

The logo for BOHS (British Occupational Hygiene Society) features the letters 'BOHS' in a stylized white font on a blue background. The 'O' is a circle with a white dot in the center.

British Occupational
Hygiene Society

The Chartered
Society for Worker
Health Protection

P403 Proficiency Qualification:

Asbestos Fibre Counting (PCM)

Qualification Specification

www.bohs.org

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Section 1

About BOHS

BOHS - The Chartered Society for Worker Health Protection

BOHS is the Chartered Society for Worker Health Protection. Our vision is to create a healthy working environment for everyone by preventing exposure to hazardous substances in the workplace.

Founded in 1953, we have developed over the last 60 years into a highly respected and influential body on workplace health issues, working closely with organisations in the UK and overseas to promote our vision. We are a registered charity, professional society and a member of the International Occupational Hygiene Association which is recognised as a non-government organisation by the International Labour Organisation (ILO) and the World Health Organization (WHO).

We were awarded a Royal Charter in 2013 in recognition of our pre-eminent role in protecting worker health.

BOHS is a membership organisation, open to anyone who has an interest in workplace health issues, and we have over 1800 members in 57 countries.

BOHS courses and qualifications – the quality choice

We are the leading awarding body in our field. Our UK courses and qualifications are recognised and respected by independent agencies such as the Health and Safety Executive (HSE) and the United Kingdom Accreditation Service (UKAS), and further afield by industry and employers worldwide. Over 60,000 people have taken one of our qualifications through our network of training providers which offer engaging, challenging and practical courses.

Our courses and qualifications are overseen by a team of highly experienced professionals who are dedicated to developing the competence and career opportunities for the many thousands of people who play a key role in protecting worker health, in diverse fields such as asbestos, legionella and control technologies.

Information about all our courses and qualifications is available on our website:

www.bohs.org/qualifications-training/bohs-qualifications/

Section 2

P403 at a glance

What is the objective?

To provide candidates with theoretical and practical knowledge in the techniques of fibre counting of asbestos air samples, using phase contrast microscopy (PCM).

Who is it for?

- Asbestos and laboratory analysts whose role involves fibre counting.
- Anyone who manages asbestos analysts or requires a deeper understanding of the asbestos analysis process (e.g. laboratory quality manager).

What are the entry requirements?

- Familiarity with *HSG248: Asbestos: the analysts' guide for sampling, analysis and clearance procedures* (Appendix 1).
- Prior experience of analysing fibre count samples using PCM.

What are the main subject areas?

- Set up of phase contrast microscope.
- Filter preparation.
- Fibre counting.
- Set up of air sampling equipment.
- Calculation of results.
- Quality control.
- Reporting and communication.

How long does it take?

Normally 2 days as a set course.

What level is it?

Level 4 in the BOHS qualifications framework.

How do candidates pass it?

Candidates must pass three parts within 12 months:

- Formative practical assessment.
- Written theory examination.
- Microscope practical examination.

Section 3

Background to the qualification

BOHS has provided asbestos proficiency qualifications in the UK for over 15 years, working closely with globally recognised, well-respected bodies such as the HSE to set educational standards and to spread best practice. In that time, over 45,000 candidates have taken a BOHS asbestos examination.

Asbestos is still a big issue in the UK and is present in many buildings constructed before the year 2000. If disturbed by demolition or remediation work, it breaks down into small fibres, which can be inhaled deep into the lungs and cause life-threatening illnesses such as lung cancer and mesothelioma. According to the HSE, around 5,000 people die from an asbestos-related disease in the UK each year.

Analysis of airborne samples plays a key role when managing asbestos in buildings in line with the Control of Asbestos Regulations (CAR) 2012. *P403 – Asbestos Fibre Counting (PCM)* gives analysts the knowledge and skills required to safely take air samples, prepare fibre counting slides, and accurately analyse these slides under a microscope in order to identify airborne fibre levels within the building or site.

The requirement to be formally trained in is outlined in *HSG248 - Asbestos: The analysts guide for sampling, analysis and clearance procedures*, which states that any workers who are liable to be exposed to asbestos should be sufficiently trained in their area of asbestos work, to ensure they are not put at risk when working with asbestos. CAR 2012, Regulation 20 also states that all persons who carry out any measurement of the concentration of asbestos fibres present in the air must be proven competent within an ISO/IEC 17025 laboratory and this qualification is a step towards proving competence.

Section 4

Key features of the qualification

Objective

This qualification is designed to improve the knowledge and skills required by asbestos fibre counting analysts, up to a standard which is recognised as preventing ill health by minimising the risk of exposure to airborne asbestos fibres.

