method is available
- Deviation/modification of methods
- Hierarchy of methods (CEN, BSI, ISO, and other methods such as ASTM, AFNOR, DIN, USEPA and VDI)
- Current standards
- Future standards
- Types of sampling systems

Analytical techniques and limits of detection

Analytical techniques used to support pollutant measurements in the field. This includes:

- Definitions and units
- Implications of analytical sensitivity for sample amounts and sampling times
- Limits of detection
- Sample handling
- Liaison with analysis laboratories
- Proficiency-testing schemes

Abatement systems and their effects on monitoring

Abatement systems used for the control of the principal pollutants from industrial processes and their impact on emission levels. Systems include:

- Centrifugal separators (cyclones)
- Electrical gas cleaning (for example, electrostatic precipitation)
- Fabric filters
- Scrubbers
- Flue gas desulphurisation

Choice of sampling location and timing

Plant configurations, their impact on monitoring results, and where to carry out sampling. This includes:

- Achieving representative sampling
- Positional requirements for particulate matter and gaseous species
- Criteria for locating sample plane
- Surveying the sample plane
- Number of sampling points

Undertaking a measurement campaign

Factors to be addressed when undertaking a measurement campaign. These include:

- Determining the objectives of the sampling exercise
- Deciding on the parameters to be measured
- Reviewing process parameters
- Selecting sampling and analysis techniques
- Batch sampling
- Continuous direct reading instruments
- Arranging sample positions, safe access and essential services
- Liaison with plant operators
- Safety on site
- Transport of samples to laboratory
- Analysis
- Evaluating results
- Report writing

STA courses can be arranged on site, and tailored to individual needs

Choice of sampling method, technique and equipment

Monitoring approaches, techniques, published methods, equipment and which factors influence their selection. This includes:

- Monitoring approach: periodic monitoring methods; and, continuous emission monitoring methods
- Choice of monitoring technique: manual; and, instrumental
- Choice of monitoring method and equipment

Types of process operation and process details

Types of process operation and relevant process details. These include:

- Types of operation: continuous (steady state, variable or cyclic); and, batch process
- Process details: timescale of operation; awareness of inputs, outputs and mass flows; fuel composition; and, stack gas conditions

Developing site-specific protocols

The candidate must demonstrate knowledge of the requirements to be considered when undertaking a measurement campaign at a specific site. These include:

- Site review
- Process knowledge
- Sampling-site details
- Risk assessments
- Regulatory permits
- Method validation
- Site-specific issues
- Quality management

Processing measurement results, calculation procedures

Procedures used for processing measurement data leading to monitoring results. These include procedures for processing:

- Analytical reports
- Report components
- Measurement traceability
- Precision
- Internal variability/repeatability
- External variability/reproducibility

Principles of calculating uncertainty

Principles of calculating uncertainty. This includes:

- Basic terminology
- Agency approach to compliance assessment
- Rules for combining uncertainties
- Confidence limits and statistically defined uncertainties
- Tests using certified reference materials
- Repeat measurements using paired instruments and comparison with certified reference method
- Building an uncertainty budget from estimates of component uncertainties
- Assessing deviations from a standard method
- Effect of number and duration of samples on accuracy

Quality assurance techniques, UKAS, auditing and MCERTS

The candidate must demonstrate knowledge of the systems for quality assurance and quality control in stack-emission monitoring and the implications for data accuracy. These include:

- Quality management for emissions monitoring
- Organisation and management
- Quality systems
- The MCERTS performance standard for organisations
- Staff
- Equipment
- Measurement traceability and calibration
- Sample storage and transport
- Quality audits and reviews
- Horizontal audits
- Spot-check audits
- System audits
- Vertical audits
- Reports
- Calculations
- Original observations
- Equipment
- Monitoring results file
- Personnel

Health and safety requirements

Risk-management approach to minimising hazards at work. This includes the use of:

- Risk-assessment and risk-management principles
- COSHH assessments
- Permanent platforms and scaffolding
- Lifting and slinging
- Personnel protective equipment assessments
- Permits to work

Other courses are available to members which include on-site operation of equipment. All one-day courses described above can be arranged on site and the other more complex courses are arranged where practical. Bespoke courses can also be provided to members on request.

For full details of all STA training, visit www.s-t-a.org.