HOKLAS Supplementary Criteria No. 50

'Environmental Testing' Test Category – Sampling and On-site Measurement for Air Quality Monitoring

0 Introduction

(a) This document serves to clarify and supplement the requirements of ISO/IEC 17025:2017 and HKAS Policy Document No. 1 for accreditation of laboratories performing sampling and/or on-site measurement of indoor and outdoor air quality, except asbestos sampling which is covered in HOKLAS SC-05. For aspects not covered in this document, ISO/IEC 17025:2017, HKAS Policy Document No. 1, HKAS 002 and other relevant criteria documents shall apply.

(b) Laboratories should note that complying with this document might not necessarily meet the requirements of all test standards. Individual test standards may have specific requirements which shall be met when conducting the tests.

(c) A laboratory seeking accreditation for air sampling shall also be accredited for testing of the related air samples. For requirements on testing of air samples in the laboratory, please refer to HOKLAS SC-06 and/or HOKLAS SC-08.

(d) Sampling, in this context, means sampling activities carried out on site in accordance with a pre-determined sampling plan and a set of documented and well-defined procedures to obtain representative air samples for subsequent testing.

(e) On-site measurement includes measurement of indoor and/or outdoor air quality performed at a site laboratory, customers' premises or ambient air environment (e.g. using gaseous analysers for direct measurement of test parameters).

(f) The scope of accreditation for sampling will include only operations carried out in accordance with a set of documented and well-defined procedures. Accreditation will not be granted for the design of sampling programmes (i.e. sampling plans) or the subsequent interpretation of test results from such sampling programmes.

(g) Assessment, reassessment and surveillance visit will be conducted at the permanent laboratory as well as individual or specific sites, as appropriate.

1 Scope

(No additional explanation)

2 Normative reference

(No additional explanation)

3 Terms and definition

(No additional explanation)

4 General requirement

(No additional explanation)

5 Structural requirements

(a) The laboratory shall have at least one staff member who has in-depth knowledge of and extensive experience in air sampling and/or on-site measurement. He/She shall be responsible for the laboratory and on-site technical operations.

6 Resource requirements

6.1 General

(No additional explanation)

6.2 Personnel

(a) Approved signatories shall have

i. at least a Bachelor of Science degree in chemistry or other relevant technical disciplines, or a Bachelor of Engineering degree, or equivalent, with at least 3 years' relevant sampling/testing experience; or

ii. an Associate Degree or a Higher Diploma, or equivalent, in chemistry, engineering, or other relevant technical disciplines, with at least 5 years' relevant sampling/testing experience.

Note: Alternatively, appropriate membership of professional bodies is acceptable. In addition, he/she shall have at least six months'

experience in the sampling/on-site measurement activities for which signatory approval is sought. Special consideration may be given to persons without the above qualifications but with extensive experience (at least ten years) in the areas concerned. In all cases, candidates for approved signatories shall demonstrate his/her technical competence in the areas under consideration to the assessors before signatory approval can be granted.

(b) The laboratory shall ensure that there is sufficient supervision by competent staff to personnel carrying out on-site sampling/measurement. Such supervision shall also cover contracted personnel who assist in sampling/on-site measurement. Means to ensure that they carry out the sampling/on-site measurement activities in accordance with the documented procedures shall be available.

(c) Training programme for staff performing sampling/on-site measurement shall be documented. The programme shall include training on the sampling techniques involved as well as the sampling/on-site measurement procedures and quality assurance plans.

(d) The performance of each site staff shall be monitored, normally on site, at least annually by authorised personnel who has relevant technical competence to perform the evaluation.

6.3 Facilities and environmental conditions

(a) Where sampling/on-site measurement is undertaken in a hostile environment, procedures shall be available for checking that the environment does not adversely affect the performance of the sampling/on-site measurement equipment.

(b) Adequate measures shall be taken to ensure good site management in the sampling/on-site measurement area.

(c) In the case where automatic sampling/on-site measurement equipment is used and where on-site staff may not be present all the time, there shall be provisions to ensure security of such equipment and integrity of samples / results obtained.

