P408 Advanced Proficiency Qualification:

Identification and Quantification of Asbestos in Soils using PLM and PCM

Qualification Specification

Contents

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 controlling risks to health in the workplace, including those arising from exposure to hazardous substances.

Founded in 1953, we have developed 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.

BOHS courses and qualifications – the quality choice

We are the leading awarding body in our field. Our UK qualifications and courses 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 50,000 people have taken one of our qualifications through our network of training providers which offer engaging, challenging and practical courses.

Our 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 including asbestos, legionella and control technologies.

Information about all our courses and qualifications is available from our website:
www.bohs.org/qualifications-training/bohs-qualifications/

Section 2

P408 at a glance

What is the objective?

To provide candidates with the knowledge and skills required to safely identify and quantify asbestos in soils.

Who is it for?

Anyone that is responsible for undertaking the qualitative and quantitative analysis of asbestos in soils, for the purpose of assessing land and ground contamination prior to remediation. This can include many disciplines, such as asbestos analysts, land surveyors and site investigators.

What are the entry requirements?

Candidates must already hold the qualification *P401 - Identification of Asbestos in Bulk Samples (PLM),* and have experience of analysing bulk samples within the last three years. This may include participation in Asbestos in Minerals Scheme (AIMs), but this is not a compulsory requirement.

Candidates are also recommended to have completed the qualification *P403 – Asbestos Fibre Counting (PCM)*, or have experience of fibre counting work within the last three years. This may include participation in the Regular Interlaboratory Counting Exchange Scheme (RICE), but this is not a compulsory requirement.

What are the main subject areas?

- Controlling the health risks of asbestos.
- Sample handling and waste disposal.
- Identification of asbestos by PLM.
- Gravimetric quantification of asbestos-containing materials.
- Discrimination and quantification of free fibres by dispersion and PCM.
- Analysis of soils - practical application.

How long does it take?

Normally 4 days.

What level is it?

Level 5 in the BOHS qualifications framework.

How do candidates pass it?

Candidates must pass three assessments:
- Formative practical assessment.
- Written Theory examination.

- 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 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. Our qualifications cover a broad range of professional disciplines, including asbestos analysis, surveying and managing asbestos-containing materials in buildings.

There is a big gap in the market for a qualification which trains people on managing asbestos-containing materials (ACMs) in soil, for those working in the land remediation industry. Areas of land which were previously built on or have had demolition work carried out on them may not have been properly cleared up, and therefore asbestos or other harmful contaminants could be buried within the soil.

BOHS is working closely with organisations within the land remediation industry to address this training gap, and to put together a suite of appropriate qualifications for managing ACMs in soils. *P408 - Identification and Quantification of Asbestos in Soils using PLM and PCM* is the first qualification in this series, which will give candidates the knowledge and skills to be able to identify and quantify asbestos in soils, to a standard consistent with the HSL Asbestos in Soils Scheme (AISS).

Section 4

Key features of the qualification

Objective

This qualification is designed to give candidates the knowledge and skills required to identify and quantify asbestos in soils, to a standard consistent with the HSL Asbestos in Soils Scheme (AISS).

Target audience

This qualification is suitable for anyone responsible for undertaking the qualitative and quantitative analysis of asbestos in soils, for the purpose of assessing contamination prior to remediation. This includes:

- Asbestos analysts.
- Laboratory analysts.
- Land surveyors.
- Site investigators.

It may also be suitable for anyone who wishes to progress into these roles.

Entry requirements

Prior to taking this qualification, candidates must already hold Proficiency Certificate *P401 - Identification of Asbestos in Bulk Samples (PLM)* and have three year's current experience of analysing bulk asbestos samples.

Candidates would also benefit from the following:

- Holding *P403 - Asbestos Fibre Counting (PCM)* or *IP403 - Asbestos Fibre Counting (PCM)*; and/or have experience of fibre counting in the last three years.
- Current experience of analysing soil samples.
- Participate in the HSL's Asbestos in Soils quality control scheme (AISS).
- Have a good working knowledge of the Environment Agency's *The quantification of asbestos in soil and associated material*.
- Participate in the Asbestos in Minerals Scheme (AIMs) or Regular Interlaboratory Counting Exchange Scheme (RICE).

