



**ISO/IEC 17025 Field Application Document**

**Chemical Testing**

**Supplementary requirements for accreditation**

**June 2010**

**Be Absolutely Assured**



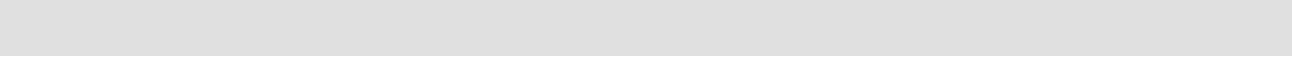
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## Section 1

### Introduction

#### Scope

The general requirements for the competence of testing and calibration facilities are described in AS ISO/IEC 17025: 2005 *General requirements for the competence of testing and calibration laboratories*, hereafter referred to as 'ISO/IEC 17025'. These requirements are designed to apply to all types of testing and calibration and therefore often need to be interpreted with respect to the type of calibration or testing concerned and the techniques involved.

This Field Application Document (FAD) provides an explanation of the application of ISO/IEC 17025 for Chemical Testing facilities and includes a description of the NATA accreditation procedures applied in this field. Facilities must comply with this document, all relevant clauses of ISO/IEC 17025, the NATA Rules and relevant statutory requirements. Additional information relating to specific areas of testing, or changes or additions to accreditation requirements, or policies may be issued from time to time in the form of Technical or Policy Circulars. These shall supersede any previous requirements where indicated. The FAD must therefore be read in conjunction with all of these references and are included in the NATA Accreditation Requirements (NAR).

The NATA Accreditation Requirements (NAR) are made up of a number of documents, most of which are available for download as a zipped file from the 'Accreditation Publications' section of the NATA website, [www.nata.com.au](http://www.nata.com.au). The documents comprising the NAR are:

1. The relevant standard (e.g. AS ISO/IEC 17025) for which accreditation is held or sought. This is not supplied by NATA and must be obtained by the facility. The following table provides information about where to obtain the applicable standards or documents.

Standard/document	Field/Program	Organisation	Website
AS ISO/IEC 17025	Laboratory Accreditation	Supplier of Australian standards	
AS/NZS ISO/IEC 17020	Inspection	Supplier of Australian standards	
AS 4633 (ISO 15189)	Medical Testing	Supplier of Australian standards	

RANZCR Standards	Medical Imaging	RANZCR	www.ranzcr.edu.au
ILAC Guide 13	Proficiency Testing Scheme Providers	ILAC	www.ilac.org
ISO Guide 34	Reference Material Producers	Supplier of ISO standards	
OECD Principles of Good Laboratory Practice	GLP Recognition	OECD Environment Directorate Environmental Health and Safety Division	<a href="http://www.oecd.org/env/glp">www.oecd.org/env/glp</a>

2. Relevant field application document (FAD) i.e. this document, for the program/field in which accreditation is held or sought (available from the NATA website).
3. NATA Rules (available from the NATA website).
4. Current Policy/Technical Circulars (where relevant) (available from the NATA website).
5. Some fields/programs have additional documents that also form part of the accreditation requirements which are referenced in the relevant field application document (FAD).

A copy of the NATA Accreditation Requirements must be readily available to staff working in a NATA accredited or applicant facility.

Other informative documents are also available from the NATA website, such as:

1. About NATA and Accreditation
2. Technical Notes
3. Information Papers
4. Proficiency Testing information

Facilities accredited or seeking accreditation by the World Anti-Doping Agency (WADA) must also comply with the requirements of the latest version of the WADA International Standard for Laboratories (ISL) as well as ISO/IEC 17025:2005 and this FAD.

### Applicability

The field of Chemical Testing covers instrument calibrations and tests on a broad range of chemicals based on the following chemical sectors: organic materials, inorganic materials, environmental, fuels and lubricants, surface coatings, foods and drugs and occupational hygiene. These sectors are supported by Technical Groups which have been established by the Chemical Testing Accreditation Advisory Committee to assist in the development of criteria within these areas of chemical testing.

The accreditation criteria are applicable to all facilities, irrespective of size, range of testing/calibration activities or number of personnel. It should, however, be noted that it is not possible to set rigid requirements for all aspects of a facility's operation. Some flexibility is necessary so that each facility's unique situation can be considered. The acceptability (or otherwise) of certain practices can therefore only be determined by assessment. Information on the assessment process is contained in Section 2.

ISO/IEC 17025 Field Application Documents are available for all of NATA's accreditation fields, as listed below.