6.4 Equipment

(a) For sampling device of disposable type e.g. adsorption tubes and filters, not less than 5% of the total size of each batch shall be checked and confirmed free

of contamination before use. For re-usable sampling device e.g. sampling bags, thermal desorption tubes and canisters, 100% of the sampling devices shall be verified clean initially in accordance with appropriate procedures before being used for sampling activities. These devices should be verified to be clean again prior to each subsequent sampling activity. Only until there is sufficient evidence to confirm the reliability of the cleaning process, then the checking frequency of sampling devices can be reduced to a lower percentage. In addition, 100% of sampling devices should be checked for leakage before and after sampling activities. Records for cleanliness verification and leakage check shall be maintained.

(b) Storage conditions of sampling devices shall be defined to avoid contamination, deterioration and invalidation of their performance. Storage conditions shall be monitored and records shall be maintained.

(c) Site sampling/on-site measurement equipment shall be checked, either on-site or in laboratory, at appropriate intervals to ensure all operating parameters are as specified. All equipment used for sampling/on-site measurement shall meet the performance characteristics as stated in the corresponding validated method.

(d) Documented procedure shall be available for handling re-usable sampling devices to ensure that cross-contamination is reduced to minimum (e.g. source sampling devices should not be used for ambient sampling). Detailed records on the history of use shall be maintained.

(e) Precautions shall be taken to ensure that the on-site measurement equipment, after transportation to the site and during use, remains in a serviceable state and in calibration.

(f) Appropriate checks shall be performed on site to confirm calibration status before sampling/on-site measurement commences. Where reliable checks cannot be carried out on site, the calibration status should be established in the permanent laboratory before and after site sampling/on-site measurement and augmented by on-site checks with suitable check standards (see Section 7.7).

(g) The laboratory should ensure that performance characteristics of the sampling device/on-site measuring equipment, either provided by the manufacturer or as validated/verified by the laboratory, are defined and such information should be available for examination during assessment. The performance characteristics for sampling device shall include breakthrough, retention efficiency, capacity, interferences and other parameters as appropriate.

6.5 Metrological traceability

(a) The calibration programme for on-site measurement equipment shall at least consist of the following features and be documented and implemented:

i. Full calibration upon commissioning and after any maintenance event which might affect the initial calibration curve or if the daily calibration criteria are not met.

1) For parameters known to display linear response, at least a zero and three concentration levels shall be used, where practicable, to construct the calibration curve. It is known that for some measurements, the concentration of analytes routinely encountered is at the lower end of the calibration range. In such case, the laboratory is recommended to include more calibration points at the lower concentrations to establish a better linearity at the routine concentration ranges.

2) For parameters known to display non-linear response, additional calibration points shall be obtained, where appropriate, depending on individual parameters.

ii. Calibration check

1) Zero and, where applicable, span check shall be performed at intervals specified in standard methods or as recommended by the equipment manufacturer. The acceptance criteria of the checks shall be defined and documented. If the equipment cannot fulfill the defined acceptance criteria, the laboratory shall stop working and rectify the problem before resuming work.

(b) In the event that the reference flowmeter is of manual soap-bubble type, the volume of such meter shall be calibrated before commissioning and visual inspection for damage at regular intervals should be carried out. Other reference flowmeters shall be calibrated, where practicable, at a frequency not less than once every two years. Other measuring equipment like vacuum/pressure gauges, time measuring device and rotameter should be calibrated at intervals recommended by HOKLAS SC-02.

(c) For flow control devices, for example, mass flow controllers and sampling pumps, flow rate shall be checked before and after sampling activities. The maximum flow rate difference during the sampling period shall be defined and

recorded after each use. The validity of the sample shall be reviewed and justified if the measured flow rate difference is greater than the defined value and the outcome of such review shall be recorded.