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 less 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 5 in the BOHS qualifications framework. This is equivalent to NVQ Level 5, such as Higher National Certificates and Higher National Diplomas.

Fees

The examination fee for each candidate is published on the BOHS website:
www.bohs.org/qualifications-training/examination-fees/

Section 5

Delivering the qualification

Teaching and learning time

P408 normally runs over four consecutive days, and requires approximately 24 hours of learning time. This is split down into:

- 18 hours of teaching time (including supervised practical work).
- 6 hours of independent study (including pre-reading and evening study).

The course can be delivered more flexibly, such as one day per week for four weeks, but should still include at least 24 hours of learning time. The Written Theory and practical examinations are carried out on the fourth day.

Tutors

The course should be taught by tutors who are experienced and qualified asbestos practitioners. As a guide, tutors will:

- Have at least three years' current experience in analysing soils or in a land remediation role.
- Hold both the P401 and P403 qualifications. At least one member of the company should also hold Certificate of Competence in Asbestos.
- Participate in HSL's Asbestos in Soils Scheme (AISS).

Teaching resources

Training providers are required to have a suitable examination room (e.g. laboratory set-up) and equipment for the analysis of soils samples. A full facilities list is provided in Appendix 1 on page 26.

Support for teaching and learning

BOHS provides:

- Sample examination questions for the Written Theory exam.
- Additional guidance on drying and reducing samples for tutors.

Language

Currently, we can offer this examination in English language only.

Section 6

Syllabus

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

Section		Time allocation
1	Controlling health risks	5%
2	Sample handling and waste disposal	5%
3	Identification of asbestos by PLM	15%
4	Gravimetric quantification of asbestos-containing materials	15%
5	Discrimination and quantification of free fibres by dispersion and PCM	10%
6	Analysis of soils - practical application	50%

1. Controlling health risks (5%)

Learning outcomes
Candidates should understand the precautions that must be taken to control the risks to health arising from the analysis of soil. In particular, they should be able to:

1.1   Identify and evaluate the potential contaminants in samples of soil.

1.2   Explain the precautions that must be taken when working with samples of soil.

1.3   Describe how control systems are managed.

1.4   Compare and contrast the risks to health caused by the analysis of soil to the risks caused by the analysis of bulk samples.

Content
The course should include:

1.1   The possible contaminants in samples of soil, including asbestos-containing materials, free asbestos fibres and other chemical and biological hazards such as organic solvents. The relative risk to health presented by the contaminants, such as the potential for the release and inhalation of free asbestos fibres from dry soil.

1.2   The use of appropriate RPE and PPE when handling contaminated soil; the use of glove boxes and safety cabinets with appropriate extraction and HEPA filters to control the spread of asbestos fibres; the procedures for the safe use of acids and RI liquids.

1.3   The requirements for routine inspection of ventilation systems to comply with CAR and COSHH regulations.

1.4   A summary of the risks to health caused by the analysis of bulk samples as a basis on which to identify the similarities and differences to the risk caused by the analysis of soils. Differences include the potential for contaminants other than asbestos, secure packaging of heavy samples and procedures for drying of wet soil.

2. Sample handling and waste disposal (5%)

Learning outcomes
Candidates should understand how to handle samples of soil in order to support the analytical procedure and to dispose of waste samples and contaminated equipment. In particular, they should be able to:

2.1   Describe what constitutes suitable, safe and sufficient samples to be received by the laboratory.

2.2   Describe how samples are stored, opened and prepared for analysis.

2.3   Explain how to avoid cross-contamination of samples.

2.4   Explain the procedures to deal with waste samples and contaminated equipment once the analysis has been completed.

Content
The course should include:

2.1   The criteria for sufficiency of samples (a minimum of 1 litre in volume and approximately 1 kg in weight), the secure packaging of samples in airtight 1 litre polythene tubs or heavy duty polythene bags, the preference for double-bagging, and labelling conventions (unique labelling of each sample and all samples labelled as 'asbestos').

