Development of a Model Training and Accreditation Programme for the European Air Pollution Monitoring Industry

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ABSTRACT

This paper describes the ongoing work on the above project "Development of a Model Training and Accreditation Programme for the European Air Pollution Monitoring Industry" (Acronym: EMMTAP). The project was funded by the European Union's "Leonardo da Vinci" scheme for vocational training. The project aims were to develop programmes to provide guidance to providers of training packages for those involved in environmental monitoring (ie stack emissions testing and ambient air quality monitoring). The project commenced in September 1999 and ends in April 2001. An assessment of current availability of environmental monitoring training packages across Europe has been carried out and a set of performance criteria which can be used as the basis for training course development and which were considered to be essential when establishing and demonstrating competency of personnel has been generated. The details of this multi-national project are set out below.

INTRODUCTION

There are many reasons why an assessment of atmospheric emissions from a process plant might be carried out. A selection is given below.

- Compliance Monitoring
- Environmental Audits
- Environmental Impact Assessments
- Calibration of Continuous Emissions Monitoring Systems (CEMS)
- Sizing of Pollution Control Plant
- Performance Testing of Pollution Control Plant
- Assessment of Process Efficiency
- Investigating Complaints from Local Residents
- Provision of Input Data for Chimney Height/Dispersion Modelling Calculations
- Generating Emissions Inventories

Monitoring exercises to assess ambient air quality are also an increasingly common requirement. They are necessary to enable regulators and local authorities to measure air quality and disseminate the information for comparison with legislative guidelines or to investigate local pollution incidents.

Whatever the reason for performing the monitoring exercise it is axiomatic that there is a crucial requirement to ensure that the quality of data is as high as possible. This enables inter-comparisons to be made with confidence and well-informed assessments of pollution control options to be performed. As national governments increasingly have to demonstrate compliance with trans-national environmental legislation, the importance of inter-comparability of environmental monitoring data is enhanced.

There are many aspects to quality assurance of environmental monitoring, but ensuring the competence of personnel is as important as any. When the EMMTAP project was proposed in 1997, there was a perception among pollution regulators and other organisations involved in environmental monitoring throughout the EU and in Central and Eastern Europe that there was no universally accepted route for the training, assessment and continuing professional development of environmental monitoring personnel. In order to help address this issue, a proposal for part-funding was submitted to the European Commission Action Programme for the Implementation of Vocational Training – the Leonardo da Vinci scheme[1]. A multinational consortium was formed to undertake the project. Details of the proposal were first published at the international conference, CEM 1998, in London, UK. Funding for the project was granted subsequently and the project was launched formally at CEM 1999 in Warwick, UK with a kick-off meeting attended by the project partners and other interested parties.

OBJECTIVES

The objective of the project was to develop a series of training modules which could be used by training providers as guidance when formulating training programmes for personnel involved in environmental monitoring. The model training programme modules have been developed by the project team which comprises European Union pollution regulators, training organisations and representatives from the European environmental monitoring fraternity. The project team consulted widely throughout the EU and pre-accession states when developing the model. It is intended that the training package framework be used throughout Europe to establish minimum quality criteria for training products and the companies that offer them. It is intended that the framework will be used in conjunction with published European standards such as EN 45013[2] to help establish improved confidence in reported data and subsequent emission inventory calculations or air quality comparisons. The transnational nature of the project will allow participant countries to achieve comparable results to enable companies to compete more easily throughout the EU. It is also hoped that individuals involved in environmental monitoring will also benefit through improved professional status and increased opportunities for labour mobility. It is hoped that another benefit of the project output will be increased customer confidence for those who place contracts for environmental monitoring which will then strengthen the market for such services. The EMMTAP programme will help to improve the quality and image of environmental monitoring and raise the status of those who perform the work.

Project Partners

- CRE (UK)
- Environment Agency (England & Wales)
- Source Testing Association (UK)
- Environmental Protection Agency (Ireland)
- TTZ Bremerhaven (Germany)
- ISQ (Portugal)
- Institute of Chemical Technology, Prague (Czech Republic)

Further details about the project partners can be found in Annex A.