#### Biological Testing

**Construction Materials Testing**  
**Forensic Science**  
**Information and Communications Technology Testing**

**Measurement Science and Technology**  
**Mechanical Testing**  
**Non-destructive Testing**  
**Veterinary Testing**

Application documents are also available for NATA's other programs including accreditation for inspection, medical testing, medical imaging, proficiency testing scheme providers, reference materials producers and research & development. Additionally, an interpretation document is available for GLP recognition against the OECD principles.

## Administration

NATA's accreditation activities are administered, under the Board's direction, by the relevant field/program Accreditation Advisory Committee. The current NATA Rules outline the functions of the Board and the Accreditation Advisory Committees.

## Terminology and presentation

The clause numbers in Section 3 of this document follow those of ISO/IEC 17025 but since not all clauses require interpretation the numbering may not be continuous. It is recognised that not all testing or calibration activities are performed in a 'laboratory'. Accordingly, the expression 'facility' is used throughout this document.

The words 'shall' and 'must' are used interchangeably throughout this document and describe mandatory criteria for accreditation. The word 'should' is used where guidance is provided but does not preclude other acceptable practices. Where a smaller size font has been used i.e. a 'Note', this indicates a matter of an advisory or informative nature.

Any references to the NATA Rules, Fee Schedule, Technical Notes etc imply the current version of such documents.

Where the words 'policy' and 'procedure' are used in ISO/IEC 17025 it is possible that one document may meet the requirements of the standard. This will be determined at assessment.

## Legislation

It is the responsibility of each facility to ensure that it complies with all relevant legislation. Legislative requirements may take precedence over, or provide additional criteria to those detailed in this document. It is also strongly recommended that facilities hold copies of relevant legislation.

## Safety

NATA does not define mandatory safety measures but does draw attention to any unsafe practices that are observed in the course of an assessment. Facilities are, however, encouraged to apply the relevant sections of AS2243 *Safety in Laboratories*. When clauses related to safety are written into test methods covered by the accreditation, these must be observed and are subject to assessment.

## Section 2

### Accreditation procedures

The following information is provided to assist facilities who seek or hold accreditation or wish to extend the scope of their accreditation. General information is also provided with regard to NATA's policies and procedures.

It should be noted that there are some differences between the fields with regard to the order in which these steps are followed. Hence, this section may vary from other ISO/IEC 17025 Field Application Documents which reflects relevant but different emphases in the various calibration and testing fields, or limitations that have been placed on the NATA process by outside influences, such as regulatory or industry-specific requirements.

Where an organisation may require accreditation in a number of different fields, every attempt is made to harmonise and coordinate accreditation activities. Corporate accreditation is available in defined circumstances to assist this process. A Policy Circular is available explaining this process and can be obtained from our offices or the NATA website.

There may also be a need to vary the steps detailed below in the case of applications from overseas facilities. Once again, every attempt is made to ensure the accreditation process is carried out in the most efficient and effective way for all parties concerned.

Where applications or accreditations are required that include non-testing/calibration NATA accreditation activities (such as the Reference Material Producers Accreditation Program, Proficiency Testing Scheme Providers Accreditation, Inspection Accreditation or GLP Recognition) every effort is also made to appropriately coordinate activities.

Clause 1.6 of ISO/IEC 17025 states that facilities that comply with ISO/IEC 17025 meet the 'principles of ISO 9001'. Facilities interested in making a statement regarding this issue for their customers should refer to the *Joint ISO-ILAC-IAF Communiqué on the Management Systems Requirements of ISO/IEC 17025: 2005* available from the 'Publications – International documents' section of the NATA website.

In conducting assessments, however, NATA cannot accept a facility's ISO 9000 certification as the sole statement of compliance with the management requirements of ISO/IEC 17025. ISO 9001: 2000 is an outcome based standard and has fewer requirements for documented procedures and records. It is also necessary to consider how the system is applied at a technical level. Therefore, the management system requirements of ISO/IEC 17025 will still be assessed in these situations.

### **The role of the authorised representative**

The authorised representative is the person nominated by the facility to be its representative in all matters relating to the application or accreditation and is the recognised official contact with NATA. Nomination is made in the appropriate place on the application form or when changes are required thereafter, on the 'Nomination of New Authorised Representative' form available for this purpose.

The rights and legal obligations of the authorised representative are detailed in the NATA Rules. At a practical level, the authorised representative is normally a senior staff member who is in a position to make decisions regarding the facility's accreditation and to effectively communicate with facility staff. The authorised representative may also choose to direct NATA to other facility personnel with whom relevant issues may be discussed.

