HOKLAS Supplementary Criteria No. 5

'Environmental Testing' Test Category – Asbestos Sampling and Testing

0 Introduction

(a) This document serves to clarify and supplement the requirements of ISO/IEC 17025:2017 for the accreditation of laboratories performing asbestos sampling and testing. This criteria document shall be read in conjunction with ISO/IEC 17025, HKAS Policy Document No. 1 and other relevant criteria documents. For areas not covered in this document, ISO/IEC 17025:2017, HKAS 002 and other relevant criteria documents shall apply.

Notes:

i. For air sampling and fibre counting, the methods commonly adopted in Hong Kong are the HSG 248 published by the U.K. Health and Safety Executive (HSE) and NIOSH #7400 of U.S.A. Similarly, methods for bulk sampling and identification are also provided by HSG 248, which enable the six types of asbestos (amosite, anthophyllite, chrysotile, crocidolite, tremolite and actinolite) to be identified.

ii. HKAS currently offers HOKLAS accreditation under the 'Environmental Testing' test category for static and personal air sampling, fibre counting of airborne samples, bulk sampling, analysis of bulk materials for presence and types of asbestos and for determination of asbestos-containing material (ACM). On-site fibre counting and bulk identification can only be accredited as an extension to the same tests accredited at the main laboratory with the additional requirement that there is a separate section in the management system manual to cover on-site testing. Except for the aforementioned sampling and testing, all other activities associated with asbestos testing work are not accreditable by HKAS under HOKLAS.

iii. To minimise variations in test results on fibre counting of airborne asbestos samples and identification of asbestos in bulk materials due to subjective assessment, differences in test methods used and in experience and training of analysts, strict control on the test procedures and their implementation is necessary.

1 Scope

(No additional explanation)

2 Normative references

(No additional explanation)

3 Terms and definitions

(No additional explanation)

4 General requirements

(No additional explanation)

5 Structural requirements

5.1 **The laboratory shall have at least one staff member who** has in-depth knowledge of and extensive experience in asbestos sampling and testing. He/she shall be responsible for all the laboratory and on-site asbestos sampling and testing activities. The authorities and responsibilities of staff carrying out on-site testing and other activities relating to security of samples, equipment and records as well as reporting of test results, written or verbal, shall be documented.

6 Resource requirements

6.1 General

(No additional explanation)

6.2 Personnel

(a) For asbestos sampling and testing, four staff groups, *viz.* samplers, counters, identifiers and approved signatories, are identified. Their criteria are as follows:

(i) Samplers
Samplers shall either hold relevant personal qualifications for asbestos sampling, or have undergone and successfully completed appropriate training on asbestos sampling by qualified personnel before they are allowed to engage in asbestos sampling.

(ii) Counters
Since there are no recognised academic qualifications for asbestos fibre counting, the laboratory shall have a documented training procedure for prospective counters with the criteria of acceptability defined. All qualified counters are required to participate in and adhere to the requirements specified for the laboratory's performance monitoring programmes.

(iii) Identifiers
Similar to counters, identifiers shall receive and complete appropriate training on bulk identification and undergo a colour blindness check to ensure any deficiency does not affect the quality of their results. Those qualified to carry out bulk identification are also required to participate in the laboratory's performance monitoring programmes according to the requirements specified therein.

(iv) Approved Signatories
Approved signatories shall have relevant and current experience in asbestos sampling and/or testing but not necessarily at the same level of skill as for the above listed operators.

A list of all qualified air samplers, bulk samplers, counters and identifiers shall be maintained.

(b) Training

(i) A documented training programme covering all aspects of the work involved and including assessment of their competence shall be implemented.

(ii) For bulk sampling, the training shall include evaluation of the analysts' familiarity with the laboratory's sample identification and registration procedure, adherence to the documented sampling procedure and capability of obtaining representative samples. The need to record the circumstances under which the bulk sampling is undertaken shall also be understood. In particular, a distinction shall be made between samples taken 'as directed by the customers' and those obtained 'according to an agreed sampling plan'. The performance of individual analysts after being registered as authorised bulk samplers shall be monitored at sampling sites and evaluated by a suitably experienced person on a regular basis with the performance records maintained.

(iii) For training of analysts in detection and identification of asbestos in bulk samples, it is necessary to ensure that they have sufficient knowledge and skills in microscopic techniques involved to produce valid test results and be able to make correct interpretation. Analysis of a variety of samples of known compositions as well as objective tests on additional series of such samples at the end of training are also required.

(iv) Training and supervision of staff for air sampling shall follow a similar regime to that of bulk sampling, with records confirming the competence of individual analysts before being accepted as authorised air samplers.

