



Course Specification

Course title	Asbestos and Other Fibres
Code	W504
Level	Intermediate
Pre-requisites	None
Course material	Available from OHTA Training.org
Coordinating editors	Jonathan Grant
Approval date	May 2010
Review date	May 2013

Aims

This course aims to:

Enhance the student's knowledge of occupational hygiene practice in relation to fibrous dusts. The module concentrates on asbestos, but other fibres, eg. Machine made mineral fibres, aramids, carbon etc., which are increasingly finding uses in industry are also covered. Successful completion of this module will benefit those working in asbestos consultancy as well as in mainstream occupational hygiene, giving an understanding of the health risks associated with asbestos and other fibres as well as the means of evaluation and control.

Learning Outcomes

On successful completion of this module the student should be able to:

- describe the composition, nature and properties of asbestos, machine made mineral and other fibres and their historical uses;
- describe the health effects of asbestos and other fibrous materials and apply appropriate exposure limits;
- describe the uses of asbestos in buildings and the public health risk that these may pose;
- understand the principles of and requirements for asbestos surveys including taking samples and identifying bulk asbestos types by microscopic techniques including relevant safety requirements;
- be thoroughly familiar with current good practice in the construction and use of enclosures for asbestos remediation and the use of decontamination units;
- understand all the principles of clearance testing, the requirements for measurement and appropriate techniques for post remediation evaluation;
- conduct air sampling to determine airborne concentrations of asbestos or other fibres in accordance with defined procedures including microscopic counting techniques.
- have the ability to advise on all the various techniques for the management of asbestos in buildings in accordance with good practice.

Course Format

Normally run as a 5 day taught course [minimum 45 hours including lectures, tutorials, practical/demonstration sessions, guided reading, overnight questions and examination].

There will be a 40 short answer question "open book" examination with an allowed time of 120 minutes.

Content

Topic	Title	Time Allocation
1	Asbestos and other Fibrous Materials	10%
2	Health Hazards and Exposure Limits	10%
3	Asbestos in Buildings and Conducting Surveys	25%
4	Asbestos Remediation and Assessment Prior to Reoccupation	20%
5	Air Sampling and Fibre Counting	20%
6	Analysis of Bulk Samples	15%

Note: Reference is made to standards and good practice documentation. This may not be the most up-to-date relevant publications and is intended as guidance for candidates only.

Detailed Course Content

1 Asbestos and Other Fibrous Materials (10%)

1.1 Asbestos

- 1.1.1 Describe the six regulated forms of asbestos in relation to the serpentine and amphibole groups of minerals.
- 1.1.2 Discuss their characteristic properties, such as flexibility, tensile strength, combustibility, thermal conductivity and resistance to chemical attack.
- 1.1.3 Describe the effects of thermal and other forms 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.
- 1.2.2 Discuss the three types of asbestos which have found significant commercial use (amosite, chrysotile and crocidolite) and the various categories of asbestos-containing materials.
- 1.2.3 Describe the use and occurrence of the other types of asbestos particularly as possible contaminants in other minerals.

1.3 Man Made Mineral and other Fibres

- 1.3.1 Describe the physical and chemical properties of other fibres such as mineral wools, ceramic fibres, special purpose fibres and continuous filament fibres.

2 Health Hazards and Exposure Limits (10%)

2.1 Health Effects of Asbestos

- 2.1.1 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.
- 2.1.2 Pay particular attention to the report by Doll and Peto, 'Effects on Health of Exposure to Asbestos' (1985), that by Hodgson and Darnton 'The Quantitative Risks of Mesothelioma and Lung Cancer in Relation to Asbestos Exposure' (2000) and IPCS EHC53 Asbestos and other fibres. Review subsequent influential publications.
- 2.1.3 Cover dose response relationships, the effects of smoking whilst working with asbestos and the risks to health from low level exposure.

2.2 Inhalation Studies

- 2.2.1 Review research studies of the effects of natural and synthetic fibres on laboratory animals, with particular attention being given to inhalation studies.
- 2.2.2 Draw attention to the differences and similarities between the results of inhalation studies on laboratory animals subjected to various types of fibre
- 2.2.3 Compare the animal experimental evidence and that derived from known human experience.

2.3 Exposure Limits etc. for Asbestos

- 2.3.1 Review exposure limits, and the clearance indicator threshold for asbestos together with the philosophy behind setting them.