2.2   The storage of samples in a controlled area to ensure access by authorised personnel only. The requirement to open samples in an appropriate safety cabinet. The criteria for deciding when to dry wet samples and the drying methodology.

2.3   When and how to clean sampling equipment and PPE.

2.4   The procedure for dealing with waste samples and contaminated equipment, including the requirement for double bagging (in an appropriate ventilated cabinet) and labelling in line with the UN-approved method. Waste includes: waste soil, filter papers and filtrate, slides and Petri dishes. The requirement to retain sub-samples for six months after results have been issued and for a minimum of six months for quality control purposes in a controlled area prior to disposal.

3. **Identification of asbestos by PLM (15%)**

Learning outcomes
Candidates should understand the recognised method for identifying the presence or absence of asbestos in soil. In particular, they should be able to:

3.1   Describe the recognised method as stipulated by the relevant authority.

3.2   Explain how and why representative sub-samples are taken.

3.3   Outline the range of likely results from the method and interpret the results.

3.4   Compare the method for identifying asbestos in soil to the method for identifying asbestos in bulk samples.

Content
The course should include:

3.1   The detailed method for identifying asbestos in soil as stipulated by HSE in *HSG248 - Asbestos: the analysts' guide for sampling, analysis and clearance procedures, Appendix 7* (2016 draft or current version), including the different routes to be taken depending on the results from each step of the method.

3.2   The rationale for taking sub-samples as a more efficient approach to analysis, balanced against the need for the sub-samples to be representative of the whole sample. The rationale for the size of the first sub-sample, which should be approximately 1% of the whole sample. The way of attaining a representative sub- sample by removing around 8-10, 2.5 – 3 ml scoops randomly from different areas of the tray to give a total of 20 – 50g, or to cone and quarter the tray sample if the soil is moist. Second sub-sample 1 – 5g from the Petri dish.

3.3   The range of likely results:
   - Asbestos detected;
   - Asbestos found at the limit of detection (1-2 fibres/bundles are found);
   - No asbestos detected.

   The significance of the results and how the information can be interpreted.

3.4   The difference in the nature of ACMs in soil from those in buildings. Asbestos in buildings are present primarily in the form of identifiable intact defined products in good condition with known asbestos content. Asbestos in soil can exist in various stages of decomposition or degradation. Some types of ACM will retain their inherent product integrity, but with a tendency over time for the material matrix to deteriorate and asbestos fibres to become 'unbound' or loosely attached to other particles. These fibres or fibre bundles are invariably retained within the damp soil

   matrix. In both cases, identification is by PLM.

4. Gravimetric quantification of asbestos-containing materials (15%)

Learning outcomes

Candidates should understand the recognised method for quantifying asbestos-containing materials in soil. In particular, they should be able to:

4.1   Describe the method as stipulated by the relevant authority.

4.2   Explain how and why representative sub-samples are taken.

4.3   Explain how the total asbestos content is calculated and how it is reported to the client.

4.4   Outline the likely results from the method and interpret the results.

Content

The course should include:

4.1   The method as stipulated by the Environment Agency in *The quantification of asbestos in soil and associated materials* (July 2016 version 14 draft or current version) with regards to '*Stage 2* and the selection and weighing of identifiable pieces of ACM.

4.2   The approach to be taken for selecting ACMs, along with how they are grouped according to material and asbestos type. The need to determine whether free fibres/bundles are present and how this impacts on the final stage of analysis.

4.3   The use of HSE guidance (including *HSG264*) as part of the identification and calculation of the mass percentage of asbestos fibre, along with how this information should be reported.

4.4   The range of likely results from this part of the method should be able to establish the different percentages of each asbestos fibre type, plus the bearing this value has with regards to how to deal with the soil.