(v) Similar to bulk identification, the documented training programme for fibre counting shall include tests of performance by random recounts and evaluation of control slides.

6.3 Facilities and environmental conditions

(a) Fibre Counting

(i) The environment in which membrane filter preparation and fibre counting are carried out shall be monitored for fibrous contamination monthly or at a more frequent interval with the result recorded. Procedures for dealing with situations where the environment is found unsatisfactory shall be documented.

(ii) Membrane filter samples shall not be prepared in close proximity to the bulk identification cabinet.

(iii) Fibre counting shall only be conducted under suitable lighting conditions.

(b) Bulk identification

(i) Preparation of bulk samples shall be carried out in a suitable fume cupboard. Particular care shall be taken to eliminate cross-contamination due to other bulk samples or areas used for the storage or preparation of fibre counting samples.

(c) On-site testing

(i) On-site testing shall be performed in a suitable environment, the monitoring of which shall be documented and conducted at a frequency appropriate to the work in hand. Blank filter determination shall be undertaken at a rate of not less than 1 in 10.

6.4 Equipment

(a) Air sampling

(i) The equipment including pumps, sampler heads, cowls and flowmeters used in air sampling shall be suitable for the range of sampling undertaken. Since samples are normally obtained by drawing a known volume of the air to be sampled through a membrane filter of known exposed area, the flow and area measurements are of prime importance to the validity of subsequent testing. A flowmeter of known performance is therefore essential.

(ii) Filter heads of the pre-loaded cassette type are acceptable and their calibration intervals may be extended if the laboratory has accumulated sufficient data to show consistency. Should such cassettes be re-used, they shall be re-checked in the same way as new units. Checks to confirm correct assembly and good electrical conductivity are also required.

(iii) For filter holders with 'O' rings, the use of PTFE type 'O' rings is recommended in view of their higher consistency in exposed filter area and less risk of damaging filters during assembly. Backing pads are not necessary.

(iv) Unless otherwise specified in standard test method, reasonable alternatives to regular on-site checks of flow rate are acceptable. One approach is to implement a maintenance and/or verification programme on sampling pumps to confirm their correct flow rates under various filter loadings and during extended sampling periods. Pumps are checked for their flow rates in the laboratory every time before being used on-site and upon their return without intermediate adjustment.

(v) The required stability and the permitted deviation from target flow rate stipulated in standard test method shall be followed. If such requirements are not specified, the flow rate shall be within ±5% of the nominal value and maintained to within ±10% of the same. Suitably graduated rotameter tube and rocket sets are needed for each range of flow to be measured and the actual flow rate shall be used for calculating the volume of air sampled.

(b) Bulk sampling

(i) Equipment shall be sufficiently robust and suitable for individual sampling situations and shall not cause any disturbance of asbestos fibre and dust during use in sampling.

(c) Presence and identification

The laboratory shall be furnished with all the necessary equipment, facilities and reference materials, including those listed below, for correct performance of the tests.

(i) A low power stereomicroscope

(ii) A polarising light microscope capable of meeting all the configurations required for polarised light stage of evaluation.

(iii) A fume cupboard of adequate size and with suitable flow and filtration system for examination of samples under a stereomicroscope.

Note: Examination of samples through a plastic bag outside the fume cupboard is not acceptable.

(iv) A set of reference asbestos samples each containing a single but different type of asbestos in matrix similar to materials usually encountered.

(v) Suitable facilities and chemicals for sample treatment.

(vi) A full series of refractive index liquids (Cargille liquids) to enable positive identification of all the asbestos types listed in the scope of accreditation of the laboratory. Relevant information on these liquids, including date manufactured, date put in use and anticipated shelf-life shall be recorded.

(d) Fibre counting

(i) A stage micrometer traceable to International System of Units (SI) with a measurement error less than one micron is required to calibrate working stage micrometers. Sufficient working stage micrometers

shall be available and, unless otherwise specified in the standard test methods, the scale divisions of which should preferably be 2-microns but not exceeding 10 microns.

(ii) A Walton-Beckett type eye-piece graticule having an observed diameter of 100 ± 2 microns as measured using the traceable stage micrometer is also required.

(iii) The number of fibres observed and graticule areas examined shall be recorded at the time of observation using tally counters or other suitable methods. To assist viewing, a green filter may be used.

(iv) Sufficient HSE/NPL Mk2 or Mk3 phase contrast test slides or equivalent shall be available.

(v) For on-site testing, a working stage micrometer and HSE/NPL Mk2 or Mk3 phase contrast test slides are required to allow setting up of the microscope prior to each fibre counting session. Instructions for setting up of the microscope shall be readily available on-site.

