British Occupational Hygiene Society
Faculty of Occupational Hygiene

PROFICIENCY MODULE SYLLABUS

P601 – Commissioning and Thorough Examination and Testing of Local Exhaust Ventilation Systems

Aim: To provide the methodology, theoretical and practical knowledge to enable the student to proficiently:

- Show awareness of the principles of good control practice and the role of local exhaust ventilation (LEV).
- Carry out commissioning of an LEV system and establish whether the system works effectively and controls exposure.
- Determine the operating criteria for continued performance to specification.
- Carry out the testing of previously-appraised LEV systems used to control exposure to substances hazardous to health.
- Produce suitable records of the results of examination and testing as required by regulatory guidance and codes.
- Understand and be able to describe the principles and the main elements of an LEV system.
- To judge whether an LEV system is capable of adequate control of the identified hazards.
- Carry out the necessary measurements safely to determine if an LEV system is effective and operating to the design specification.
- Provide suitable advice to remedy any faults discovered.

Prior Knowledge: Candidates for this course are expected to have some basic knowledge of the components of ventilation systems and their purpose and be aware of the contents of HSG 258 (2008) Controlling Airborne Contaminants at Work

Content:

Topic		Time Allocation
1	**Workplace Control Principles**	**20%**
2	**Ventilation Systems and their Performance Evaluation including Commissioning**	**50%**
3	**Health and Safety during Examination and Testing of LEV Systems**	**10%**
4	**Practical**	**20%**

Note: Reference is made in this syllabus to HSE guidance or other documentation. These may not be the most up-to-date relevant publications from HSE/other sources and the information is intended as guidance for candidates only

1 Introduction of Workplace Control Principles (20%)

Educational Objectives The student should understand the complex nature of exposures in the workplace, appreciate the basic principles of workplace control and the type of approach that is required for successful implementation of a control programme. The student should be able to understand how to relate the outcome of a risk assessment to selection of control options.

1.1 Principles of good control practice

- How hazards and risks are identified in the workplace.
- The range, reliability and effectiveness of control options including work procedures, process engineering controls, ventilation and PPE.
- Practicable programmes for control which may involve a combination of measures.
- Practical application of the use of a combination of measures including a stepwise approach to their implementation.

- The identification of effective control strategies as they relate to reasonable practicability.
- The control of emissions as they relate to the control of exposure.

1.2 Achieving control

The meaning of adequate control including reference to WELs and other published or in-house standards. Duties under the COSHH Regulations, the Control of Lead at Work Regulations and the Control of Asbestos Regulations 2006.

1.3 The Role of Assessment

Identifying exposures, confirming compliance, achieving adequate control at the design stage and in existing facilities from normal operations and during non-routine or maintenance activities.

2 Ventilation Systems and their Performance Evaluation including Commissioning (50%)

Educational Objectives The student should have a basic understanding of the principles of the design of ventilation systems and the differences in performance between general and local exhaust systems. He/she should be able to carry out the appropriate measurements to check the effectiveness of the system and be able to identify when air sampling is required to determine whether adequate control is being achieved. Where an existing system has not been commissioned properly then he/she should be able to carry out appropriate measurements to assess the effectiveness of such a system and document the results.

2.1 Types of System

The types of system in use, for example, general ventilation and local exhaust ventilation.

2.2 Principles of Ventilation Systems and their Components

Basic Design principles of the system itself and of its components, including:

Hood designs. *Enclosure, captor hoods, booths, including an understanding of other types of extract hood, i.e. partial enclosure (not necessarily the same as a booth) and receptor hoods. Some special types should also be known about, such as push-pull systems, High Velocity Low Volume (HVLV) systems etc.*

- Application of hoods, slots, enclosures to industrial situations *Capture velocities, face velocity. The importance of air distribution across the face of a large extract hood.*
- Ducts *transport velocities (duct size, configuration and materials).*
- Fans (*types and their application, effects of direction of rotation).*
- Air cleaners *Treatment systems and filtration standards (types and their performance, for example gravity and centrifugal collectors, dry fabric, electrostatic, wet methods, absorption).*
- Facilities for maintenance, examination, testing and conditioning.
- Balancing (systems and with their environment).
- The nature of flammable dusts and vapours and of explosion prevention, and explosion relief in relation to LEV.
- Discharge arrangements and the risk of recirculation of contaminated air *(where is the discharge, and can it be drawn back into the building?).*
- The provision of replacement air, *especially if the workroom is either relatively small, or relatively well sealed.*
- Fletcher and Garrison methods of predicting air flows, velocity contours and effects of flanges.
- The filtration standard that is needed if air that contained particulates is to be re-circulated into the workroom (i.e. HEPA to a minimum of EU13).

2.3 General Ventilation Systems

Use of general ventilation systems as a means of controlling exposures:

- Principles of natural ventilation and infiltration.
- Mechanical ventilation, dilution or displacement, including methods of delivery and distribution. How hot plumes behave.
- Determination and calculation of ventilation requirements.
- Application and limitations of general ventilation.

2.4 Measurement and Testing of LEV Systems

Performance considerations:

The measurement of performance and its relation to the attainment of control of exposure including limitations of measurement equipment and the need for calibration.[Whether all of the significant sources of exposure are controlled adequately.]