- 2.4 *Machine Made Mineral and other Fibres*
 - 2.4.1 Describe the health effects of machine made mineral and other fibres such as skin, eye and upper respiratory tract irritation as well as carcinogenic effects.
 - 2.4.2 Review the IARC 2B classification.
 - 2.4.3 Review health effects of other fibres including Aramids, carbon etc
- 2.5 *Typical Exposures to Machine Made Mineral and other Fibres.*
 - 2.5.1 Give examples of typical exposures while working with machine made mineral and other fibres in fibres/ml and explain what can be achieved under good working conditions. Operations discussed should include processes which result in a wide range of possible exposure levels.
 - 2.5.2 Comment on the relationship between mass concentrations and fibre counts
- 2.6 *Typical Legislative Approach*
 - 2.6.1 Discuss the WHO guidelines and documentation relating to elimination of asbestos related diseases for control of asbestos exposure.
 - 2.6.2 Discuss legislative approach with particular reference to employer's responsibilities for reducing risks.
 - 2.6.3 Review literature and typical guidance documentation.

3 Asbestos in Buildings and Conducting Surveys (25%)

- 3.1 *Types and Uses of Asbestos in Buildings*
 - 3.1.1 Use the literature as a primary source of information on products and their locations in buildings.
 - 3.1.2 Explain the physical and chemical properties of asbestos which have determined the use to which it has been put by industry.
 - 3.1.3 Discuss the three types of asbestos which have found significant commercial use (amosite, chrysotile and crocidolite) in relation to sprayed and thermal insulation, insulating boards, coatings, cement products and other reinforced products (eg. vinyl tiles, roofing felts) commonly used in building construction.
 - 3.1.4 Discuss the uses and composition of other asbestos products likely to be used or found inside buildings on plant, machinery or domestic appliances (eg textiles, friction materials, seals, gaskets etc)
- 3.2 *Surveys of Asbestos Containing Materials in Buildings*
 - 3.2.1 Discuss the types of survey which can be carried.
 - 3.2.2 Describe how to plan, organise and conduct surveys.
 - 3.2.3 Discuss which parameters need to be assessed and recorded during the survey.
 - 3.2.4 Explain reporting standards, typical errors and how to present results in meaningful manner and record properly the location of asbestos containing materials.
- 3.3 *Bulk Sampling*
 - 3.3.1 Discuss the reasons for bulk sampling ranging from the collection of one sample through to a complete asbestos audit of a building to compile an asbestos register.
 - 3.3.2 Describe the techniques used and precautions required when collecting bulk samples.
- 3.4 *Risk Assessment of Asbestos Containing Materials in Buildings*
 - 3.4.1 Examine strategies for risk assessment of asbestos containing materials in buildings and the compilation of asbestos registers.
 - 3.4.2 Outline the types and sources of information required and discuss the uses to which this information is put.
- 3.5 *Management of Asbestos Containing Materials in Buildings*
 - 3.5.1 Examine strategies for management of asbestos containing materials in buildings and the use of asbestos registers and permit to work systems.
 - 3.5.2 Outline the types and sources of information required and discuss the uses to which this information is put.
 - 3.5.3 Describe the decision-making protocols for prioritizing relevant management actions

4 Asbestos Remediation and Assessment Prior to Reoccupation (20%)

4.1 Preparation

- 4.1.1 Discuss the steps required in a job specification, preparation of a plan of work by the contractor, tender evaluation and the various roles required for proper management of the site.
- 4.1.2 Include other health and safety aspects such as emergency procedures.

4.2 Enclosures

- 4.2.1 Correct principles of construction and implementation of an enclosure for asbestos remediation
- 4.2.2 Methods of enclosure examination and the documentation associated with the enclosure.
- 4.2.3 Correct procedures for entry, exit and decontamination.
- 4.2.4 The use of negative pressure monitors
- 4.2.5 Use of secondary enclosures.

4.3 Remediation Procedures

- 4.3.1 Describe the various control measures available to a removal company to ensure that asbestos dust levels are kept as low as is reasonably practicable inside the enclosure.

4.4 Waste Removal

- 4.4.1 Describe the requirements for removal, storage and disposal of waste from an enclosure.

4.5 Role of Analyst

- 4.5.1 Describe the role of the analyst as a competent person/consultant.
- 4.5.2 Understand the requirements for quality management systems in accordance with ISO17025 and accreditation with national bodies.