5. Discrimination and quantification of free fibres by dispersion and PCM (10%)

Learning outcomes

Candidates should understand the method for discriminating and quantifying free asbestos fibres in soil. In particular, candidates should be able to:

5.1   Describe the method stipulated by the relevant authority.

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5.2   Outline the theory of phase contrast microscopy and describe how to set up a microscope ready for the analysis of free fibres.

5.3   Outline the limitations of the method and techniques to improve accuracy of the results.

5.4   Explain how the mass percentage of asbestos in the sample is estimated.

5.5   Explain how the results of the method are reported to the client.

Content
The course should include:

5.1   The method as stipulated by the Environment Agency in *The quantification of asbestos in soil and associated materials* (July 2016 version 14 draft or current version) with regards to '*Stage 3*' for the discrimination and quantification of free fibres, and the use of a representative sub-sample.

5.2   The setting up of a microscope for phase contrast microscopy (PCM), including the use of test and calibration slides. The use of PCM/polariser/red tint plate to discriminate and then count asbestos fibres.

5.3   Details regarding the interferences and limitations as a result of asbestos not uniformly distributed in soils, along with discrimination of fibres based on morphology and width. Accuracy can be increased using additional quality control and alternative techniques.

5.4   The mass percentage estimated through counting the qualifying fibres and also including the presumed fibres.

5.5   The process and method for evaluating the percentage of asbestos-free fibre content in the original sample on a dry weight basis. The reported results also need to include the ACMs/visible fibres.

6. Analysis of soils – practical application (50%)

Learning outcomes
Candidates should be able to carry out the full three-stage analytical procedure using the methods stipulated by the relevant authorities, taking the necessary precautions to control risk to health. In particular, they should be able to:

6.1   Demonstrate good practice in sample handling.

6.2   Demonstrate compliance with the methods stipulated by the relevant authorities for a range of sample types.

6.3   Demonstrate the correct use of weighing balances, stereomicroscopy, PLM and PCM microscopes.

6.4   Demonstrate safe working practices.

6.5   Calculate accurate results for a range of sample types, report the results in an appropriate format and provide advice for the client.

Content

The course should include:

6.1   Dealing with samples arriving into the laboratory. The preparation of samples within controlled environments to prevent contamination. Cleaning of equipment and disposal techniques for waste.
.
6.2   Practice in the analysis of a range of samples following the methods stipulated in HSE and the Environment Agency publications. This includes *HSG248 Asbestos: the analysts' guide*, *HSG264 Asbestos: the survey guide,* and *The determination of asbestos in soil and associated materials.*

6.3   Practice in setting up and utilising all types of microscopes used during the analysis of samples, including the checks required before analysis commences and the calibration of analytical balances.

6.4   Working safely using appropriately ventilated ovens and cabinets, while also eliminating contamination risks.

6.5   Practice in the analysis of samples to include identification and quantification of the percentage of ACMs/asbestos fibres plus free fibres present.

Section 7

References and further reading

1   Asbestos in Soils Scheme (AISS) Information Book for Participants 2017/18, Issue 6, HSL

2   CL:AIRE (2016), CAR-SOIL™ Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance

3   CL:AIRE (2017), Decision Support Tool for the Categorisation of Work Activities Involving Asbestos in Soil and Construction & Demolition Materials in accordance with the Control of Asbestos Regulations 2012 (available for download from www.claire.co.uk)

4   Environment Agency (2017), The Quantification of Asbestos in Soil: Methods for the Examination of Waters and Associated Materials (Standing Committee of Analysts Blue Book Method)

5   HSG248 (2005), Asbestos: The analysts' guide for sampling, analysis and clearance procedures, HSE

6   HSG264 (2012), Asbestos: The survey guide, HSE

7   Managing asbestos on brownfield sites, HSE website: http://www.hse.gov.uk/asbestos/managing/brownfield.htm

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

Useful websites

All of 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.
- Practical examination.