The authorised representative is required to notify NATA within 14 days if:

- the name or ownership of the facility changes;
- changes in duties or departures of key staff; or
- significant changes occur to the functions or accommodation of the facility.

### **Facility contact person**

Recognising that the authorised representative is not necessarily the most appropriate person to answer day to day and technical queries regarding an accredited facility's activities, NATA provides facilities the opportunity to nominate a person to deal with technical and other enquiries. This person can, however, also be the authorised representative.

### **Fees for services**

The various parts of the accreditation process where charges are levied are indicated in this document. Specific information on charges can be obtained from our current Fee Schedule (available from the NATA website) or by contacting a NATA office.

### **Preliminary steps**

The facility is encouraged to hold discussions with relevant NATA technical staff prior to lodging a formal application for accreditation.

When seeking accreditation, facility staff should also familiarise themselves with the NATA Accreditation Requirements (NAR). The NAR can be obtained from the NATA website.

### **Advisory visit**

An advisory visit to the facility can be undertaken by a NATA technical staff (lead assessor) to further discuss the assessment process and to explain the significant requirements that relate to accreditation. Such a visit includes an informal review of the facility which can help determine its state of readiness for accreditation. It should, however, be remembered that the NATA lead assessor, whilst an experienced scientist, is not a technical assessor. Accordingly, the formal assessment (refer below) is the process whereby compliance with the accreditation requirements is determined.

Following the visit, a written report is provided which summarises the key points of discussion.

An advisory visit is usually conducted prior to an application for accreditation being submitted, however, the most appropriate timing for such a visit will be a matter for negotiation between the facility and the NATA lead assessor.

While an advisory visit is not mandatory it is strongly recommended that facilities avail themselves of this service prior to applying for accreditation. There are of course cases in which facilities have good knowledge of NATA through existing contacts or accreditations. In such cases, the merits of an advisory visit should still be discussed with relevant NATA technical staff.

Prior to an advisory visit, the facility will be asked to provide relevant documentation for review. The NATA lead assessor will advise exactly what information is required. This activity is known as 'document review' and is described below.

A fee is levied for an advisory visit in accordance with NATA's Fee Schedule.

### **Document review**

Depending on the state of readiness of the facility for accreditation, it will be asked (either prior to an advisory visit or after an advisory visit, but before the formal on-site assessment), to submit a copy of its proposed scope of accreditation, current management system documentation, calibration and/or test procedures and information on staff so that a document review can be undertaken.

A document review is most often conducted by the NATA lead assessor who will be involved in the assessment of the facility.

The document review provides a comparison of the facility's documentation and procedures with the accreditation requirements as detailed in the NAR. The NATA lead assessor also makes note of particular references within the facility's documented system that require review at the assessment or areas that appear to require further explanation or investigation. Written feedback will be provided on the findings of the document review. Depending on the extent of the action required the facility may be asked to provide further information prior to the assessment or this information will be sought at the assessment.

A fee is levied for the document review in accordance with NATA's Fee Schedule.

### **Application for accreditation**

Applications for accreditation may be made by any legally identifiable organisation and must be made on the prescribed application form. This form will be provided at an appropriate time with regard to the intended time of application. The application must be accompanied by the current application fee in accordance with NATA's Fee Schedule.

### **Assessment**

Compliance of an applicant with the accreditation requirements is determined primarily by an on-site assessment.

The objective of an assessment is to establish whether the facility can competently perform the activities for which accreditation is being sought. The NATA assessment team is required to investigate the operation of the facility against the criteria detailed in the NATA Accreditation Requirements. The assessment team reports its findings to both the facility seeking accreditation and the relevant Accreditation Advisory Committee (AAC).

The assessment team is comprised of at least one NATA lead assessor and one or more specialist volunteer technical assessors. Review of the management system is essentially conducted by the NATA lead assessor whilst the volunteer assessors concentrate on the technical activities performed by the facility. The size of the assessment team is dependent upon the areas that must be covered in the course of the assessment.

Technical assessors are chosen according to their specialist knowledge and are matched as closely to the activities of the facility as is possible. Consideration is given to possible concerns about conflicts of interest in selecting assessors.

Assessments will generally take at least one working day and may extend over a number of days depending on the range of activities to be covered.

Facility staff will be called upon to discuss, with the technical assessors, technical issues relating to measurements and tests that are in progress or carried out by the facility. Occasionally, such discussion may be hypothetical. NATA may also request prior to the assessment, or in the course of the assessment, that particular procedures or tests be demonstrated. Facilities undergoing an assessment should expect all areas for which accreditation is sought to be covered in some way.