Target audience

The qualification is suitable for anyone who is:

- Required to undertake asbestos fibre counting as part of their work.
- Considering a career in asbestos analysis.
- Responsible for managing asbestos analysts.

Entry requirements

Candidates for this course are expected to be familiar with the contents of *HSG248-Asbestos: the analysts' guide for sampling, analysis and clearance procedures* (in particular Appendix 1: Fibres in air: sampling and evaluation of by phase contrast microscopy).

Candidates will preferably have prior experience of fibre counting RICE slides and practice in the optimisation and use of phase contrast microscopes. They may also already be participating in a quality control scheme.

Candidates also need good literacy and numeracy skills to complete the examination.

Age range

There is no age restriction on candidates taking the qualification. However, there are requirements within the Management of Health at Safety at Work Regulations 1999 (Regulation 19) which specifies that people younger than 18 years old should not be employed in work which exposes them to carcinogens.

Level

The level of a qualification indicates the relative complexity and depth of knowledge and skills required to attain the qualification. This qualification is set at level 4 in the BOHS qualifications framework. This is equivalent to NVQ Level 4 (HNC).

Fees

The examination fee for each candidate is published on the BOHS website: www.bohs.org.

Section 5

Delivering the qualification

Teaching and learning time

The P403 course will normally run over two consecutive days and includes 11 hours of study time. This includes 9 hours taught (teaching and formative practical assessment) and two hours of independent study (in the candidate's own time).

The course can be delivered more flexibly, such as on one day per week over two weeks, but should still include 9 hours of teaching.

Tutors

The course should be taught by tutors who are experienced and qualified/certified asbestos practitioners or occupational hygienists. As a guide, tutors will typically have:

- At least three years' current experience in asbestos fibre counting;
- A recognised asbestos qualification or a professional occupational hygiene qualification/certification such as:
 - BOHS Certificate of Competence (Asbestos).
 - BOHS Certificate of Operational Competence.
 - BOHS Diploma of Professional Competence.

This list is not necessarily exhaustive or definitive.

Teaching resources

Training providers should have the following facilities and equipment:

- Counting microscope with all relevant calibration and set-up materials.
- Slide making facilities and suitable examples to demonstrate counting methods.
- Projection microscope for teaching purposes.
- Air sampling equipment for candidates to use in the practical sessions and the formative assessment.

Support for teaching and learning

BOHS provides sample examination questions for tutors.

Language

The examinations are provided in English only.

Section 6

Syllabus

The qualification is structured into four sections, each with an indicative time allocation:

Section		Time allocation
1	Setting up of microscope	10%
2	Filter preparation, fibre counting and set up of air sampling equipment	30%
3	Calculation of results, quality control, reporting and communication	10%
4	Practical work	50%

1. Setting up of microscope (10%)

Educational objectives

Candidates should understand how phase contrast microscopy works in principle, and how to set up all components of a phase contrast microscope.

- 1.0.1 Describe the theory of phase contrast microscopy.
- 1.0.2 Use of light microscopy, setting up of Koehler or Koehler type illumination, calibration of stage micrometer and use of test slides.
- 1.0.3 Demonstrate and use of the Walton-Beckett graticule, stage micrometer and NPL test slide.
- 1.0.4 Candidates must be given the opportunity to set up various makes of microscope used in this work, as well as to count slides of known quality such as those used in the RICE scheme.

2. Filter preparation, fibre counting and set up of air sampling equipment (30%)

Educational objectives

Candidates should be able to describe and carry out the approved methods for correctly setting up air sampling equipment, taking air samples and fibre counting. Candidates should also have an understanding of the accuracy and limitations of these methods.

- 2.0.1 Selection and set up of air sampling trains for monitoring of airborne fibre concentrations. Calibration of air sampling trains and minimisation of sampling error.

- 2.0.2 Air sampling strategies (e.g. requirements and locations for leak testing, background testing, reassurance sampling and personal monitoring).
- 2.0.3 Handling and preparation of filters, and counting of fibres in accordance with the recognised counting rules (i.e. the WHO method as specified in HSG248).
- 2.0.4 Discussion of the limitations of the methods together with understanding of accuracy, precision and systematic differences.

3. Calculation of results, quality control, reporting and communication (10%)

Educational objectives

Candidates should be able to accurately calculate fibre count results, in line with the requirements of internal and external quality control schemes. They should also understand how to present these results and communicate them to clients and contractors.