Phase 1: Assessment of Current Availability of Environmental Monitoring Training Packages

One of the first tasks carried out by the project team was to survey the attitudes and knowledge of regulators throughout Europe. A questionnaire was devised and circulated as widely as possible throughout the EU and pre-accession countries. The main purpose of the questionnaire was to assess the availability of environmental monitoring training courses. In this paper-based questionnaire, the recipients were asked to describe how each country approached the issues of training, competency and accreditation. This enabled the project team to collate ideas from around Europe to ensure that there was no duplication of effort. The questionnaire was produced in English and translated into French and German. It was distributed to a total of 123 environmental regulators and associated contacts from 32 countries throughout the EU and pre-accession states. Responses were received from 42 contacts representing 18 countries. Details of training course availability, associated accreditation (where applicable) and evidence of assessment were requested. The types of training course were summarised along with the types of organisation providing training. The main conclusion was that there was a pressing need for training courses to address the issue of competency amongst environmental measurement personnel. The consensus among the respondents was that that there are too few qualified and competent staff carrying out environmental monitoring. There is also a need to make environmental monitoring more attractive - to recruit high quality personnel and retain them in the profession. Many respondents expressed the hope that improved competency standards would result in better data and that the market for environmental monitoring would be improved through better training. Several respondents hoped that the training model to be developed by the EMMTAP project could be used to promote harmonisation along EU guidelines and that the status and professional standing of environmental monitoring personnel would be increased.

Some countries (eg UK, Germany) had some availability of environmental monitoring training courses but no consistent standardisation or accreditation. In some countries there was no availability of suitable training courses at all. In other countries there was no availability of environmental monitoring training courses *per se;* but some universities or colleges of higher education offered syllabuses which contained modules on the subject. Some of the training organisations expressed the desire for a stable environment to give confidence that there would be a predictable demand for their products. This would encourage them to develop and constantly improve their training packages. It was suggested that the EMMTAP project could help stimulate a Europe-wide market for training by developing common and complementary drivers. It would also help to reinforce the benefits of improving the competence of monitoring personnel to industry and regulators. It was concluded that, throughout the EU, there is a number of training providers offering courses to stack and air quality testers; but their availability is somewhat limited. In addition, there has not yet been a consistent way of evaluating the tester's competency in carrying out regulatory measurements.

From the results of the survey, it was apparent that the issue of personnel competency was not well defined outside of the laboratory accreditation systems used in most countries to ensure competency at the chemical analysis stage which forms part of much environmental monitoring. In the field of environmental monitoring, the collection of a valid sample for subsequent analysis is an essential element in ensuring a viable result. Demonstrating the competency of sample collection personnel is similarly important. In the UK, the Source Testing Association has worked for a number of years on the basis of minimum requirements and has established a system for assessing what personnel do on site when collecting stack samples. The development of the Environment Agency's Monitoring Certification Scheme (MCERTS) started with equipment certification and is being extended to include the assessment of organisations *and* personnel.

Phase 2: Establish Minimum Quality Criteria for Training

Having established in Phase 1 that there was widespread support for the aims and objectives of the EMMTAP initiative, the project team then began to build up a set of performance criteria. These could then be used as the basis for training course development and were considered to be essential when establishing and demonstrating competency of personnel. The performance criteria are intended to be adopted by training providers as they see appropriate. The modules, which can be used collectively or individually, are set out below.

- Health and safety
- Operation of equipment
- Data processing
- Purpose of measurement
- Quality management
- Process knowledge
- Pre-sampling reconnaissance visit
- Method selection
- Sampling location/frequency
- Protocol development
- Reporting
- Experience/competence

These performance criteria were then expanded individually to cover each criterion in more detail. The resulting document was distributed widely throughout Europe using the database of contacts generated in Phase 1 of the project. In total, approximately 160 copies of the discussion document were distributed for consultation. The sub-headings to the performance criteria are reproduced below. A full copy of the discussion document can be viewed on the EMMTAP web site www.emmtap.eu.com. It should be noted that some criteria are applicable to *both* stack emissions and ambient air quality monitoring, and some to one or the other only. The division is highlighted in the discussion document through colour-coding.