(vi) For filter mounting, the use of a commercially designed acetone vaporizer and a hot block attachment to speed filter clearing is recommended. Glass cover slips of type no. 1½ (0.16-0.19 mm) thickness shall be used.

(vii) Microscope eyepieces shall be at least 12.5x magnification with a suitable Walton-Beckett graticule. Block 5 on an NPL/HSE certified test slide shall be visible in accordance with the details provided with the slide. One such slide, in addition to the traceable stage micrometer, shall be available at each counting location. Since any loss or damage of either of these items may result in suspension of counting, it is recommended that one spare test slide and a master stage micrometer be kept in reserve.

(viii) Microscope stage verniers shall be calibrated to ensure traceability of measurements of exposed filter area.

(ix) Commercial bubble/soap film flowmeters or equivalent devices, if used for calibration of flowrates, shall be accompanied by calibration certificates demonstrating direct traceability to SI unit.

6.5 Metrological traceability

It is considered that certain aspects of calibration, particularly the flow rate, filter exposed area, stage micrometer, graticule area, phase contrast slide and refractive index liquids are crucial in asbestos sampling and testing. The requirements for individual aspects are as follows:

(a) Flow rate

(i) There are up to four levels of flow rate calibration as given below needed to be maintained, of which Stage I to Stage III shall be traceable to SI unit.

Stage I - A calibrated master flowmeter.

Stage II - One or more sub-master flowmeters for routine calibration of portable flowmeters which in turn are used for calibration of sampling pumps.

Stage III - Portable flowmeters taken on site for the routine checking of pump flow rate before, during and after sampling operations.

Stage IV - Flowmeters built into sampling pumps which are considered relatively inaccurate but are useful for indicating that the pumps are in operation.

(ii) The laboratory shall be furnished with Stage I and Stage III flowmeters. In case where several pumps are being used, the use of intermediate Stage II flowmeters as a cost-effective measure is acceptable.

(iii) Time shall be measured with a suitably calibrated stopwatch. The bubble flowmeter requires a tube of suitable length and diameter to give sufficient volume for the desired range of flow rate. The volume shall be accurately determined and the tube graduated. The volume measurement shall be traceable to SI unit either by calibration at a laboratory accredited by HKAS or its MRA partners for the activities concerned or in-house using a gravimetric method. The in-house method shall establish traceability for both mass and temperature.

(iv) Calibration of flowmeters shall cover the anticipated range of working flow rates.

(v) If Stage II flowmeters are used, the manual type film / bubble flowmeter consisting of a glass tube with graduation markings may be used as master flowmeter. In such cases, the volume of the glass tube shall be calibrated on commissioning.

(vi) Recalibration or correction of flow rate is required if the sampling altitude differs from that under the calibration conditions by more than 500m or the sampling temperature by 15°C.

(vii) Sensitivity of Stage I flowmeter for a given range of flow rate shall be greater than that or equivalent to that for Stage II flowmeter which in turn shall be greater than that or equivalent to that for Stage III flowmeter.

Notes

i. The master flowmeter Stage I can be calibrated either by a laboratory which is accredited by HKAS or its MRA partners for the activities concerned and issues a calibration certificate stating traceability to SI unit or by the laboratory itself. In the latter case, a soap film/bubble flowmeter or similar device involving measurements of time and volume may be used.

ii. Difficulties with in-house calibration may be experienced if either the bubble meter volume exceeds 1000 mL or the time interval to be measured is less than 15 seconds. Therefore, the maximum flow rate for in-house calibration is normally 4 L/min.

iii. Frequency of re-calibration for flowmeters is dependent on the extent and conditions of use. Generally, calibration intervals should not exceed the following:

Stage	Type	Re-calibration Frequency
I	master flowmeter	every 2 years, or more frequent if Stage II is not used
II	rotameter	monthly
	electronic soap bubble flowmeter	every 6 months
III	rotameter	weekly
	electronic soap bubble flowmeter	monthly

iv. For using commercial bubble / soap film flowmeter or equivalent device, the sub-master (Stage II) flowmeter may be calibrated by placing it in series with the master flowmeter and drawing air through both flowmeters.

Portable flowmeters (Stage III) may be calibrated against sub-master flowmeter by placing both flowmeters in series as for Stage II calibration. For use on site in series with the pump, the sampling head with filter should be between the Stage III flowmeter and the pump to obtain a reading that corresponds to the flow received at the filter.

(b) Filter areas

(i) The effective area exposed to the air stream by each filter holder shall be at least 20 mm in diameter and calibrated at three-monthly intervals or sooner if the sampling head is heavily used. Recalibration is necessary if the type of filter or holder, or if any aspect relating to filter clearing, is changed.

(ii) After calibration, the filter holder shall be marked with a serial number, the due date for next calibration and the effective area determined.