Formative practical assessment

Soil samples taken for analysis will almost inevitably be wet, and often too large to handle in the analysis procedure. They may also contain other hazardous materials in addition to asbestos.

It is therefore essential that all candidates taking the P408 qualification can demonstrate individual practical experience of handling soil samples, in appropriate use of soil drying facilities along with sample division techniques. This should include experience of the general facilities and the relevant risk assessments required in the analysis of asbestos in soils.

The formative practical assessment requires candidates to complete a number of practical tasks in line with BOHS guidelines. All candidates must undertake the tasks at an appropriate time during the course under the supervision of the course tutor, so that the tutor is able to verify it has been completed to a satisfactory standard. 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, for example 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.

The practical tasks
The formative practical assessment should be an integral part of the practical work session for the course, and should confirm that all candidates have personally achieved and demonstrated the skills required to carry out sample reduction and drying of soil samples in an appropriate and safe manner. This should cover oven drying of samples, and using methods such as coning and quartering or riffling to reduce sample size.

As part of the practical session, the tutor should also discuss the procedures to be observed when drying and reducing the size of soil samples. This must include all the relevant risk assessments that apply to the course facilities, and must also include all measurements and monitoring procedures used. For training purposes, non-asbestos containing soil samples can be used for this assessment.

Marking and reporting

The course tutor that assesses the candidates must complete a Formative Practical Assessment Report Form for each candidate (see Appendix 2). The report must clearly show whether 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 to complete the assessment.

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

Results

The results for each candidate must be sent to BOHS within five working days of 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 module until they complete the formative practical assessment.

Written Theory examination

The written theory examination usually takes place at the end of the course, and tests that candidates have the breadth and depth of knowledge to identify and quantify asbestos in soils.

The examination comprises 20 short-answer questions, to be answered in 60 minutes. Short-answer questions require candidates to give brief answers, sometimes as bullet points or calculations. All questions are worth 4 marks and candidates may be awarded between 0 and 4 marks per question. Candidates should attempt all questions as no marks are deducted for incorrect answers.

The pass mark is 50%.

The examination covers sections 1 to 5 of the teaching content of the qualification, in proportion to the time allocation given for each section. This gives a question allocation as follows:

	Section	Number of questions
1	Controlling health risks	2
2	Sample handling and waste disposal	2
3	Identification of asbestos by PLM	6
4	Gravimetric quantification of asbestos-containing materials	6
5	Discrimination and quantification of free fibres by dispersion and PCM	4

The sections are clearly marked in the examination paper.

The Written Theory examination is a closed-book examination. Electronic calculators are permitted, but programmable calculators/personal computers are not.

Invigilation

The written theory 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.

Candidates receive their results in writing from BOHS. The results are reported as pass or fail plus a percentage. Borderline fail results are automatically re-marked by a second marker.

Training providers are sent a list of results for all candidates on a course.

Feedback

Candidates receive feedback on their examination performance. For example, the feedback for a candidate that scored 70% would be shown as follows:

	Syllabus area	Result (marks and percentage)	
1	Controlling health risks	8/8	(100%)
2	Sample handling and waste disposal	2/8	(25%)
3	Identification of asbestos by PLM	12/24	(50%)
4	Gravimetric quantification of asbestos-containing materials	18/24	(75%)
5	Discrimination and quantification of free fibres by dispersion and PCM	16/16	(100%)

Total	56/80	(70%)

Training providers receive feedback on the overall performance of all candidates.

Written Exam Performance against syllabus		Number of candidates in each scoring band		
		0-49%	50-75%	76-100%
Written Theory	1. Controlling health risks	1	6	1
Written Theory	2. Sample handling and waste disposal	2	5	1
Written Theory	3. Identification of asbestos by PLM	2	6	0
Written Theory	4. Gravimetric quantification of asbestos-containing materials	1	5	2
Written Theory	5. Discrimination and quantification of free fibres by dispersion and PCM	1	5	2

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

Practical examination

Candidates are required to demonstrate that they can carry out both qualitative and quantitative assessments on a single 300gm soil sample, which has been produced in line with the Asbestos in Soils Scheme (AISS). The WHO counting rules must be used.

