

**The British Occupational Hygiene Society
Faculty of Occupational Hygiene**

PROFICIENCY MODULE SYLLABUS

P401 – Identification of Asbestos in Bulk Samples (PLM)

Aim: To provide 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 HSG 248 (Asbestos: The Analysts Guide) 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:	Topic	Time Allocation
	1 Asbestos Fibres	5%
	2 Set Up and Use of a Polarised Light Microscope	15%
	3 Analysis of Bulk Samples	40%
	4 Practical Work	40%

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 Asbestos Fibres (5%)

1.1 Asbestos

Describe the 6 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

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

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.

Educational Objectives The student must have a good knowledge of the types and forms of asbestos fibres and their industrial uses.

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

2.1 Equipment and Use

Review 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*

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*

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.

Educational Objectives The student must know the theory of polarised light and the practicalities involved in setting up and using a polarised light microscope.

3 **Analysis of Bulk Samples (40%)**

3.1 *Macroscopic Examination*

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*

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*

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*

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*

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 CAR/COSHH regulations.

3.6 *Quality Control*

Discuss Quality Control procedures, likely detection limits, problems of cross contamination during sampling and analysis, together with the handling of homogeneous and heterogeneous samples. 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*

Describe the other types of fibres which may interfere with asbestos identification e.g. leather swarf, skin cells, polyethylene. Problems with other products such as floor tiles. The effects of heat on asbestos fibres.

Educational Objectives The student must 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.

4 **Practical Work (40%)**

Practical work must be carried out to provide the student with all practical knowledge in carrying out the following:

- microscope set-up

- sample preparation
- PLM typing of unknown samples
- Identification of asbestos using polarised light dispersion staining techniques.

References

- (1) HSE Guidance HSG248 (2005) Asbestos: The Analyst's guide for sampling, analysis and clearance procedure

Course Length

It is envisaged that this course will be conducted over 2 days with a further ½ day for the examination and assessment.

This course will require 16 hours of study time (teaching and practical), some of which may need to be undertaken in the candidates own time.

Course Examination/Assessment

The students would be assessed as follows:

- A 45 minute BOHS examination consisting of 20 short answer questions
- A practical assessment, which involves the identification of unknown samples supplied by BOHS and carried out by an approved practical assessor as follows:

Practical Assessment – Asbestos Identification

Assessment must include:

- Identification of 6 unknown samples - A full marking schedule based on HSL scoring is used
- Observation of safety protocols
- Evaluation/checking of working environment control systems
- Evaluation of competence in use of microscopes

Full details of the practical assessment requirements are provided as a separate document GA.2 P401 Practical Requirements.

Successful completion of the above will lead to a:

**'PROFICIENCY CERTIFICATE' in
Identification of Asbestos in Bulk Samples (PLM)**