(iii) Frequent changes in the exposed areas determined should be taken as indicative of problems with the equipment or method.

(iv) The effective exposed filter area shall be determined using suitable methods.

Notes

An example of determining the effective exposed filter area is given hereunder for reference:

i. Place a small quantity of dark coloured dust e.g. carbon, cement or road dust, into a 2 to 5 litre container with a lid and vigorously shake the container. Set up the sampling equipment and draw air container through a membrane filter in a holder until the airborne dust forms an obvious visible deposit on the filter. Remove the filter from the holder and mount it onto a microscope slide in the usual manner.

ii. Repeat the dust deposition and slide mounting procedure as described above with another two filters. Measure at least two diameters of the resultant dust deposit at right angles to within ± 0.2mm for each filter. (The use of microscope object stage verniers has been found satisfactory).

iii. If the measured diameters of the three filters all agree to within 1mm, calculate the exposed area of each filter and take their arithmetic mean as the effective exposed filter area.

iv. In case where the two measured diameters of a filter vary by more than 1 mm, discard the filter and repeat steps i. and ii. using a new filter. If this replacement or if more than one of the original filters have diameters varied by more than 1mm, investigate the cause.

(c) Stage micrometers

(i) The master stage micrometer shall be traceable to SI unit with an error less than one micron. Recalibration is needed if its condition or accuracy appears to have changed.

(ii) Working stage micrometers shall be calibrated annually or at shorter intervals as required, utilising the traceable stage micrometer.

(d) Microscope graticule

(i) The Walton-Beckett type eye-piece graticule shall be purposely made for each microscope. Working stage micrometers shall be used for measuring the diameter of the eye-piece graticule prior to any session of fibre counting and the result recorded.

(e) Phase contrast test slides

(i) Phase contrast test slides traceable to certified reference materials e.g. HSE/NPL MK 2 or Mk 3 or equivalent shall be used for checking the microscope prior to any session of fibre counting and the result recorded.

(f) Refractive index liquids (Cargille liquids)

(i) The concept of traceability to SI unit is generally not applicable to Cargille liquids. However, the refractive index of the liquids should be checked at no less than six-month intervals. Any Cargille liquid that has been kept longer than the shelf-life specified by its manufacturer shall be withdrawn from use.

(ii) Records of purchase, date opened, dates checked and date disposed of shall be maintained. The container holding the Cargille liquids shall be labelled or otherwise identified to indicate their status

of routine checks, including the date on which the previous check was conducted, the due date for next checking and the expiration date.

6.6 Externally provided products and services

(No additional explanation)

7 Process requirements

7.1 Review of requests, tenders and contracts

(No additional explanation)

7.2 Selection, verification and validation of methods

(a) Air Sampling

(i) The procedures and acceptance criteria for blanks, whenever given in the relevant test standards, shall be followed. In the absence of such procedures, the following shall be followed:

For each new batch of filters used, one in every twenty-five filters shall be taken as a blank. The filter batch shall be rejected if the blank produces a count of more than 3 fibres in 100 graticule areas. In this case, a more frequent environmental monitoring and better control of the filter preparation area is necessary.

In addition, one field blank sample is required for each monitoring session and at a minimum one per every twenty samples taken.

(ii) The measured eye-piece graticule diameter shall be used when calculating test results.

(b) Bulk Identification

(i) The test methods including sample handling procedures shall be documented.

(ii) The documented test methods shall include any additional procedures used by the laboratory on a routine basis to confirm the test results obtained.

(c) Fibre counting

(i) The counting procedures for conformity to control limits shall be clearly distinguished from those for air monitoring of clearance work.

(ii) The method used for calibration of working stage micrometers shall be compatible with the procedures for setting up the microscope.

(iii) Drying of filters prior to mounting is only required for very wet environment or conditions. Provision for determining the number of fields to be counted and combining counts for clearance samples are also needed. Reference can be made to HSG 248.

(d) ACM determination

(i) The method specified in G.N. 884 shall be used only for determining whether a substance is an ACM within the meaning of Section 2 of the Air Pollution Control Ordinance and not for quantifying asbestos content for other purposes.

(e) On-site testing

(i) For on-site testing, the test methods shall be available for use by the analysts on-site and the quality control procedures as outlined in Section 11 shall be applied.

7.3 Sampling

(a) Airborne sampling

(i) A documented strategy for airborne sampling is required. The strategy, in this context, refers to the requirements on the number and locations of sampling equipment, sampling time and volume of air to be sampled for the range of work undertaken.

(ii) The documented strategy shall be appropriate to the type of sampling and shall fit for the intended use. It shall also take into account the protection of equipment during transportation and sampling, setting up and dismantling of equipment as well as handling, protection and avoidance of contamination of samples.