(d) Reference materials shall, where possible, be traceable to national or international certified reference materials. In cases where it is necessary to use commercially prepared chemical standards as reference materials, the assigned values of each batch of the chemicals shall be verified (e.g. against certified reference gases) and verification records shall be maintained. Please refer to HOKLAS Supplementary Criteria No. 1 'Acceptability of chemical reference materials and commercial chemicals used for the calibration of equipment' for details.

(e) Where it is necessary to use flow measuring/control devices and reference materials on site, adequate precautions shall be taken to ensure that their calibration status and performance are maintained during transportation and while on site.

(f) There shall be documented procedures as far as practicable for the use, storage and transportation of flow measuring/control devices and reference materials from the permanent laboratory to the site for sampling/on-site measurement.

6.6 Externally provided products and services

(No additional explanation)

7 Process requirements

7.1 Review of requests, tenders and contracts

(a) The review procedure shall ensure a sampling plan and/or an on-site measurement plan is produced in accordance with statutory and/or customer's requirements. Whenever reasonable, the sampling plan shall be based on appropriate statistical method(s).

(b) If specified in the standard method, the instructions or strategies pertinent to sampling plan, including but not limited to selection and number of sampling/measurement sites, number of samples taken/measured from the sites, sample size and/or sampling time requirement, shall be followed.

7.2 Selection, verification and validation of methods

7.2.1 Selection and verification of methods

(a) Sampling/on-site measurement procedures shall be available to all staff performing on-site work. Where available, procedures published in international and national standards should be employed. In-house sampling and/or on-site measurement method may be accredited provided that the method is fully validated by the laboratory.

(b) Sampling procedures should be given in adequate detail to ensure consistent application, taking into consideration the requirements of the sampling plan. The documented procedures should include but not limited to the followings:
   i. the specific parameter of interest;
   ii. sampling techniques i.e. active or passive;
   iii. types of sampling i.e. grab or time-weighted average;
   iv. maximum/minimum sample volume;
   v. sampling time and flow rate;
   vi. sampling device capacity;
   vii. sampling interferences;
   viii. storage requirements of samples and sampling device;
   ix. verification requirements of sampling device;
   x. types of equipment used and its calibration (if required);
   xi. reference to other on-site procedures (if required) and sampling record forms;
   xii. the use of actual airflow and sampling time recorded on site in determining test results if relevant to the type of sampling performed.

(c) On-site measurement procedures should be given in adequate detail to ensure consistent application. The documented procedures should include but not limited to the followings:
   i. operation of the measuring equipment;
   ii. types of reference standards/materials used for calibration or verification;
   iii. method precision;
   iv. acceptance criteria for equipment drift; and
   v. performance check, if any.

(d) Procedures shall be documented for contingency situation when equipment is inoperative or damaged at the site, including where necessary the halting of work and its resumption after repair or replacement of the equipment.

7.2.2 Validation of methods

(No additional explanation)

7.3 Sampling

(a) 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, video and photographs should be included as part of the records.

(b) The person(s) performing the sampling and/or on-site measurement, and the supervisor if present on site, shall sign on the record sheet at the time when the activities are being carried out.

(c) Access to the sampling/on-site measurement site and customer's permanent facilities (if testing is performed there after sampling) shall be provided for HKAS representatives and assessors during HOKLAS assessment. If the site is not under the direct control of the laboratory, the laboratory shall have proper arrangement with the site owner or its representative for providing the assessment team's access to parts of the site that are relevant to the activities being assessed.

7.4 Handling of test or calibration items

(a) Every sample obtained on site shall carry a unique sample identification, the sampler identification, date of sampling, time, location and environmental conditions of sampling, and any additional information as required by the test procedure.

7.5 Technical records

(No additional explanation)

7.6 Evaluation of measurement uncertainty

(a) Since there are various approaches to evaluate measurement uncertainty of sampling and on-site measurement, any valid methods given by reputable professional and standard writing bodies will be accepted by HKAS Executive. The measurement uncertainty evaluated should be in line with the definition given in JCGM 200 'International Vocabulary of Metrology - Basic and General Concepts and Associated Terms (VIM)' and should include all major components of uncertainty.