- Qualitative assessment of systems. The visualisation of air flows and their effective capture of the contaminant(s) into the ventilation system which must include the use of a dust lamps, smoke generators and smoke tubes.
- The operation of pressure and flow measurement instrumentation [Pitot tubes and micro-manometers, anemometers [thermal and vane]etc.] to provide quantitative data on ventilation systems including the appropriate locations to take such measurements.
- Full understanding of all calculations for volume flows from pressure and velocity measurements.
- The requirements, including frequency, for maintenance examination and test; periodic checks and inspections, thorough examinations, statutory examinations and testing. A suitable reporting scheme for results is also required.
- The requirements for commissioning an existing system that does not have any suitable commissioning documentation.
- The specification of suitable measurable performance criteria for an LEV system.
- The effects of partial or total blockages in a section of duct, the effects of filter blinding, holes in filter bags, air by-passing the filters etc.
- Test procedures and standards of air re-circulation system.
- Practicability of the system for use and Limitations of LEV.

3 Health and Safety during Examination and Testing of LEV Systems (10%)

Educational Objectives The student must be capable of undertaking an assessment of all relevant risks, both to their own safety, and how their actions might affect the safety of others as related to ventilation system.

3.1 Understanding of:

- Need to comply with permit to work systems and lock-out procedures.
- Safety aspects of working at heights, use of ladders, cherry-picker etc, (avoidance of dropping things on people below them).
- Use of PPE (skin, body and eyes) and RPE during examination and test of LEV system.
- The effect of a hot plume of contaminated air (if the extract to be tested is high up).
- The potential effect of testing on the discharge side of the fan (contaminated air blowing out under a positive pressure).
- The potential consequences of any actions they might take to correct the performance of a system (e.g. get a qualified electrician to rewire the fan if it is rotating in the wrong direction rather than attempting to do it themselves; what effect changing the positions of dampers in the system might have on other parts of the system; etc).
- The potential for a dust explosion or the ignition of flammable vapour.

4 Practical (20%)

Educational Objectives The student should understand the principles behind the operation of ventilation systems. He/she should be able to carry out measurements to check the effectiveness of the system. The student should also understand the limitations of this approach to control and of the crucial importance of the design element at the interface with the worker.

4.1 Practical Knowledge

The student should be able to carry out a test on a typical LEV system using:

- Appropriate techniques to visualise air flows as a means to test control.
- Common pressure and velocity measuring instruments, demonstrating an understanding of which test equipment to use for which measurements and where to undertake the measurements in relation to each extract point (e.g. face velocity or capture velocity).
- A pitot tube, understanding how one works, how to undertake a pitot tube traverse and how to calculate an average transport velocity from a pitot tube traverse.
- Where to undertake duct measurements to get meaningful results.

The student should be able to demonstrate an understanding of the numbers produced by the tests (e.g. what is an acceptable capture velocity for the application? What duct velocity would prevent dust deposition in this situation? What are the likely causes of the static pressure going up or down to a significant degree compared to the last test? etc).

Recommended Documentation

1 HSE Guidance HSG258 (2008) Controlling Airborne Contaminants at Work
2 ACGIH Industrial Ventilation – A Manual of Recommended Practice.
3 HSE Guidance WIS23 (1992) LEV General Principles of System Design
4 The Control of Substances Hazardous To Health Regulations 2002 ACOP and Guidance.
5 HSE Guidance Note HSG 193 (1999) COSHH Essentials Easy Steps to Control Chemicals
6 "The dust lamp: A simple tool for observing the presence of airborne particles" MDHS 82. HSE Books.
7 The Control of Lead at Work Regulations 2002.
8 The Control of Asbestos Regulations 2006.
9 LEV Topic Inspection Pack "Assessing and inspecting Local Exhaust Ventilation [LEV]systems April 2009 available as free down load from HSE web site.
10 http://news.hse.gov.uk/2009/07/03/lev-inspection-pack/

Course Length

It is envisaged that this course will be conducted over 4 days which includes the examination and the practical assessment.

This course will require 24 hours' study time, of which at least 18 hours will be taught (teaching and practical). The additional study time will be required in the candidates' own time.

Course Examination/Assessment

The students will be assessed as follows:

1. 35 short answer questions to be answered in 105 minutes.
2. A practical assessment (see below).
3. Submission of two acceptable reports (see below).

2. Practical Assessment:

Candidates Individual Assessment must include:

- Visualisation of air flows as a means to test control (smoke tubes, smoke generators and dust lamps) on at least two typical ventilation systems
- Duct measurements using:
  - a pitot tube traverse, and how to calculate an average transport velocity from a pitot tube traverse.
  - a selection of static pressure measurements at different points in a ventilation system, and understand the variation in the readings across the system and what would happen if the filters are overloaded, or a duct is blocked.
- Measurements in relation to a selection of extract point (e.g. face velocity or capture velocity) using thermal and vane anemometers and show understanding of requirements
- Carry out risk assessments and demonstrate knowledge of the use of PPE/RPE.
- Evidence of Field Proficiency by the use of a case study which must test the candidates abilities to evaluate whether adequate control has been achieved by the ventilation systems. This must include a full understanding of the numbers produced by the tests (e.g. What is an acceptable capture velocity for the application? What duct velocity would prevent dust deposition in this situation? What is the likely cause of the static pressure going up or down to a significant degree compared to the last test? etc).

3. Submission of reports:

Candidates are required to demonstrate that they have carried out, possibly under supervision, two field initial appraisal and thorough examination and testing of local exhaust ventilation systems which must include actual measurements, analysis of the results, confirmation that the system is fully functional and adequate for purpose as a control measure and any relevant recommendations.

A copy of each of these two relevant reports must be submitted to BOHS within three months.

Full details of the report requirements are provided as a separate document GG.6, P601 Submission of Reports – Requirements for Candidates.

Successful completion of the above requirements will lead to a:

'PROFICIENCY CERTIFICATE' in
COMMISSIONING AND THOROUGH EXAMINATION AND TESTING OF LOCAL EXHAUST VENTILATION SYSTEMS