(iii) There shall also be provision for contamination monitoring which generally takes the form of additional filter heads being exposed to all stages of the operation, except that they are not taken into the area under study.

(iv) Details on treatment of the sampling area prior to sampling e.g. sealing, damping or drying; disturbance by mechanical or physical means of dust or other material on surfaces and of the sampling area, as well as the conditions for their application, shall be documented.

(v) As it is not feasible to take meaningful duplicate or repeat samples of airborne fibre, the test sample for fibre counting generally constitutes the whole of the sample taken. The accuracy and reliability of the sampling is therefore of primary importance to the usefulness and value of the subsequent test results.

(b) Bulk sampling

(i) Whilst the sampling of bulk material is not subject to single sample limitation as in case for airborne sampling, it is crucial that the samples taken are representative of the bulk.

(ii) The sampling strategy shall be documented and shall take into account the types of materials likely to be encountered and also the need to ensure as far as practical that sampling locations selected and number of samples taken is truly representative of the bulk material being sampled. Avoidance of cross-contamination and eventual safe disposal of samples should also be emphasized.

(iii) The sampling procedures shall cater for all sampling situations likely to be encountered.

Notes:

i. In view of the need for valid sampling prior to undertaking asbestos testing, the

sampling activity directly associated with the subsequent fibre counting or analysis of bulk material may be accredited. The areas of asbestos sampling cover:

- *air sampling for the purpose of asbestos fibre counting by either static or personal samplers; and/or*
- *bulk sampling of material for the purpose of determining the presence of asbestos, identifying the asbestos types or establishing whether the material is an ACM.*

ii. Assessment and accreditation for sampling are strictly limited to laboratories accredited and responsible for the subsequent tests. The terms of accreditation for sampling are further restricted to definitive and quantifiable activities. Accreditation will not be extended to include the design of sampling programmes.

7.4 Handling of test items

(a) All sample preparation for bulk identification shall be carried out in fume cupboards. Only the final examination of prepared samples under microscope can be performed in an open laboratory.

(b) Suitable documented procedures for storage of samples, removal of waste from fume cupboards and transfer of waste out of the laboratory premises shall be available and implemented.

(c) There shall be measures to ensure no cross-contamination or disturbance of the filter surface during storage of un-mounted air samples.

7.5 Technical records

(a) Full details of staff training, performance monitoring and any remedial action taken shall be maintained.

(b) Sampling records shall contain sufficient details to ensure that the sampling event could be repeated in exactly the same conditions and location if possible. Sketches and, where appropriate, videos and photographs should be included as part of the records. Actual measurements on airflow, time, filter area, and graticule area shall be used in determining test results. Worksheets used on-site and in the laboratory shall include provision for recording the above information together with details of the equipment used and names of the responsible analysts.

(c) A work schedule for on-site sampling, fibre counting and bulk identification

with indication of the respective responsible analysts shall be available.

7.6 Evaluation of measurement uncertainty

(a) In evaluating the measurement uncertainty in air sampling and subsequent fibre counting, the major sources of uncertainty including air flow rate, sampling time, sampled volume, effective filter area, number of counted fibres and fields, etc. shall be included. For bulk sampling and determination of ACM, the method bias, sample inhomogeneity and other uncertainty contributions due to matrix reduction, weighing and point-counting processes, etc., shall be taken into account. As regards asbestos identification, evaluation of measurement uncertainty is not required.

7.7 Ensuring the validity of results

(a) To ensure ongoing satisfactory performance, the laboratory shall implement, in addition to quality audits and reviews, an in-house comparative testing programme as given in Appendix for monitoring the performance of individual qualified analysts and participate, whenever possible, in proficiency testing programmes for asbestos fibre counting and bulk identification.

(b) As the above schemes are not feasible or appropriate for sampling activities, only qualified samplers are allowed to take responsibility for sampling.

(c) For fibre counting and identification, all staff authorised to undertake these tests shall regularly take part in the internal quality control scheme to ensure that the required level of their performance is maintained. Remedial actions shall be taken in case where inadequacy in their performance is identified.

(d) Bulk Identification

(i) The internal quality control scheme for bulk identification shall incorporate the use of routine samples and laboratory prepared samples covering the types of asbestos for which their identification is accredited.

(ii) Performance shall be assessed on a regular basis, monthly where

possible, against a defined and documented criterion of acceptability. Analysts with performance fallen outside the acceptance limits shall be suspended from undertaking bulk identification until a period of training has been satisfactorily completed and the performance assessed to meet the acceptance criterion again.