The candidate must correctly identify the asbestos types in the soil sample and then carry out gravimetric analysis of the asbestos in this soil sample, followed by free fibre analysis of the soil. The candidate will be allowed four hours to complete this analysis.

The assessment is open-book, which means that candidates may have access to relevant reference material during the assessment. 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
Training providers will be required to have all the appropriate facilities for the safe handling and analysis of soil samples for asbestos, and these must **all** be made available during the course to candidates as part of the learning experience. This includes:

- Stereomicroscope, Polarised Light microscope and Phase Counting microscope, along with appropriate calibration and set-up equipment.
- Appropriate fume cupboards or dust control cabinets.
- Inspection and sampling trays.
- Sample pre-treatment re-agents.
- Appropriate tools.
- RI liquids, microscope slides and cover slips.
- Membrane filters.

- Acetone vaporiser for slide clearance.
- Top pan balance capable of two decimal places.
- Analytical balance capable of five decimal places.
- Stoppered slurry flask.
- Automatic pipette.
- Measuring cylinder.

The training provider's facilities and equipment must match the requirements as detailed in Appendix 1 of this document.

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. BOHS will appoint a competent specialist invigilator for each examination, to check that the facilities and equipment are fully adequate for the purpose before and during each examination and to supervise the candidates.

Specialist invigilators are authorised to postpone an examination if the facilities and equipment are not adequate. They can also exclude candidates from assessments for disruptive or unsafe actions.

Soil samples

Soil samples will be put together by HSL and dispatched directly to the training provider. Each candidate will have one soil sample of 300gm each to analyse. BOHS provides up to four soil samples per exam sitting due to cost and time constraint on the exam; therefore the maximum number of candidates is four. Sittings with more than four candidates will incur an additional charge for the soil samples and invigilator time.

An additional sample will be provided for emergency use (e.g. accidental contamination during the examination or destroyed to such an extent that it is no longer useable). Training providers will be charged in this instance, and this cost may be passed on to the candidate at the training provider's discretion.

Disposal of soil samples

Training providers are responsible for safely disposing of soil samples immediately after the examination. Samples cannot be re-used for future examinations as they will be depleted during the examination.

Exam documentation

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

- Examination attendance record.
- Candidate answer form.
- Candidate information form.

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

Marking and results
The results will be assessed using a detailed marking schedule based on the AISS scoring scheme.

Qualitative results
Points are allocated to a candidate for each analytical error made. The magnitude of the score is dependent on the seriousness of the error. For example, the failure to identify a trace component in a two asbestos component mixture would not score as highly as the failure to identify a major component in a two-component mixture or a trace asbestos component, where no other asbestos type is present.

Three types of error are considered: super-critical, critical and non-critical. A full list of the different types of error and error codes is given in Appendix 3 of this document.

Candidates are assessed as having satisfactory performance if their cumulative score on the soil sample is less than or equal to 18. 19 or above will be deemed as a fail result.

Quantitative results
The quantitative result is assessed on the basis of a z-score, based on the following formula published in Annex 1 of the AISS scheme:

> **z score**
> $z = (l-a)/\sigma$
>
> Where: l = candidate result, a = assigned value
> σ = standard deviation set initially at 40% of the median

z-s cores should be interpreted as follows:

- A score of zero implies a perfect result.
- Candidates meeting the pass criteria will commonly produce scores falling between -2 and 2. The sign (i.e. + or -) of the score indicates a negative or positive error respectively.
- A score outside the range from −2 to +2 will be taken to indicate a failed result.
- The error codes in a set of failed results would be classified as either QSC1 (quantitative result greater than Z=+2) or QSC2 (quantitative result less than Z=-2).

