Proficiency Module Syllabus

P602 – Basic Design Principles of Local Exhaust Ventilation Systems

Aim
To provide the basic methodology, theoretical and practical knowledge to enable candidates 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.

Prior Knowledge:
Candidates are expected to have successfully completed module P601 – Thorough Examination and Testing of Local Exhaust Ventilation Systems or be able to demonstrate equivalent knowledge. They should also have a good understanding of the contents of HSG258 Controlling airborne contaminants at work: A guide to local exhaust ventilation (LEV).

Content
The syllabus is structured into four sections:

<table>
<thead>
<tr>
<th></th>
<th>Workplace Control Principles</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Design of Local Exhaust Ventilation Systems</td>
<td>55%</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation of the Performance of LEV Systems</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>Practical</td>
<td>15%</td>
</tr>
</tbody>
</table>

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 is intended as guidance for candidates only.

1 Workplace Control Principles (10%)

Educational Objectives
Candidates should understand the complex nature of exposure to hazardous substances in the workplace, appreciate the hierarchy of control measures and the overall approach that is required for successful implementation of a control programme. Candidates should fully understand the consequences of ineffective exposure control measures.

1.1 Principles of Good Control Practice
1.1.1 Understanding of the need to recognise all of the sources of exposure, and how each of these sources can be controlled.
1.1.2 Awareness of the hierarchy of control options including work procedures, process engineering controls, ventilation and PPE.
1.1.3 Practical application of control measures including testing for the adequacy of the control measure and evaluation of its on-going performance.

1.1.4 The control of emissions as they relate to the control of exposure and the consequences [health and financial] of inadequate control.

1.1.5 The need for proper development and management of exposure control measures and their implication for COSHH assessments.

1.2 Achieving Control
1.2.1 Appreciation that the overall exposure control measure for a procedure comprises a mixture of process design, extraction systems and working practices. Understanding that 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
1.3.1 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
Candidates should understand the details of good design practice for local exhaust ventilation systems along with the common design errors which can make such systems ineffective.

Candidates should understand the role of visualisation and measurement techniques in the evaluation of LEV systems.

2.1 Types of System
2.1.1 The range of systems in use, including general ventilation and types of local exhaust ventilation.

2.2 Principles of LEV Systems and their Components
Design principles of the system itself and of its components, including:
2.2.1 Hood designs: captor, receptor, enclosure etc. and their application
2.2.2 Ductwork design: duct size, configuration and materials, design of bends and junctions.
2.2.3 Fans and other air movers: types and their application.
2.2.4 Air cleaners: types and their performance, gravity and centrifugal collectors, dry fabric filters, electrostatic, wet methods, absorption.
2.2.5 Facilities for maintenance, examination, testing and conditioning.
2.2.6 Balancing within systems and with their environment.
2.2.7 The nature of flammable dusts and vapours and of explosion prevention, and explosion relief in relation to LEV.
2.2.8 Discharge systems and their risks and deficiencies.
2.2.9 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
2.3.1 Identification of the sources of release.
2.3.2 Need to enclose each source as far as this is practicable.
2.3.3 Captor and Receptor hoods. Enclosures and Booths, including full enclosures, room enclosures and partial enclosures. Special types such as slots, push-pull systems, High Velocity Low Volume (HVLV) systems etc.
2.3.4 Application of hoods, slots, enclosures to industrial situations.
2.3.5 Specifying relevant measurable performance criteria for an LEV system.
2.3.6 Capture velocities, face velocity, transport velocities.
2.3.7 Calculating the air flow that is required in each branch of an LEV system.
2.3.8 Pressure loss calculations for a multiple branch LEV system.
2.3.9 Calculating the fan duty [air flow and pressure drop] that is required.
2.3.10 Balancing the air flows in an LEV system – use of duct design or dampers, use of a flow control valve.
2.3.11 The importance of air distribution across the face of a large extract hood.
2.3.12 How hot plumes behave.
2.3.13 Discharge arrangements and the risk of recirculation of contaminated air (where is the discharge, and can it be drawn back into the building?).
2.3.14 Treatment systems and filtration standards, including their maintenance requirements.
2.3.15 Limitations of LEV and practicability of the system for use.
2.3.16 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
Candidates should understand the basic techniques for measurements associated with the evaluation of LEV systems and be able to use them as part of the system commissioning process.

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

4 Practical (15%)

Educational Objectives
Candidates should understand the principles behind the operation of ventilation systems and 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
- Design of an LEV system to control release of hazardous substances from a process.
- Use of an appropriate technique 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.

Relevant Documents
(1) HSG258 (2011) Controlling airborne contaminants at work: A guide to local exhaust ventilation (LEV)
(2) ACGIH Industrial Ventilation – A Manual of Recommended Practice
(3) WIS23(rev1) (2012) Wood dust: Controlling the risk
(4) The Control of Substances Hazardous to Health Regulations 2002 (as amended) ACOP and Guidance
(5) HSG 193 (1999) COSHH Essentials: Easy steps to control chemicals
(6) MDHS 82 (1997) The dust lamp: A simple tool for observing the presence of airborne particles HSE Books
Course Length
The course will normally be conducted over four days which includes the examination.

This course will require approximately 28 hours’ study time, of which at least 20 hours will be taught. Additional study will be required in the candidates’ own time.

Examination and Assessment
Candidates are required to pass the following examination and case studies assessment to be awarded the module:

A  Written theory examination
This is a closed-book examination comprising 35 short-answer questions to be answered in 1 hour 45 minutes. The examination covers sections 1 to 3 of the syllabus in proportion to the time allocation given on the front page of the syllabus. The examination is overseen by a BOHS invigilator.

B  Case studies
Candidates who pass the written theory examination are required to complete two case studies. The case studies include:

- the design of a system for the control of hazardous material from a process, and
- fault diagnosis of a poor system design.

The completed case studies are submitted to BOHS for marking.

Further information about the case studies is published in the following document on the BOHS website: http://www.bohs.org/education/examinations/proficiency-modules/

- Case Studies: Information for Tutors and Candidates

Certification
Candidates who pass the examination and case studies assessments within 12 months will be awarded a Proficiency Certificate in Basic Design Principles of Local Exhaust Ventilation Systems.