Where consultants are associated with a facility, NATA reserves the right to contact these persons to establish their level of involvement if they are not present at the assessment.

An exit interview or meeting is held at the conclusion of the assessment at which the assessment findings are presented by the NATA lead assessor. It is the prerogative of the facility to decide which of their staff should attend this meeting. Generally, the authorised representative would be expected to attend as well as relevant senior staff. The purpose of the exit meeting is to allow frank and open discussion about the findings of the assessment. Facilities are strongly encouraged to clarify issues they consider may have been misunderstood by the assessment team and to seek clarification about assessment findings where this may be necessary. Where the assessment team and facility do not agree on a finding or the emphasis placed on an issue, this will be noted by the NATA lead assessor and considered during the report review process (refer below). Further information may also be requested by NATA and included in the final report where this information was not available during the assessment.

An interim written report is usually left on the day. This report is subsequently reviewed by NATA senior staff and where relevant, the AAC, prior to the issue of the final report. This review ensures that the assessment team findings are appropriate and in accordance with the accreditation requirements, that evidence gathered at the assessment support the findings and that there is consistent interpretation and appropriate application of the accreditation requirements. Occasionally, a specific issue raised in the report may also be referred for review to other technical experts (not members of the AAC) where further advice is sought. In such cases, the identity of the facility concerned is kept confidential. Where necessary, the final report will detail the action required by the facility to allow accreditation to be recommended. In these cases, the facility will be asked to provide NATA with the necessary evidence that action has been taken, as claimed.

Occasionally, the AAC may recommend that a further visit by a NATA lead assessor or that another assessment be conducted. There are a number of reasons for this, including concerns about the competence of the facility, the inability to assess certain aspects of the facility during the scheduled visit because of lack of availability of key staff, or to review the effective implementation of the corrective action taken as a result of the assessment. The same procedures for assessment will be followed but may concentrate on only the area(s) found to be deficient.

Fees are levied for the conduct of assessments in accordance with NATA's Fee Schedule.

### **Granting accreditation**

NATA's Chief Executive grants accreditation following a recommendation by the relevant AAC. This recommendation is made when the facility has met all the requirements for accreditation. The authorised representative is formally advised of the granting of the accreditation and issued with a certificate and the scope of accreditation.

### **Scope of accreditation**

Accreditation is described by classes and sub-classes of test. The collective expression, or scope of a facility's accreditation, is known as its 'scope of accreditation'. These classes and sub-classes are fixed descriptors, free text being used to qualify or amplify the scope as necessary. Where the scope of accreditation of a facility cannot be adequately described by existing descriptors, the AAC may from time to time establish new classes and/or sub-classes of test. A copy of the classes of test available in the field of Chemical Testing is provided in Section 5 of this document. Classes of test are, however, revised from time to time so for the most current version please contact a NATA office or visit our website.

Applications for accreditation may be made for one or more classes of test, or for one or more subclasses within a class of test.

The scopes of accreditation of all NATA accredited facilities are available on the NATA website.

### **After accreditation**

NATA accredited facilities must continue to comply with all accreditation requirements detailed in the NATA Accreditation Requirements. In order to ensure continued compliance with these requirements, scheduled visits to facilities are arranged.

Generally the assessment cycle is three years which includes a surveillance visit at 18 months followed by a reassessment at 36 months.

Shorter intervals to a facility may also be specified by the relevant Accreditation Advisory Committee. Such intervals will be determined on the significance of issues identified during a visit to a facility and/or any doubt over a facility's continuing compliance with the accreditation requirements.

Reassessments follow the same general process as the initial assessment. The scope of review covers all of the facility's technical activities, however only selected elements of the management system against the accreditation requirements detailed in the NAR. A document review is generally not conducted prior to a scheduled reassessment.

Extensions to the scope of accreditation and/or signatories requested as part of a scheduled reassessment will only be accommodated where such requests do not compromise the purpose of the reassessment (see Variations to scope of accreditation). Fees will be charged where additional resources and time are required to accommodate the request as part of a scheduled reassessment. NATA technical staff will provide further information.

Surveillance visits are conducted by a NATA lead assessor and involves review of the management system in full (including a document review) and selected technical elements against the accreditation requirements detailed in the NAR. Extensions to the scope of accreditation will normally not be considered as such visits do not include technical assessors.