Feedback
Examination results are sent to candidates by post and results are sent to training providers after each examination. More detailed feedback can be provided to candidates on request, which indicates the grading of the results produced by the candidate, along with a series of error codes as relevant. A detailed list of error classification codes is given in Appendix 3.

Certification

Candidates who pass all three elements of the qualification will be awarded an Advanced Proficiency Certificate in **_P408 - Identification and Quantification of Asbestos in Soils using PLM and 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.

The system should include an internal verification process which ensures that the practical assessment is conducted in line with requirements and that fair and consistent decisions are made about the attainment of candidates.

External quality assurance

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

Section 10

Offering the qualification

Approved Training Providers

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

Please note that only training providers with UKAS-accredited laboratories for asbestos in soils are applicable to run P408. Training providers will also be required to take part in a facilities inspection* and mandatory tutor briefing prior to running P408.

New training providers

Please send an email to qualifications@bohs.org expressing your interest in offering the P408 qualification and we will advise you about the approvals process.

Please note that only training providers with UKAS-accredited laboratories for asbestos in soils are applicable to run P408. Training providers will also be required to take part in a facilities inspection* and mandatory tutor briefing prior to running P408.

*Please note that following the facilities inspection and application approval, this qualification falls under the Asbestos Training Provider Inspection Scheme for which separate charges apply.

Section 11

Other courses and qualifications

For a full list of BOHS' courses and qualifications, please visit
http://www.bohs.org/qualifications-training/bohs-qualifications/

Appendix 1

Facilities and requirements list for practical examination

The P408 practical examination requires training providers to provide suitable facilities, including an appropriate examination room and equipment with the necessary safety features. A detailed list of equipment requirements is given below.

General

Safety cabinets, which must:

- Be large enough to enable the analysis of soil samples.
- Contain stereomicroscopes, slide making facilities and asbestos sample handling equipment.
- Be fitted with high efficiency HEPA filtered extraction units.

The cabinet extractor units and face velocities must be checked regularly in line with current guidance (HSG248:2016 draft) to ensure the linear velocity is > 0.5 m/s and DOP tested every six months to check filter efficiency.

Samples for this practical assessment should be dry, and thus will not require access to oven drying facilities during the examination procedure. Samples will be of an appropriate size to test the candidate's capability to do the analysis without recourse to quartering and/or coning techniques.

Identification

- Cargille/McCrone RI fluids.
- Polarising light microscope.

Cargille/McCrone fluids must be checked regularly, be in date and have relevant contamination check information displayed.

Quantification

Reagents:

- Acetone.
- Triacetin.

These must be checked regularly, be in date and have relevant contamination check information displayed.

Apparatus

Gravimetric:

- Balance capable of weighing to two decimal places and analytical balance capable of weighing to five decimal places, to achieve 0.001%.

- Disposable gloves.
- Metal spatula.
- Sample bags.
- Stereomicroscope.

Free fibres:

- Balance capable of weighing to two decimal places.
- Analytical balance capable of weighing to five decimal places.
- Blunt nose forceps.
- Mixed cellulose-ester membrane filters, 25mm diameter, pore size of 0.8 or 1.2 µm, (blank tested).
- Straight-sided filter apparatus.
- Filtration collar.
- Vacuum pump.
- Auto pipettes, various, including one capable of pipetting 0.25 ml.
- 1 ml Pasteur pipette.
- Acetone hot block/vaporiser.
- Microscope slides and coverslips (the slides should be 0.8 – 1.0 mm thick and the coverslips should be 0.16 – 0.19 mm thick).
- 5 ml syringe.
- Conical flasks, various volumes up to 1000 ml.
- Metal spatula.
- Phase Contrast Microscope with polariser/analyser and red tint plate (without this addition, the fibre count could potentially be spuriously higher).