(e) Air Sampling

(i) Quality control of air sampling shall follow a similar regime to that for bulk sampling in respect of training, testing and subsequent supervision with records confirming the competence of the authorised air-sampling operators. Sound knowledge of the principle of occupational hygiene is important for the development of air sampling strategy.

(f) Fibre Counting

(i) The quality control scheme adopted shall include the monitoring of the performance of counters relative to the laboratory mean performance and counting of permanently mounted reference samples (including high and low density samples) and randomly selected routine samples. It should reflect the nature of the work undertaken by the laboratory.

(ii) Individual analysts shall receive feedback on their performance, preferably in a graphical form. Their performance shall be assessed against a defined and documented criterion of acceptability on at least a monthly basis. Analysts with performance outside the limits of acceptability shall be withdrawn from fibre counting until a period of training has been satisfactorily completed and their performance assessed to meet the criterion again.

(iii) Laboratories are also required to establish limits on the amount of fibre counting undertaken by their analysts in specified periods. To ensure consistency in quality of counting, no more than the equivalent of 12 clearance samples (i.e. 2400 graticule areas) shall be counted in any 8-hour period. Workloads in excess of this shall be supported by additional internal quality control.

(iv) Basically intra-laboratory control will require an appropriate

training programme, objective tests of performance and monitoring by random recounts and the evaluation of control slides. The laboratory is required to build up a library of control slides with a known counting history. These slides shall be representative of the normal working situation and checked for uniformity before acceptance for use in the quality control programme. Each authorised counter shall then count a number of controls each month and have his performance reaffirmed against the objective criteria. These criteria shall include comparison of each month's counts against the established laboratory norm and also examination of a moving average and outlier results. To cater for low density counting situations, the use of an equivalent standard deviation (ESD) as given in Appendix has been found very useful.

Note:
Laboratories having only a few fibre counters may find it necessary to exchange samples with other accredited laboratories for monitoring the performance of their counters.

(g) Proficiency test programmes

(i) Laboratory in-house verification on asbestos fibre counting and bulk identification shall be supported by participation in inter-laboratory programmes to maintain their respective accredited status.

(ii) In addition to the on-site performance assessment, laboratories seeking accreditation for fibre counting and/or bulk identification shall satisfy the following criteria:

(1) a minimum of two recent rounds of an external proficiency testing programme have been completed for all proposed counters for fibre counting and all proposed fibre identifiers in case for bulk identification

(2) the results of the completed rounds are satisfactory.

On-site assessment can be arranged and conducted prior to the fulfillment of the above criteria.

(iii) Laboratory nominees for HOKLAS approved asbestos counters /

identifiers shall meet the criteria 7.7(g)(ii)(1) and (2) above and be able to demonstrate to the assessors during assessment their technical competence in the concerned area. Assessment of the nominees may however be conducted prior to the attainment of satisfactory results for the two rounds.

(iv) An approved counter / identifier shall be suspended from his fibre counting / identification work if his proficiency testing performance at any time becomes unsatisfactory according to the acceptance criteria for individual proficiency programmes. A counter / identifier under suspension may apply for re-instatement after the specified requirements of 7.7(g)(ii)(1) and (2) are fulfilled. HKAS will arrange an on-site assessment upon request to evaluate his suitability for the re-instatement in similar manner as for new nominees.

7.8 Reporting of results

(a) Test results on fibre counting and identification shall be clearly and unambiguously presented in test reports. Opinions and interpretation shall not be included unless the laboratory is accredited for giving them.

(b) For fibre counting, the method detection limit is generally taken as 0.01 fibres/mL. Laboratories obtaining densities below this level shall report the result as “Less than 0.01 fibres/mL”. However, laboratories using low sample volumes or number of graticule areas counted which do not satisfy the requirements specified in HSG 248 shall not claim to have attained this detection limit and report it in their test certificates.

(c) Accreditation for air sampling is only available to laboratories which are accredited for fibre counting and responsible for counting their own samples. In case where laboratories not responsible for sampling but receive samples for counting, the test reports issued shall include only the number of fields counted, number of fibres counted, graticule area and, if checked, the exposed filter area. The air sample volume which cannot be confirmed may be given in test reports, providing that a statement specifying that the sample volume is provided by the customer and is not determined by the laboratory.

(d) Similarly, accreditation for bulk sampling is only available to laboratories capable of identifying the six types of asbestos as specified in Section 0 and

accredited for their identification.

(e) Even where a laboratory has been found capable of identifying the six types of asbestos, there will be times when positive identification of one type may not be possible, though asbestos is detected. The documented method shall therefore include reporting instructions for the analyst to cover this possibility and also cases in which no asbestos is detected. For the latter case, wording such as 'asbestos is not detected' instead of 'none' shall be used.