- 3.0.1 Calculation of airborne fibre concentrations from fibre count data and comparison of results with appropriate standards. Calculation of the limit of quantification.
- 3.0.2 Examination of the reliability of results, in relation to quality control schemes such as UKAS, RICE and ISO and European Standards for Good Laboratory Practice (GLP).
- 3.0.3 Necessity for internal quality schemes (i.e. counting of blank filters and counting audits.)
- 3.0.4 The requirements for formal reporting of and communication of analytical results.

4. Practical work (50%)

Practical work must be carried out to provide candidates with the skills in carrying out the following:

- ☒ Setting up and calibration of air sampling trains.
- ☒ Air sampling strategies for leak testing, background sampling, reassurance sampling and personal exposure monitoring,
- ☒ Preparation of microscope slides following sampling.
- ☒ Microscope set-up and an understanding of the counting rules,
- ☒ Fibre counting for a range of fibre densities and types, and interpretation of data.

Section 7

References and further reading

1.	Bradbury, Savile (1989), <i>An Introduction to the Optical Microscope (Royal Microscopical Society Microscopy Handbooks)</i>
2.	Bradbury, Savile (1991), <i>Basic Measurement Techniques for Light Microscopy (Royal Microscopical Society Microscopy Handbooks)</i>
3.	HSG248 (2005), <i>Asbestos: The analyst's guide for sampling, analysis and clearance procedures</i> , HSE
4.	MDHS 59/2 (2014), <i>Machine-made fibres: Airborne number concentration and classification by phase contrast light microscopy</i> , HSE
5.	MDHS 87 (1998), <i>Fibres in air - Guidance on the discrimination between fibre types in samples of airborne dust on filters using microscopy</i> , HSE and HSL

HSE guidance is reviewed and revised periodically. Training providers should check that the publications listed above are the current versions.

Useful websites

All the Health and Safety Executive (HSE) publications listed above are available as free downloads from the HSE website: www.hse.gov.uk/asbestos.

Section 8

Achieving the qualification

Candidates are required to pass three mandatory components to be awarded the qualification:

- ☒ Formative practical assessment.
- ☒ Written Theory examination (WT).
- ☒ Microscope practical examination.

Formative practical assessment

Candidates are required to have the requisite skills to take air samples of atmospheres potentially containing airborne asbestos fibres, and to carry out fibre counts using phase contrast microscopy (PCM). As part of this assessment, candidates will need to demonstrate the following:

- ☒ Setting up the equipment for air sampling (i.e. a clean filter correctly mounted in a sampling head and the setting and measurement of a suitable flow of air).
- ☒ Mounting filters, preparing slides, setting up the microscope and demonstrating an understanding of the counting rules.
- ☒ Appreciation of different air sampling strategies (e.g. requirements and locations for leak testing, background testing, reassurance sampling and personal monitoring).
- ☒ Carrying out all relevant calculations.

The formative practical assessment is designed to enable candidates to demonstrate that they have achieved the relevant asbestos analysis skills, by carrying out a number of practical tasks. All candidates must undertake the tasks at an appropriate time during the course under the supervision of the course tutor. The tutor may be assisted by other appropriately qualified and experienced people if necessary.

The assessment is open-book and candidates are permitted to access written reference materials and written procedures during the tasks, but not electronic databases.

The course tutor is permitted to support candidates who are experiencing difficulties in carrying out one or more of the tasks, such as by providing verbal feedback or by demonstrating correct techniques. However, to complete the assessment, candidates must demonstrate a satisfactory level of proficiency in all tasks independently and without support.

Equipment

Tutors will need to have access to the following equipment for the assessment:

- Air sampling equipment (e.g. sampling pumps, heads and filter).
- Acetone.
- Coverslips.
- Slides.
- Filter clearing equipment (i.e. acetone vaporiser).
- Filters.
- Flat-headed tweezers.
- Glycerol triacetin.
- Microscopes and calibration/test slides for set up.

The practical tasks

The following five elements must be included in the formative practical assessment:

Element 1 - Set up and collection of air samples

Candidates must demonstrate:

- Filter handling and mounting in filter head.
- Pump preparation and assembly of sampling train.
- Flow calibration.
- Sampling time and flow-rate recording.
- Post-sampling transportation of filters.
- Understanding of sampling strategies for personal exposure monitoring, background/reassurance monitoring and leak testing.

Element 2 - Filter clearance procedure

Candidates must demonstrate:

- Use of acetone hot block method to clear filters.
- Preparation of microscope slides using glycerol triacetin as mounting medium.