(b) Reference to ISO 20988 'Air Quality – Guidelines for Estimating Measurement Uncertainty', ISO 11222 'Air Quality – Determination of the uncertainty of the

time average of air quality measurements', Nordtest Technical Report 'Uncertainty from sampling – A Nordtest handbook for sampling planners on sampling quality assurance and uncertainty estimation' and EURACHEM/CITAC Guide 'Measurement Uncertainty Arising from Sampling: A Guide to Methods and Approaches' published jointly by EURACHEM, EUROLAB, CITAC, Nordtest and the RSC Analytical Methods Committee may be useful.

7.7 Ensuring validity of results

(a) For sampling, the laboratory should have a quality control (QC) programme which includes the use of blanks and duplicates as appropriate. Acceptance criteria for QC measures should be established and documented. The frequency for the use of QC measures should be defined, but normally, at a minimum of once per batch of samples or type of matrix or per twenty samples, whichever is more frequent. Given below for reference are common QC measures:

i. Routine preparation of field/trip blanks for use in detection of presence or absence of possible contamination during sampling and transportation.

ii. Collection of duplicate samples for assessing the precision of the sampling procedure.

(b) For on-site measurement, a routine data verification programme including zero check, span check and/or duplicate measurement as appropriate should be documented and implemented accordingly. Acceptance criteria should be established and documented in each on-site measurement procedure for individual analytes.

(c) Data obtained from such verification programme should be recorded for trend analysis and statistical techniques shall be applied if practicable.

(d) Procedures for dealing with situations where the acceptance criteria for the QC programme (Section 7.7 (a)) and data verification programme (Section 7.7 (b)) are not met shall be available. Records of corrective actions shall be kept.

(e) Laboratories shall participate in appropriate PT activities where applicable. The frequency of participation shall commensurate with the outcome of the laboratory's risk assessment and shall be at least once per reassessment cycle for each area of technical competence, as defined by a minimum of one measurement technique, parameter and matrix which are related (please refer to Appendix C of ILAC-P9:01/2024 for more details).

7.8 Reporting of results

(a) Results and information obtained from sampling/on-site measurement shall be identified as such on reports and certificates issued by the laboratory. Such reports and certificates shall contain the following information:

i. An indication as to whether the reported results refer to sampling and testing performed by the same laboratory, or to sampling and testing respectively performed by the laboratory and subcontractor laboratory.

ii. Quality control data and other relevant information, for example, temperature, pressure and humidity of the site during sampling/on-site measurement, if required for proper interpretation of sampling/on-site measurement results, requested by the customer or specified in the test standards.

(b) In determining decision rule, international guidelines, such as ILAC-G8:09/2019 ‘Guidelines on Decision Rules and Statements of Conformity’, EURACHEM/CITAC Guide ‘Use of uncertainty information in compliance assessment’ and EUROLAB Technical Report ‘Decision rules applied to conformity assessment’ may be followed.

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)

Annex
(Informative)

Bibliography

1 EURACHEM/CITAC Guide *Measurement uncertainty arising from sampling: A guide to methods and approaches*

2 EURACHEM/CITAC Guide *Use of uncertainty information in compliance assessment*

3 EUROLAB Technical Report No. 01/2017: *Decision rules applied to conformity assessment*

4 ILAC-G8:09/2019 *Guidelines on Decision Rules and Statements of Conformity*

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

6 ISO 11222 *Air Quality – Determination of the uncertainty of the time average of air quality measurements*

7 ISO 20988 *Air quality – Guidelines for estimating measurement uncertainty*

8 JCGM 200 *International Vocabulary of metrology - Basic and general concepts and associated terms (VIM)*

9 Nordtest Technical Report 604 *Uncertainty from sampling – A Nordtest handbook for sampling planners on sampling quality assurance and uncertainty estimation*

Remark: For dated references in the whole Annex, only the edition cited applies. For undated references cited, the latest edition (including any amendments) applies.