(f) Since accreditation does not cover identification of fibres other than asbestos nor asbestos quantification (v/v) under stereo-microscope, no reference to the nature of the non-asbestos content and no statement of % content shall be made in test reports.

(g) Except the conclusion as to whether test samples are ACMs within the meaning of Section 2 of the Air Pollution Control Ordinance, any quantitative results or opinion based on the use of the method provided in G.N. 884 shall not be reported.

7.9 Complaints

(No additional explanation)

7.10 Nonconforming work

(No additional explanation)

7.11 Control of data and information management

(No additional explanation)

8 Management system requirements

(No additional explanation)

APPENDIX

Internal Quality Control Schemes for Asbestos Testing

A. Fibre Counting

1 Introduction

1.1 The internal quality control scheme for asbestos fibre counting outlined below is based on the "LGC Scheme" as given in the Annals of Occupational Hygiene by Ogden et al (vol 30, No 4, pp 411-425, 1986). It is designed to meet the need of the laboratory for ensuring satisfactory performance of its counters, both as individuals and as a group. Although absence of data at the commencement of the scheme is assumed, the laboratory may use data already produced by its counters.

1.2 The scheme forms only part of the quality control with respect to fibre counting as there is still the need to ensure satisfactory performance in routine counting which usually involves some form of random recounting of routine slides coupled with defined criteria for acceptable performance.

1.3 The scheme shall not be viewed as an end point but rather as an ongoing commitment to improve the quality of testing. It shall therefore be audited periodically to ensure that its objective is achieved.

1.4 The laboratory is also required to participate in national or international proficiency testing programmes where available and appropriate.

2 Implementation

2.1 To get the scheme running, an initial set of reference slides in appropriate number and of asbestos density commensurate with levels commonly encountered is required. The slides shall be permanently mounted preferably by the permanent method routinely used in the laboratory. They shall be divided into three groups according to their fibre density ranges viz. Low (<15 f/mm^2), Medium (15-30 f/mm^2) and High (>30 f/mm^2), all assuming a notional sample volume of ~240 litres. Laboratories which routinely and consistently sample higher volumes may therefore need to set different levels of fibre density for these three ranges. For laboratories dealing primarily with "clearance indicator" type of work, the reference set shall contain ~60% Low,

~20% Medium and ~20% High density slides.

2.2 In order to set a laboratory reference value, in fibres/mm², for the reference slides, at least ten counts shall be carried out on each slide. These counts should preferably be obtained by a counter who has some experience or credibility. A suggested appropriate "qualification" for the counter is one who performs to the requirements of AFRICA or NATA, on an individual basis. Counts on prospective reference slides can be provided by external counters but the eventual data shall be carefully checked to ensure absence of grouping effect (i.e. the external counts are consistently outliers when compared to the laboratory's own counters).

2.3 The reference slides shall be checked to ensure that they are of good quality in respect of mounting and that the fibres are evenly distributed over the whole filter area. Checks shall be made on the spread of data to ensure that the slide is suitable for use as a reference slide. As a suggestion for initial acceptance criteria, the standard deviation of data should be <40%, <30% and <20% of the mean value respectively for low density, medium density and high density slides. It should be emphasised that the reference values are very much first guestimates and may need to be substantially revised when real data are available.

2.4 When the laboratory reference value has been assigned to the slide, the respective equivalent standard deviation (ESD) may be calculated for each slide by substituting the reference value N(f/mm²) in the Ogden equation:

$$ESD = \sqrt{N + 0.04N^2}$$

The ESD values are normally given to four significant figures but this does not of course imply any particular level of accuracy. Laboratory reference values shall be recalculated whenever a slide has had an additional ten counts made on it.

2.5 Each authorised counter is required to count each month at least five laboratory reference slides which shall generally reflect the types of slides routinely counted. A typical mix for a counter primarily involved in 'clearance indicator' work would be 3 low, 1 medium and 1 high, but this should not be a standard mix for obvious reasons.

2.6 Each individual counter's performance shall be checked on a monthly basis (i.e. after the completion of a QC round for the counter) against a defined set of

criteria. Whilst it would be nice to be able to set tight controls at the outset, it is more sensible to set achievable limits to begin with, as long as they are not too slack, and gradually tighten them as experience of the scheme increases.

2.7 The performance value (PV) for individual counters can be calculated as follows:

$$PV = \frac{F/mm^2 - N(f/mm^2)}{ESD}$$

$$PV = \frac{F/mm^2 - N(f/mm^2)}{ESD}$$

where F = fibre density of the slide
N = mean fibre density of the slide (reference value)
ESD = equivalent standard deviation

2.8 The move towards the use of fibre/mm² in the Ogden equation, rather than the number of fibres counted, means that there are no apparent appropriate criteria for acceptable performance. It therefore follows that those given below may need to be revised when data are available.