Element 3 - Microscope set up

Candidates must demonstrate:

- Adjustment to obtain Koehler illumination.
- Use of Walton-Beckett graticule.
- Use of stage micrometer.
- Evaluation of HSE NPL test slides.
- Use of phase telescope (or appropriate alternative) to check phase ring alignment.

Element 4 - Counting fibres

Candidates must demonstrate their knowledge and application of fibre counting rules.

Element 5 - Calculation of results

Candidates must demonstrate:

- Use of formulae to convert fibre counts into airborne fibre concentrations.
- Knowledge and application of limits of quantification.

Marking and reporting

The course tutor that assesses the candidates must complete a Formative Practical Assessment Report Form for each candidate (see Appendix 1). The report must clearly show if each candidate has achieved a satisfactory or unsatisfactory level of proficiency for each assessment element, and should include other comments about the candidate's performance, such as weaknesses that were corrected and key points to take into asbestos practice.

Candidates are required to achieve a satisfactory level of proficiency for each element in order to successfully complete the assessment.

A copy of the relevant form should be given to the candidate.

Results

The results for each candidate must be sent to BOHS within five working days after the end of the course.

Re-sits

The formative practical assessment is not time-constrained, and it is expected that candidates who meet the entry requirements for the qualification will pass the assessment during the course. However, candidates are permitted to re-sit the assessment at a later date if required.

Candidates who do not complete the tasks are permitted to take the written and practical examinations, but will not be awarded the qualification until they successfully complete the formative practical assessment.

Written theory examination

The written theory examination usually takes place immediately after the course. It enables candidates to demonstrate that they have attained the required breadth and depth of knowledge in the techniques of air sampling, fibre counting and use of microscopes.

The examination comprises 20 short-answer questions, to be answered in one hour. Short-answer questions require candidates to give brief answers, sometimes as bullet points or calculations. All questions are worth a maximum of 4 marks. Candidates should attempt all questions as no marks are deducted for incorrect answers.

The pass mark is 50%.

The examination covers sections 1 to 3 of the syllabus in proportion to the time allocation given for each section. This gives a question allocation as follows:

Section		Number of questions
1	Setting up of microscope	4
2	Filter preparation, fibre counting and set up of air sampling equipment	12
3	Calculation of results, quality control, reporting and communication	4

The sections are clearly marked in the examination paper.

The written theory examination is a closed-book examination, which means that candidates are not permitted to have access to any external materials.

Invigilation

The written examination is carried out in controlled conditions, to help ensure that all candidates demonstrate their true level of attainment. BOHS appoints an invigilator to ensure that the examination is conducted properly and fairly.

Marking and results

All examination papers are marked by BOHS. Borderline fail results are automatically re-marked by a second marker.

Candidates receive their results in writing from BOHS. The results are reported as pass or fail plus a percentage. Training providers are sent a list of results for all candidates on a course.

Feedback

Candidates receive feedback on their examination performance for both examinations. For example, the feedback for a written theory examination in which a candidate scored 60% would be shown as follows:

Syllabus Area		Result	
1	Setting up of microscope	8/16	(50%)
2	Filter preparation, fibre counting and set up of air sampling equipment	24/48	(50%)
3	Calculation of results, quality control, reporting and communication	16/16	(100%)
Total		48/80	(60%)

Training providers receive feedback on the performance of all candidates. For example, the feedback for a course with six candidates would be as follows:

Written Exam Performance against syllabus		Number of candidates in each scoring band		
		0- 49%	50- 75%	76- 100%
Written Theory	1. Setting up of microscope	1	4	1
Written Theory	2. Filter preparation, fibre counting and set up of air sampling equipment	0	3	3
Written Theory	3. Calculation of results, quality control, reporting and communication	2	4	0

Resits

Candidates may re-sit the examination, but they must pass within 12 months of the original sitting.

Microscope practical examination

Candidates are required to count eight prepared microscope slides and achieve at least the equivalent to RICE category B performance (or better) on all slides with one exception. The WHO counting rules in accordance with HSG248 must be used.

The examination is open-book, which means that candidates may have access to relevant reference material during the examination. However, candidates are not permitted to access electronic databases or electronic communication devices such as mobile phones, tablets or computers. Additionally, candidates are not permitted to communicate with each other.

Facilities and equipment

The practical examination requires training providers to provide suitable facilities, including an appropriate examination room and counting microscopes. BOHS appoints a specialist invigilator for each examination who checks that the facilities and equipment are fully adequate for the purpose before and during each examination.

Specialist Invigilators will check equipment for this practical examination, especially equipment brought in by individual candidates for their own use. Specialist invigilators will check that all electrical equipment, including extension cables and microscopes, has received appropriate testing and is appropriately labelled.