PERFORMANCE CRITERIA

1. PURPOSE OF MEASUREMENT

It is important that the reason for a measurement programme is known to all concerned with the project. There are a number of possible reasons for making measurements and each one has a different focus. Knowledge of the purpose of measurement enables informed decisions on sampling methodologies and equipment to be taken.

- Regulatory compliance

Relevant legislation
Which determinands to measure
How to specify appropriate methods and equipment
What are the sampling requirements
The need for accredited sampling and/or analysis methods
When to sample
Correction to standard reference conditions

- Process optimisation

Basic understanding of the process or equipment to be monitored
Know which determinands to measure
Support of Environmental Management Systems

- Equipment performance guarantee

Basic understanding of the process to be monitored.
Basis of performance specification
Selection of appropriate methods and equipment

- Measuring for calibration

A basic understanding of the principles of operation of CEM/AQM equipment.
Knowledge of possible interferences between gases, particles and/or vapours.
Interpretation and comparison of data
Measuring in response to nuisance complaints
Knowledge of relevant legislation
Knowledge of application of equipment
Where to deploy monitoring equipment
Where and when to apply dispersion models

2. PROCESS KNOWLEDGE

It is important that personnel involved in emission monitoring build knowledge of a range of processes. This knowledge helps them to design operating protocols and make instrument choices in order to generate reliable data.

- Emissions Testing

  Type of process
  Types of process operation
  Process measurement priorities
  Process operation data & conditions
  Sampling site facilities

- Air quality testing

  Type of process
  Atmospheric conditions
  Sampling site

- Competency assessment
  Evidence assessment
  Results presentation

3. HEALTH AND SAFETY

A great deal of emission testing is carried out at heights and in difficult working situations. The current provision for carrying out this work is often inadequate. This can result in Health and Safety problems and low quality testing data. Some examples of the issues that need to be addressed are given below:

- General

  Sampling equipment
  Equipment operation
  Sampling locations
  Risk assessment
  Hazard identification
  General site hazards
  Falling hazards/working at heights
  Electrical hazards
  Flue Gas hazards
  Chemical hazards
  Handling hazards

- Personal Protective Equipment PPE

  Selection and use
  Appropriate PPE for the identified hazard
  General principles for Health & Safety training

4. PRE-SAMPLING RECONNAISSANCE VISIT

A reconnaissance visit is a very useful tool to assess the necessary measures that need to be considered when planning an emissions or air quality monitoring campaign.

- Emission monitoring

  Process knowledge
  Sampling site details
  Site facilities available
  Risk assessment
  Basic performance on site
  Measurement method selection
  Personnel facility requirements
  Special arrangements

- Air quality control

  Sampling site
  Risk assessment

5. METHOD SELECTION

There is a range of published reference methods for environmental monitoring. Knowledge of the availability and applicability of these methods is required to be able to select appropriate methods.

Topics for consideration include:

Knowledge of standard methods
Defined hierarchy of methods
Knowledge of appropriate methods
What to do if no standard method is available
Need for verification of proposed method
Deviation/modification of methods
Methods to be avoided wherever possible and justification required if used

6. PROTOCOL DEVELOPMENT

The following discussion deals with the development of protocols for air pollution monitoring. The term "protocol" in this context refers to a documented procedure or record sheet that is designed for a specific site or sampling location.

Monitoring personnel will encounter documentation in various forms (e.g. work procedures for on-site measurement, field record sheets, calibration and maintenance procedures, etc.). Depending on the level of responsibility, some personnel will require a competency in developing site-specific protocols, others will simply be required to understand their significance and adhere to them.

The following is a list of items that should appear in any training programme that is designed to provide for competency in protocol development.

Competencies for the protocol developer
Protocols and Quality Management
Elements of protocols
Work instruction for on-site measurement
Field record sheets
Equipment calibration procedures and record sheets
Equipment maintenance procedures and record sheets
Reference sources for protocol development
Standard methods
Equipment manuals
QM documents
Regulatory permits
Level of detail
Site specific issues
Validation

7. SAMPLING LOCATION/FREQUENCY

Before undertaking the monitoring it is important to define the aims and objectives of carrying out the work. Why is the monitoring being undertaken? What needs to be reported? How should the data be presented? Sampling location is often defined in standard emissions monitoring methodologies (especially those for particulate sampling) but the number of sampling runs is often site-specific. Site selection is a critical decision in any air quality monitoring exercise. Other issues are outlined below.