2.9 Laboratories accredited for asbestos counting shall ensure that the following criteria are met:

(a) No individual performance value is outside the range of -2.0 to +2.0

(b) A running modulised mean of the last six performance values is maintained at <1.5 with 1.0 as the warning level

(c) At least 80% of the performance values from the last four months lie between -1.5 and +1.5

2.10 Failure of a counter to meet any of the above criteria shall result in appropriate action by a designated person who may be the quality manager responsible for checking performance on a monthly basis. Different response as described below is required to deal with individual criteria.

(a) A counter returning a performance value outside the range -2.0 to +2.0 is required to recount the slide concerned as soon as possible, with his name temporarily removed from the list of authorised counters. If the recount results obtained meet the specified criteria, no further action is necessary. If the recount results are unsatisfactory, then appropriate

action shall be taken to identify and resolve the problem. Should informal or formal retraining be given as part of remedial action, the counter is required to count a number of reference slides, usually linked to the laboratory's training schedule, and the results shall meet the criteria before being allowed to regain the status of authorised counter. If a long delay in the corrective action programme is anticipated, the name of the analyst shall be formally taken out from the list of authorised counters.

(b) The use of a warning level indicator is designed to control counters' performance from falling outside the level set for the running modulised mean. Should counters fail to meet this criterion, they shall undergo some formal retraining and have their authorised counter status withdrawn. The retraining should again be linked to the training schedule and the individual counters shall complete a formal assessment involving the use of reference slides to ensure compliance with the criteria before being reinstated as authorised counters. Since this process is likely to take more time than the action for 2.10 (a), the name of the individual may have to be formally removed from the list of authorised counters.

(c) Interpretation on individual analysts' performance against the third criterion is more flexible since the quality manager or the designated person is allowed to interpret at his discretion the cause of non-conformity. The interpretation may include consideration of the types of samples involved and the degree of non-conformity. It should be remembered that the possibility of 'rogue' results when dealing with low density slides is quite high and the implementation of the scheme should not result in a constant stream of counters requiring retraining.

2.11 When assessing performance of individual analysts, it is necessary to record all 'observations' and 'corrective actions' especially in cases where the specified criteria are overruled for specific reasons.

2.12 When an analyst fails to meet the criteria, random checks on results produced by him/her since his/her last performance assessment are required. Any action taken shall be justified and recorded.

2.13 The performance of individual counters shall be regularly monitored, preferably in form of performance chart. Individual counters should be informed of their own–performance and allowed to look at the performance

chart of other counters for effective harmonisation of performance.

B. Bulk Identification

1 Introduction

1.1 The laboratory shall establish and implement an appropriate internal quality control scheme, in addition to participation in inter-laboratory proficiency testing programmes, for bulk identification and shall designate personnel to be responsible for its implementation.

2 Implementation

2.1 Check samples in appropriate number and of known composition with absence of asbestos, single asbestos component or mixed asbestos, obtained from recognised external suppliers, using field samples previously analysed by competent analysts, or prepared in-house shall be maintained.

2.2 At least one check sample shall be randomly selected and distributed to each laboratory asbestos analyst for examination on a bi-monthly basis. The results shall be recorded and compared with the known composition.

2.3 Analysts failing to identify all the asbestos types in the given check sample shall repeat the analysis. If the results so obtained are still incorrect, the concerned analysts shall be suspended from and re-retrained for bulk identification. Only when the analysts have successfully completed the re-training programme can their duties for bulk identification be resumed and their approved identifier status reinstated.

Annex
(Informative)

Bibliography

Laboratory staff members responsible for asbestos sampling and testing are strongly advised to consult the following references.

1. Health and Safety Executive (HSE) (2006) *Asbestos: The analysts' guide for sampling, analysis and clearance procedures (HSG 248)*

2. Health and Safety Executive (HSE) (2021) *Asbestos: The analysts' guide (HSG 248 2nd Edition)*

3. NIOSH method 7400 Issue 3 (2019) *Asbestos and Other Fibers by PCM*

4. G.N. 884 of Gazette published on 14 February 2014 No. 07 Vol. 18 *Method for Determining Asbestos Containing Material under Section 2 of the Air Pollution Control Ordinance*

5. Annals of Occupational Hygiene by Ogden *et al* vol 30, No 4, pp 411-425 (1986) *Within-Laboratory Quality Control of Asbestos Counting*

6. ILAC-P9:01/2024 ILAC Policy for Proficiency Testing and/or Interlaboratory Comparisons other than Proficiency Testing