# British Occupational Hygiene Society
# Faculty of Occupational Hygiene

## PROFICIENCY MODULE SYLLABUS

## P602 – BASIC DESIGN PRINCIPLES OF LOCAL EXHAUST VENTILATION SYSTEMS

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

- Demonstrate awareness of the principles of good control practice and the role of local exhaust ventilation (LEV).
- Understand the importance of design considerations in terms of the workplace, process, and plant, as a means of reducing occupational exposures
- Understand the principles and the main elements of an LEV system and be able to design basic LEV systems that will be capable of adequately controlling the identified hazards.
- Know how to carry out the necessary measurements at commissioning of a system and to check whether a local exhaust ventilation system is effective and operating to the design specification.
- Provide suitable records of the basis of design.

**Content:**

| Topic | | Time Allocation |
|---|---|---|
| 1 | **Workplace Control Principles** | **10%** |
| 2 | **Design of Local Exhaust Ventilation Systems** | **55%** |
| 3 | **Evaluation of the Performance of LEV systems** | **20%** |
| 4 | **Practical** | **15%** |

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

### 1 WORKPLACE CONTROL PRINCIPLES (10%)

**Educational Objectives** The student should understand the complex nature of exposure to employees in the workplace, appreciate the hierarchy of control measures and the overall approach that is required for successful implementation of a control programme. The student will need to fully understand the consequences of ineffective exposure control measures.

*1.1 Principles of good control practice*

- Understand the need to recognise all of the sources of exposure, and how each of these sources can be controlled.
- The hierarchy of control options including work procedures, process engineering controls, ventilation and PPE.
- Practical application of control measures including testing for the adequacy of the control measure and evaluation of its ongoing performance.
- The control of emissions as they relate to the control of exposure and the consequences [health and financial] of inadequate control.
- The need for proper development and management of exposure control measures and their implication for COSHH assessments.

*1.2 Achieving Control*

The overall exposure control measure for a procedure comprises of a mixture of process design, extraction systems and working practices. All of these parameters [hardware and software] must be properly considered in the overall design to achieve a proper level of sustainable control.

*1.3 Assessment of Exposure and Risk Assessments*

Use of process and procedure risk assessments to evaluate the potential over-exposures that control measures need to overcome to achieve adequate control at the design stage for a process.

## 2 DESIGN OF LOCAL EXHAUST VENTILATION SYSTEMS (55%)

**Educational Objectives** The student should understand the details of the good design factors of local exhaust ventilation systems along with the common design errors which make such systems ineffective. The use of prototype systems and measurement methods in the evaluation of LEV systems.

*2.1 Types of System*

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

*2.2 Principles of LEV Systems and their Components*

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

- Hood designs. [Captor, Receptor, Enclosure etc.]
- Ducts (duct size, configuration and materials, design of bends and junctions).
- Fans (types and their application, effects of direction of rotation).
- Air cleaners (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 systems and their risks and deficiencies.
- The provision of replacement air, especially if the workroom is either relatively small, or relatively well sealed. The importance of the distribution of the replacement air in a workroom.

*2.3 Design Considerations of LEV Systems*

- Identification of the sources of release.
- Need to enclose each source as far as this is practicable.
- Captor and Receptor hoods, Enclosures, Booths, including an understanding of other types of extract hood, i.e. partial enclosure (not necessarily the same as a booth). 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.
- Specifying relevant measurable performance criteria for an LEV system.
- Capture velocities, face velocity, transport velocities.
- Calculating the air flow that is required in each branch of an LEV system.
- Pressure loss calculations for a multiple branch LEV system.
- Calculating the fan duty [air flow and pressure drop] that is required.
- Balancing the air flows in an LEV system – use of duct design or dampers, use of a flow control valve.
- The importance of air distribution across the face of a large extract hood.
- How hot plumes behave.
- Discharge arrangements and the risk of recirculation of contaminated air (where is the discharge, and can it be drawn back into the building?).
- Treatment systems and filtration standards, including their maintenance standards.
- Limitations of LEV and Practicability of the system for use.
- 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).

## 3 EVALUATION OF THE PERFORMANCE OF LEV SYSTEMS [20%]

**Educational Objectives** The student needs to be able to understand the basic techniques for measurements associated with the evaluation of LEV systems and be able to use them as part of a system commissioning.

*3.1 Measurement considerations*

- The visualisation of air flows and the effective capture of the contaminant(s) into the ventilation system including the use of a dust lamp.
- The use of common measurement systems for LEV systems.
- Full understanding of all calculations for volume flows from pressure and velocity measurements and their importance during commissioning or re-commissioning of systems.
- The specification of suitable measurable performance criteria for an LEV system and reporting.

**4 PRACTICAL (15%)**

**Educational Objectives** The student should understand the principles behind the operation of ventilation systems. He/she should be able to design a system to meet relevant criteria and then carry out measurements to check the effectiveness of the system.

*4.1 Practical Knowledge*

The student should have the experience in carrying out the following:

- Design of a LEV system to control a process.
- Use of an appropriate techniques to visualise air flows as a means to test control.
- Use common pressure and velocity measuring instruments, to undertake the measurements in relation to LEV systems (e.g. face velocity or capture velocity).
- Where, and how, to undertake duct measurements to get meaningful results.

**RECOMMENDED DOCUMENTATION**

1 HSE Guidance HSG258 (May 2008) Working Title :Local Exhaust Ventilation - principles and practice
2 HSE Guidance --Employers Guidance (May 2008)
3 HSE Guidance -- Employees Guidance (May 2008)
4 ACGIH Industrial Ventilation – A Manual of Recommended Practice
5 HSE Guidance WIS23 (1992) LEV General Principles of System Design
6 The Control of Substances Hazardous To Health Regulations 2002 ACOP and Guidance.
7 HSE Guidance Note HSG 193 (1999) COSHH Essentials Easy Steps to Control Chemicals.
8 “The dust lamp: A simple tool for observing the presence of airborne particles” MDHS 82. HSE Books.

**COURSE LENGTH**

It is envisaged that the course should be conducted over 4 days with at least 3 days for the course and 1 day for the examination and practical assessment.

**COURSE EXAMINATION/ASSESSMENT**

The students will be assessed as follows:

1. An MCQ examination of 45 questions with a maximum time allowed of 1 hour 15 minutes
2. A practical assessment carried out an independent practical assessor. (see below).

1. **MCQ Examination**

An MCQ examination consisting of 45 questions with a maximum time allowed of 1 hour and 15 minutes.

2. **Practical Assessment**

Candidates Individual Assessment must include:

- Design of systems: Two LEV system design studies for the control of hazardous material from example processes.
- Fault Diagnosis: Evaluation of poor system designs using photographs and questions.

Successful completion of the above requirements will lead to a:

**'PROFICIENCY CERTIFICATE' in**
**Basic Design Principles of Local Exhaust Ventilation Systems**