Practical issues

Need to define monitoring strategy aims and objectives
Define what makes a good sampling location
How to prove the selected location is good
Constraints on sample location
Impacts of deviations from standard location
Numbers of samples and frequency of sampling/monitoring
Number of samples required
Frequency of sampling/monitoring

8. OPERATION OF EQUIPMENT

The general aim of this topic is to introduce the trainee to the basic requirements for efficient operation of measurement equipment. Knowledge of fault recognition and diagnosis, the differentiation between malfunctioning, calibration problems and incorrect results needs a knowledge of significance for all instrument parameters, and a basic understanding for technical equipment in general use.

- Theoretical knowledge

General knowledge of the measurement of parameters
Conversion of these parameters
Theory of sampling
Usage/knowledge of all relevant reference documents
Knowledge of measurement planning

- Practical knowledge

Handling of basic technical equipment
Training in the handling of instruments
Practical demonstration of the different applications of sampling

- Evidence from practical experience

Presentation of measurement reports
External or internal audit reports

9. DATA PROCESSING

Consideration must be given to data collection, data analysis/data reduction and data presentation in advance of performing the emissions/air quality monitoring campaign. The outcomes of these deliberations may have an impact on the protocol for data handling. Some topics for consideration are set out below.

Background/theory
Basis for establishing legislative compliance
Averaging requirements (eg 15-minute, monthly, rolling averages etc.)
How are exceedances expressed
How should site data be recorded
Manual record keeping
Chart recorders
Data loggers
Continuous vs discontinuous/extractive
Monitoring systems
Data storage/archiving
Data processing
Incorporation of additional data into final results

- Ancillary Measurements

Normalisation Data
Basis
Units

10. REPORTING

Reports are traditionally paper-based but moves to electronic reporting are being developed. Reports should be formatted to ensure that all relevant information is presented clearly to enable reliable data comparisons, for example with legislative guidelines.

Structure of reports

Contents of the summary report
Retention of data
Report generation
Checking and approval procedure
Auditing of reports
Internal quality/peer review
External audit

11. QUALITY MANAGEMENT

In the context of emission and air quality measurements, it is important that the need for quality management in testing and calibration exercises is understood. Without proper handling, regular calibration and exact documentation of the tests, any equipment may produce incorrect or non-reproducible results. A regime of quality management (QM) should be used at all stages of emission and air quality measurement to ensure the integrity of the final data. The internationally accepted standard EN ISO/IEC 17025:2000[3] is appropriate for assessing the competence of testing and calibration laboratories.

- Introduction into Quality management

  Purpose of QM
  Explanation of QM systems
  Practical introduction into QM

- Document control

  Document revision
  Use of forms
  Chain of custody

- Use of equipment

  Calibration
  Handling of blanks

- Traceability of standards

  Maintenance of quality
  Regular training of staff
  Participation in “ring” tests and proficiency testing schemes

12. EXPERIENCE/COMPETENCE

There are a number of records that can be used as tools for experienced people to demonstrate their professional standard of competency. Each tester should maintain a set of personal professional information, validated with signatures and certificates where relevant. Sufficient detail contained in these records can be very useful in the competency assessment process.

- Log Books

  Dates/Location
  Types of test / process details
  Methods used
  Deviations & effects
  Team structure / hierarchy

- Training Records

  Courses' content and syllabus
  Dates
  Venues
  Qualifications/Certificates gained

- Relationships

  Mentor details
  Assessments
  Evidence

In addition, consideration was given to the issue of demonstrating competence and appropriate assessment procedures as outlined below.

13. ASSESSMENT PROCEDURES

Practical assessment
Assessment of environmental monitoring theory
Oral assessment
Evidence assessment
Examination assessment (set by independent body)
Assessment overview
Results presentation
Review period (3-5 years?)