4.6 Air Monitoring and Other Techniques

- 4.6.1 Identify the various stages where air monitoring should be employed both during and post remediation.
- 4.6.2 Discuss other inspection techniques such as the dust lamp, smoke tubes, negative pressure monitors which are also useful for checking of the effectiveness of the work and the control measures.

4.7 Certification of Reoccupation

- 4.7.1 Demonstrate all the essential requirements of the required clearance procedures on completion of asbestos remediation work including the decontamination unit. This must include the certification for reoccupation.

5 Air Sampling and Fibre Counting (20%)

5.1 Types of Air Sampling

- 5.1.1 Detail the types of air sampling that can be carried out.
- 5.1.2 Examine the sampling requirements and their relevance for identification of sources of contamination.
- 5.1.3 Cover assessment of personal exposure and the checking of efficiency and effectiveness of control measures

5.2 Air Sampling Equipment and Procedures

- 5.2.1 Discuss the requirements of the World Health Organisation method in relation to sampling of airborne asbestos and other fibrous materials.
- 5.2.2 Demonstrate the equipment required and the adjustment, measurement and calibration of sampling rate.
- 5.2.3 Discuss the requirements for recording calibration and site sampling information etc

5.3 Clearance Sampling

- 5.3.1 Discuss when and how clearance sampling is carried out, what should be looked for and the types and frequency of disturbance which must take place.

5.4 Setting Up Microscopes for Fibre Counting

- 5.4.1 Describe use of light microscopy, setting up of Koehler illumination, calibration of stage micrometer, test slides.
- 5.4.2 Describe the theory of phase contrast microscopy, with particular attention being paid to the microscope specifications outlined in guidance material.

- 5.4.3 Demonstrate and allow students to practice the use of the Walton Beckett graticule, stage micrometer and NPL test slide or equivalent. Students should be given the opportunity to set up various makes of microscope used in this work as well as to count slides of known quality
- 5.5 *Filter Preparation*
 - 5.5.1 Make students familiar with the preparation of filters and counting of fibres in accordance with the WHO method
 - 5.5.2 Discuss the limitations of the methods together with examination of accuracy, precision and systematic differences
- 5.6 *Calculation of Results and Quality Control*
 - 5.6.1 Examine the reliability of results in relation to quality control schemes
- 5.7 *Electron Microscopy*
 - 5.7.1 Give an outline of the basic principles of SEM and TEM
 - 5.7.2 Discuss the discrimination between asbestos types and other fibres using SEM and TEM together with Energy Dispersive X-Ray analysis (EDXA)

6 Analysis of Bulk Samples (15%)

- 6.1 *Macroscopic Examination*
 - 6.1.1 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 behavior in water
- 6.2 *Sample Preparation*
 - 6.2.1 Explain and demonstrate the options for sample preparation to segregate the asbestos for analysis
 - 6.2.2 Demonstrate sample preparation methods to remove matrix materials before Polarised Light Microscopic identification, including acid washing, solvent extraction and combustion
- 6.3 *Polarised Light Microscopy*
 - 6.3.1 Examine using polarized light microscopy characteristics such as morphology, colour, pleochroism, birefringence (interference colours), sign of elongation and extinction of different asbestos types
- 6.4 *Dispersion Staining*
 - 6.4.1 Describe and demonstrate dispersion stain microscopy using Refractive Index 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
- 6.5 *Health and Safety Precautions During Identification*
 - 6.5.1 Discuss the precautions required when working with asbestos and other fibres eg. 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
- 6.6 *Quality Control*
 - 6.6.1 Discuss Quality Control procedures, likely detection limits, problems of cross contamination during sampling and analysis, together with the handling of homogeneous and heterogeneous samples
- 6.7 *Interfering Fibres and Products*
 - 6.7.1 Describe other types of fibres and other products which may interfere with asbestos identification eg. leather swarf, skin cells, polyethylene
 - 6.7.2 Cover problems with products such as floor tiles
 - 6.7.3 Describe the effects of heat on asbestos fibres

Learning and Teaching Activities

Learning Time

Scheduled contact hours: (Note these timings are indicative only)	Lectures	16
	Seminars	2
	Practical Sessions	8
	Tutorials	8
	Examinations (including preparation)	3
	Other Scheduled Time	
Guided independent study Note: include in guided independent study; preparation for scheduled sessions, follow up work, wider reading or practice, revision	Independent Coursework	8
	Independent Laboratory Work	
	Other Non-scheduled Time	
Total Hours		45