Invigilation

The practical examination must be carried out in controlled conditions, to help ensure that all candidates demonstrate their true level of attainment and to prevent communication between candidates.

Specialist invigilators are authorised to postpone an examination if the facilities and equipment are not adequate. The sample slides are listed samples which are provided by

HSL and other sources, so candidates must not have access during the practical examination to any HSL or BOHS slide records.

Sample slides

Slides are provided by BOHS for each examination, normally via post to the training provider one week before the examination. The slides arrive in a single padded envelope containing a box with a set of eight slides. Training providers must keep the slides secure and only specialist invigilators are authorised to open the envelope.

Each set of slides is suitable for examinations with up to eight candidates, and will contain two each of slides designated as $<<63.7$, <63.7 , >63.7 and $>>63.7$ fibres/mm². These represent an appropriate diversity of fibre densities to fully test the candidates' abilities.

Where more than eight candidates are being examined at the same time, a second set of slides is normally supplied.

Where the candidates are split into two or more groups and are examined sequentially, specialist invigilators will ensure that sample numbers and other information is not passed from group to group.

Where groups are examined on different days, different sets of slides will be used in order to maintain security. The BOHS office must be advised of this requirement in advance so that multiple sets of slides can be provided. These will be labelled for the relevant dates.

Exam documentation

Specialist invigilators ensure that candidates understand the examination requirements, and that candidates complete all relevant documentation, including:

- Examination attendance record.
- Sample access record sheet.
- Candidate practical examination answer form.
- Candidate information form (if required).

Specialist invigilators are responsible for returning the completed documentation to BOHS.

Marking and results

Grading of the slide counting results is carried out against a full and detailed marking scheme.

The counts are graded as being in band A, band B or outside band B. Errors where candidates record the wrong slide number, analyse the same slide twice or fail to analyse a slide are classified as 'supercritical' errors and will be graded as outside band B. Candidates must achieve 7 out of the 8 samples in band B or better to gain a satisfactory performance rating. Two or more samples outside band B automatically results in a fail.

Examination results are sent to candidates by post and results are sent to training providers after each examination.

Feedback

Feedback is provided to candidates on request and will indicate the grading of the results for individual samples.

Return of slides

Training providers are responsible for returning slides to BOHS by special delivery within two working days of the date of the examination.

Certification

Candidates who pass all the assessment parts within 12 months will be awarded a Proficiency Certificate in *P403 - Asbestos Fibre Counting (PCM)*.

Section 9

Quality assurance

Internal quality assurance

Training providers must operate an internal quality assurance system which evaluates and improves the delivery of the qualification.

External quality assurance

BOHS undertakes desk-based reviews of documents, including teaching materials, and conducts surveys of candidates. We also may inspect training providers.

This qualification is included in the mandatory asbestos training provider inspection scheme.

Section 10

Offering the qualification

Approved training providers

Please complete and return the 'Application Form for Additional Qualifications' to qualifications@bohs.org. The form is available on the BOHS website.

New training providers

Please send an email to qualifications@bohs.org expressing your interest in offering the qualification and we will advise you about the approvals process.

Section 11

Other qualifications

Candidates who achieve this qualification may wish to take one of the following qualifications:

P401 - Identification of Asbestos in Bulk Samples (PLM)

Objective

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

Target audience

The qualification is suitable for anyone who is:

- Required to analyse bulk asbestos samples as part of their work.
- Considering a career in asbestos analysis.
- Responsible for managing asbestos analysts.

P404 - Air Sampling of Asbestos and MMMF and Requirements for a Certificate of Reoccupation Following Clearance of Asbestos

Objective

To provide candidates with theoretical and practical knowledge in the techniques of air sampling and clearance testing and the provisions for certification for reoccupation.

Target audience

The qualification is suitable for anyone who:

- Undertakes clearance inspections and air monitoring of asbestos as part of their work (e.g. asbestos site analyst).
- Issues certificates of reoccupation following asbestos clearance procedures.

Appendix 1 - Formative Practical Assessment Report

Training provider	
Course start date	
Location of course	
Candidate name	
Date of assessment	

Assessment element	Tutor comment on level of proficiency (please enter satisfactory or unsatisfactory, with additional comments if required)
1 Set up and collection of air samples	
2 Filter clearance procedure	
3 Microscope set up	
4 Counting fibres	
5 Calculation of results	

I certify that the above candidate has been assessed in accordance with BOHS requirements and has achieved the level of proficiency for each element as shown.

Name of tutor		Signature of tutor	
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