As stated above, the performance criteria have been expanded upon to form a comprehensive discussion document. The completed document was shipped to over 160 interested parties throughout EU, pre-accession states and beyond in January 2001. Recipients were invited to take part in the consultation exercise and responses will be accepted until March 2001. The final training model will be produced after the consultation exercise has been completed and the responses evaluated.

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Ms Sandra Cardoso	ISQ, Portugal

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2. General criteria for certification bodies operating certification of personnel. European Standard EN 45013:1989.
3. General requirements for the competence of testing and calibration laboratories. European Standard EN ISO/IEC 17025:2000.

ANNEX A – PROFILES OF PROJECT PARTNERS

CRE, UK is a respected international energy and environmental consultancy company formed from the former Coal Research Establishment of the British Coal Corporation. Following a merger with ETi Group in October 2000, CRE is now part of EMC Environment Engineering - an autonomous organisation wholly owned by IMC Group Holdings Ltd. CRE's services include the monitoring of airborne pollutants and environmental training. CRE has considerable experience of European projects including European Coal and Steel Community, Joule, Thermie, Tacis and Phare. CRE was the main contractor and co-ordinator of the project. CRE was also the lead project team consultant in stack emissions sampling and the training of such staff.

The Environment Agency for England and Wales is one of the most powerful environmental regulators in the world. The Agency exists to provide high quality environmental protection and improvement. This is achieved by an emphasis on prevention, education and vigorous enforcement wherever necessary. The Environment Agency's National Compliance Assessment Service advised the project team of the requirements of pollution regulators.

The Environmental Protection Agency, Ireland is an independent body, set up under the Environmental Protection Agency Act, 1992. It was formally established on 26 July 1993 with the purpose of protecting Ireland's natural environment. The Environmental Protection Agency advised the project team of the requirements of pollution regulators.

The Department of Gas Coke and Air Protection, Czech Republic is part of the Institute of Chemical Technology, Prague. The work of the Department includes air analysis, and development of new approaches to air analysis, preparation of Czech National Standards, evaluation of various technologies with reference to emission rate and authorised measurement of emission and/or imission levels of large a set of pollutants. The Prague Institute of Chemical Technology advised on the Eastern European environmental monitoring arena and provided input to project tasks.

ISQ, Portugal is a private, service-orientated, non-profit making association, which provides consultancy services, carries out technical inspections and conducts laboratory testing. ISQ's mission is to contribute to projecting Portuguese industry and services across Europe and beyond. ISQ has considerable experience of managing European programmes, including Leonardo da Vinci. ISQ was the lead project team adviser on distance learning, interactive systems and web-site construction.

The mission of the Source Testing Association, UK is to advance the science and practice of source testing, especially as it relates to compliance monitoring, and to develop and maintain a high professional standing amongst its members. STA acted as the project monitor, and evaluated the progress of the project against targets agreed during the project set-up meeting.

TTZ Bremerhaven, Germany was formed in 1987 when the business community, the University and local authorities in Bremerhaven founded TTZ, the technology transfer centre at the Technical University of Bremerhaven. It has since become the pivot of technological progress. The work of TTZ is orientated towards innovation and the needs of small and medium sized industry. TTZ has been involved in many European projects including ADAPT, FAIR, CRAFT and Joule. TTZ Bremerhaven acted as project team consultant in the measurement of pollutants in ambient air and provided input to other project tasks.

BIOGRAPHICAL DETAILS

Simon Medhurst graduated in Chemistry from Warwick University in 1984 and then worked in the chemical manufacturing industry. In 1985, he joined the Coal Research Establishment (CRE) of the British Coal Corporation to work on the measurement of atmospheric emissions from coal utilisation. Mr Medhurst was Environmental Quality Manager from 1990-2000 responsible for gaining and maintaining UKAS accreditation for stack emissions monitoring services. Project Manager for numerous commercial emissions monitoring contracts including work undertaken for UK regulators. Recently appointed Training Manager for EMC Environment Engineering – a company formed following the successful merger of CRE and ETi Group in October 2000.

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