Assessment Details

Methods of Assessment	Practical Assessment	Open Book Examination
Grading Mode	Formative	Summative
Weighting %	NA	100
Pass Mark	NA	Set by the examining body
Outline Details	<p>All candidates must participate in the practical studies and demonstrate the required skills. The studies should be designed by the course tutor(s) to test the basic skill and knowledge of each of the candidates in the techniques for safely taking samples from bulk materials and also assessing fibre concentration in the atmosphere. The exercises must, therefore, involve:</p> <ul style="list-style-type: none"> • Set up and use of an air sampling system for asbestos fibres in air with suitable high-volume pump and the subsequent preparation of slides for counting. • Sampling of bulk material for asbestos identification including all the required safety precautions. [Surrogate materials to be used] <p>Full details of the practical requirements and the individual candidate reporting forms etc. are available in document JD.2 Practical Evaluation Report which is available from www.bohs.org and www.ohtatraining.org</p>	<p>40 short answer questions to be answered in 120 minutes. The questions require candidates to write short answers which will require no more than the box provided but may include multiple answers. Some questions may require calculations.</p> <p>Students can only refer to the W504 student manual during the examination.</p>

Is the student required to pass ALL elements of assessment in order to pass the course? Yes

Indicative Course Materials and Reading:

ISBN Number	Author	Date	Title	Publisher
			W504 Asbestos and Other Fibres Student Manual. Downloadable for free from www.ohattraining.org	OHTA
978-0-7282-0512-3	W.J.H Sanderson	2007	Asbestos for Surveyors. 2nd Edition	
		2007	Alternative Code of Practice 2 Surveying for Asbestos	Asbestos Control and Abatement Division of Thermal Insulation Contractors Association. [DL1 40B UK]
		2007	ACAD Alternative Code of Practice 1 for 'work with asbestos requiring a license'	Asbestos Control and Abatement Division of Thermal Insulation Contractors Association. [DL1 40B UK]
924154193 8			International Programme for Chemical Safety EHC53 Asbestos and other	
			WHO fibre counting technique described at http://www.who.int/occupational_health/Publications/en/oehairbornefibre.pdf	WHO
	Thomas	1999	Asbestos and Man Made Fibres in Buildings, Practical Guidance.	DETR
	Doll, R & Peto, J	1985	Asbestos: Effects on Health of Exposure to Asbestos	London, HM Stationery Office
	Hodgson JT & Darnton A	2000	Annals of Occupational Hygiene, Volume 44, Number 8, 1 December 2000, pp 565-601(37) Oxford University Press, The Quantitative Risks of Mesothelioma and Lung Cancer in Relation to Asbestos Exposure (2000)	OUP
		2005	ISO 17025 (2005) General Requirements for the Competence of Testing and Calibration Laboratories	ISO
		2012	ISO 17020 (2012) Requirements for the Operation of Various Types of Bodies Performing Inspection	BSI
978 0 7176 6385 9		2012	HSE Guidance Note HSG 264 (2012) Asbestos: The Survey Guide	HSE [available as PDF]
07176 2874 4		2006	HSE (UK) Guidance HSG 247 (2006) Asbestos: The Licensed Contractor's Guide	HSE [available as PDF]
		1988	HSE (UK) Guidance MDHS 59 (1988). Man Made Mineral Fibre Airborne Number Concentration by Phase Contrast Light Microscopy	HSE [available as PDF]
0717628752		2005	HSE (UK) Guidance HSG 248 (2005) Asbestos: The Analysts Guide for Sampling, Analysis and Clearance Procedures	HSE [available as PDF]

0780717665 37		2012	HSE Guidance Note HSG 210 (2012) Asbestos Essentials	HSE [available as PDF]
		2012	HSE Guidance INDG 223 (2012) Managing Asbestos in Workplace	HSE [available as PDF]
9780717662 07		2006	HSE ACOP (L143) (2006) Work with Materials Containing Asbestos	HSE [available as PDF]
9780717662 24		2007	HSE ACOP and Guidance L144 (2007) Managing Health and Safety in Construction. Construction (Design and Management) Regulations 2007	HSE [available as PDF]
9780717662 08		2006	HSE ACOP (L127) (2006) Management of Asbestos in Non-Domestic Premises	HSE [available as PDF]
978 0 7176 2381 5		2002	HSE Guidance Note HSG 227 (2002) Comprehensive Guide to Managing Asbestos in Premises	HSE [available as PDF]