

## Proficiency Module Syllabus

### P401 – Identification of Asbestos in Bulk Samples (PLM)

#### Aim

To provide candidates with theoretical and practical knowledge in the techniques of asbestos sample identification using polarised light microscopy (PLM).

#### Prior Knowledge

Candidates for this course are expected to be aware of the contents of HSG248 Asbestos: the analysts' guide for sampling, analysis and clearance procedures and in particular Appendix 2: Asbestos in bulk materials: sampling and identification by polarised light microscopy (PLM). Candidates will preferably have prior experience of analysing bulk samples and may already be participating in a quality control scheme.

#### Content

The syllabus is structured into four sections:

	<b>Time Allocation</b>
<b>1 Asbestos Fibres</b>	<b>5%</b>
<b>2 Set Up and Use of a Polarised Light Microscope</b>	<b>15%</b>
<b>3 Analysis of Bulk Samples</b>	<b>40%</b>
<b>4 Practical Work</b>	<b>40%</b>

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

#### 1 Asbestos Fibres (5%)

**Educational Objectives** Candidates should have a good knowledge of the types and forms of asbestos fibres, their health effects and their industrial uses.

##### 1.1 Asbestos

1.1.1 Describe the six regulated forms of asbestos in relation to the serpentine and amphibole groups of minerals. Discuss their characteristic properties, such as flexibility, tensile strength, combustibility, thermal conductivity and resistance to chemical attack. Describe the effects of thermal and other forms of degradation on asbestos minerals.

##### 1.2 Uses of Asbestos

1.2.1 Explain the physical and chemical properties of asbestos which have determined the use to which it has been put by industry. Discuss the three types of asbestos which have found significant commercial use (Amosite, Chrysotile and Crocidolite) and the types of materials they were added to. Describe the use and occurrence of the other types of asbestos particularly as possible contaminants in other minerals.

##### 1.3 Health Effects of Asbestos

1.3.1 Describe the full range of health effects ranging from the benign (pleural plaques) to the terminal (mesothelioma) in the light of results from epidemiological studies carried out on asbestos workers.

## 2 Set Up and Use of a Polarised Light Microscope (15%)

**Educational Objectives** Candidates should know the theory of polarised light and the practicalities involved in setting up and using a polarised light microscope.

### 2.1 *Equipment and Use*

2.1.1 Identify the minimum equipment required. Discuss and demonstrate alignment of the optics and obtaining Koehler or Koehler type illumination. Discuss and demonstrate the alignment and use of the rotating stage, polarisers and cross-hair eyepieces, field and sub-stage diaphragms, phase and dispersion staining objectives.

### 2.2 *Theory*

2.2.1 Discuss the theory of polarised light and the effects produced on crystalline and amorphous or vitreous materials. Cover the basic physics behind colour, pleochroism, birefringence (interference colours), sign of elongation and extinction.

### 2.3 *Observations*

2.3.1 Demonstrate the occurrence of colour, pleochroism, birefringence (interference colours), sign of elongation and extinction. Discuss and demonstrate the use and effects of refractive index oils and the use of Becke line and dispersion observations.

## 3 Analysis of Bulk Samples (40%)

**Educational Objectives** Candidates should be able to describe the approved methods for analysis of bulk fibre samples and have an understanding of the exposure controls and quality controls required during this activity.

### 3.1 *Macroscopic Examination*

3.1.1 Using HSG248 (1) as a basis, demonstrate examination by low power stereo microscope, including the recognition of the basic physical properties of the main asbestos types, i.e. colour, lustre, elasticity, tenacity, morphology and behaviour in water.

### 3.2 *Sample Preparation*

3.2.1 Explain and demonstrate the options for sample preparation to segregate the asbestos for analysis. Using HSG248 (1) as a basis, demonstrate sample preparation methods to remove matrix materials before PLM identification, including acid washing, solvent extraction and combustion.

### 3.3 *Polarised Light Microscopy*

3.3.1 Examine using polarised light microscopy characteristics such as morphology, colour, pleochroism, birefringence (interference colours), sign of elongation and extinction of different asbestos types.

### 3.4 *Dispersion Staining*

3.4.1 Describe and demonstrate dispersion stain microscopy using R.I. liquids together with a McCrone dispersion staining objective or phase contrast microscopy with polariser in relation to the assessment of refractive indices of asbestos and other fibres.

### 3.5 *Safety During Identification*

3.5.1 Discuss the safety precautions required when working with asbestos and other fibres, e.g. the use of glove boxes and ventilated cabinets as well as the required precautions when using acids during sample preparation and when handling R.I. liquids. This must include the routine inspection/checking of ventilation and control systems as required under the Control of Asbestos/COSHH Regulations.

### 3.6 *Quality Control*

- 3.6.1 Discuss quality control procedures, likely detection limits, and problems of cross contamination during sampling and analysis, together with the handling of homogeneous and heterogeneous samples. Refer to external proficiency schemes such as AIMS. Discuss the problems associated with fatigue and eye strain and how to minimise them.

### 3.7 *Interfering Fibres and Products*

- 3.7.1 Describe the other types of fibres which may interfere with asbestos identification, e.g. leather swarf, skin cells, polyethylene. Describe problems with analysing products such as floor tiles, and those caused by the effects of heat on asbestos fibres.

## 4 **Practical Work (40%)**

Practical work must be carried out to provide candidates with all practical knowledge in carrying out the following using safe working methods:

- microscope set-up,
- sample preparation,
- PLM typing of unknown samples,
- identification of asbestos using polarised light dispersion staining techniques.

### **Relevant Documents**

- (1) HSG248 (2005) Asbestos: The analyst's guide for sampling, analysis and clearance procedures

### **Course Length**

This course will require approximately 16 hours of study time, of which at least 12 hours will be taught (teaching and formative practical assessment) and 4 hours will be independent (in the candidates' own time).

### **Examinations and Assessment**

Candidates are required to pass all of the following parts (A, B and C below) to be awarded the module.

#### **A Formative Practical Assessment**

The formative practical assessment is carried out by the training provider during the course. It enables candidates to demonstrate their ability to:

- work safely at a fume cupboard whilst using a stereo microscope to examine samples,
- correctly prepare slides for examination under a polarising microscope,
- set up a polarising microscope to allow identification of asbestos types within a sample.

Further information about the formative practical assessment is published in the following document on the BOHS website: <http://www.bohs.org/education/examinations/proficiency-modules/>

- Formative Practical Assessment: Guidance for Tutors and Candidates

#### **B Written Theory Examination**

This is a closed-book examination comprising 20 short-answer questions to be answered in one hour. 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.

#### **C Practical Examination**

This is an open-book practical examination which requires candidates to identify the asbestos types in six samples. The samples are from the AIMS scheme, provided to BOHS by HSL.

Candidates are permitted to access relevant reference material but not electronic databases, computers, tablets or mobile phones. Communication between candidates is not permitted. The examination is overseen by a BOHS specialist invigilator.

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

- Practical Examination Requirements

### **Certification**

Candidates who pass all the parts (A,B and C) within 12 months will be awarded a ***Proficiency Certificate in Identification of Asbestos in Bulk Samples (PLM)***.