The microscope should comply with the following specifications (HSG248:2016 draft):

- ➢ A binocular stand with Kӧhler, or Kӧhler type illumination, including a field iris. The condenser (sub-stage assembly), objectives and eyepieces specified below must all be compatible with each other and with this stand.
- ➢ A sub-stage assembly, incorporating an Abbe or an achromatic phase contrast, condenser in a centred focusing mount, with phase annulus centring independent of the condenser centring mechanism.
- ➢ A built-in mechanical stage with slide clamps and xy displacement.
- ➢ A low powered objective (e.g. x10 or x4 magnification), which is used for carrying out checks on the evenness of the dust deposit on the filter.
- HSE test slide.
- Stage micrometer slide.
- G25 type Walton and Beckett Eyepiece Graticule, with an apparent diameter of 100 +/- 2 µm.
- Tally counter.
- Coarse filters (for waste disposal).
- 47 mm diameter 0.8 µm filters (for waste disposal).
- Oven for drying to a temperature between $30^{O}C$ and $110^{O}C$.

All tools must be clean, safe and operable.

Appendix 2

Formative practical assessment report form

Name of candidate:	Date of birth:
Date of assessment:	**Training provider and location:**

Practical assessment element	Tutor comment*
Sample reduction procedure	
Sample drying	
I certify that the above candidate achieved a satisfactory level of proficiency in the above tasks.	
Name of tutor carrying out practical assessment	**Signature**

* Tutor should enter 'satisfactory' for each element, with additional comments if necessary relating to the candidate's ability and expertise in that element.

Appendix 3

Qualitative results: error classification list

Super-critical error (sample evaluation)

A super-critical error is an error which is analytically unacceptable, and which would have serious consequences if committed in reality. Such an error might be the failure to detect a single asbestos component of significant proportion in a matrix that would not impair detection, which would score 20 points.

SC 1	Failure to find a significant component in a single component sample
SC 2	Failure to find any significant component in a two component sample
SC 3	Failure to find any significant component in a three component sample

Super-critical error (other)

Recording the sample number erroneously, or destroying or contaminating the sample are regarded as analytically unacceptable, and examples of super-critical errors which would score 20 points. Where materials are wrongly spelt and ambiguous this is also analytically unacceptable and will also score 20 points.

SC 10	Sample number wrongly recorded
SC 11	Not applicable (used for P401 exam only)
SC 12	Asbestos types wrongly spelt and ambiguous
SC 13	Destruction or contamination of sample

Critical error

A critical error is an error which, though analytically unacceptable, might not have significant consequences if committed in reality. Such an error might be the failure to detect a significant proportion of one asbestos component in the presence of an already detected asbestos type, or to report asbestos where none exists. These would score 12 points.

C1	Asbestos found in a non-asbestos containing sample
C2	Failure to find a non-significant component in a single component sample
C3	Failure to find a significant component in a two component sample
C4	Failure to find a significant component in a three component sample
C5	Failure to find two significant components in a three component sample (scores as two critical errors)
C6	Asbestos type wrongly spelt but correctly identified
C7	Additional asbestos type found and wrongly spelt

Non-critical error

A non-critical error is an error which is analytically almost acceptable and would have no significant consequence if committed in reality. Such an error might be a false positive

identification of one or more asbestos types in the presence of an already detected amphibole asbestos, or the non-detection of a non-significant proportion of asbestos in the presence of other asbestos species, or the identification of Tremolite or Anthophylite as Actinolite or vice versa. The wrong designation of Tremolite or Anthophylite present in a sample as each other does not score as an error. All others score 7 points.

In addition the use of the term Fibrous Grunerite as an alternative to Amosite or vice-versa does not score as an error.

NC1	Additional component found in a non-asbestos-containing sample
NC2	Additional component found in a single asbestos-containing sample
NC3	Additional component found in a two asbestos-containing sample
NC4	Additional component found in a three asbestos-containing sample
NC5	Incorrect identification of the type of asbestos in a sample
NC6	Failure to find a non-significant component in a two component sample
NC7	Failure to find a non-significant component in a three component sample
NC8	Failure to find two non-significant components in a three component sample (scores as two non-critical errors)