Facilities must respond to reassessment and surveillance visit findings by the nominated response date, otherwise the status of their accreditation will be reviewed.

The annual membership fees payable by accredited facilities generally cover the costs of reassessments and surveillance visits.

Requests for variations to the scope of accreditation outside routine reassessments may also be considered (see Variations to scope of accreditation).

Unscheduled visits may be conducted to investigate a complaint or following the receipt of information that casts doubt over the facility's continuing compliance with the accreditation requirements. At such visits, specific activities may be targeted for review rather than the entire facility operation.

### **Variations to scope of accreditation**

Accredited facilities may request variations to their scope of accreditation or signatory approvals at any time once accredited. NATA technical staff will provide direction on the information required, the process that will be followed and the charges that will be levied.

Extensions to the scope of a facility's accreditation or signatory approvals may be accommodated at the same time as a scheduled routine reassessment but only where review of the additional activity(ies) will not compromise the purpose of the reassessment (which is to review the existing scope of accreditation to determine ongoing compliance with the accreditation requirements). Adequate notice by the facility must also be provided in order for the variation to be considered. Variations to the scope of accreditation must be supported by relevant documentation in advance of the assessment (e.g. proposed scope, calibration or test procedures, sample worksheet, report and uncertainty calculations). Fees will be charged for extensions to the scope of accreditation conducted during a routine reassessment where additional effort is necessary (e.g. additional time and/or technical assessors are required).

### **Approved signatories**

NATA grants formal approval to facility staff to authorise test reports or calibration certificates for work covered by the scope of accreditation. Such personnel are known as 'approved signatories' and their capability to undertake this role is determined primarily at assessment.

Approved signatories assume responsibility for the technical validity and accuracy of all information contained in test reports and/or calibration certificates.

A facility must have approved signatories to cover the complete range of its scope of accreditation. The accreditation will be suspended for any parts of the scope for which approved signatories are no longer available.

Individuals may be approved as signatories for all or part of the facility's scope of accreditation. Signatory approval is not a personal qualification and is not transferable from one facility to another without approval having been granted at each facility.

Signatory approval is available to consultants to the facility provided that they have the knowledge necessary to allow them to be approved as signatories and have authority over the testing and/or calibration activities.

It is expected that all signatories (and other reporting officers formally designated/approved as such by NATA) will be present at every reassessment and surveillance visit for review of that approval. In cases where only a partial reassessment of the facility is conducted, individuals need only be present for the assessment of those areas of the facility relevant to their signatory approval. Authorised representatives shall therefore ensure the availability of all such individuals when assessment arrangements are being discussed with NATA.

It is however, recognised that there will be occasions when signatories will not be able to be present at a given assessment due to unforeseen circumstances. Signatories not present at an assessment are noted as such in the 'Approved Signatories' section of the assessment report. Any signatory not present at a scheduled reassessment must be present at the next routine visit to the facility (which covers the area(s) relevant to the approval). Signatories not present for two consecutive scheduled visits will have their signatory approval withdrawn.

Signatory approval can be reinstated following a signatory interview for which the facility will be charged or at the next scheduled reassessment (see Section 2, Variations to scope of accreditation).

The specific requirements for approved signatories are covered in Section 3.

### **Delegation of signatory approval**

Facilities may select to delegate the approval of their 'NATA approved signatory(ies)' to staff who they deem as appropriate to authorise results for test reports or calibration certificates for work covered by the scope of accreditation.

Where regulatory requirements specify NATA approved signatories, the onus is on the facility to determine whether delegation of signatory approval is permitted under the requirements.

Where the facility's scope of accreditation (either in full or part) is no longer covered by a NATA approved signatory(ies), the facility may operate with only delegated signatories for a period not exceeding six months. NATA must be informed in writing at least three months before the six month period expires, in order to arrange for a signatory interview(s). Where delegated signatories were not appointed prior to the leaving of the facility's NATA approved signatory(ies), then the same procedure regarding suspension as noted above shall apply.

Delegated signatories will normally be expected to be present at assessments and to take part as required by the assessment team.

If a facility's delegation approval process or a delegated signatory is found not to satisfy the requirements of accreditation, the facility will be required to review all reports issued since the time it was determined not to comply and, if necessary, withdraw and/or issue replacement reports.

The specific requirements for delegation of signatory approval are covered in Section 3.

### **Signatory interviews**

NATA undertakes specific signatory interviews of proposed new signatories or extensions to existing approvals as part of a reassessment or as a separate activity. Fees may be charged for interviews for new signatories or extensions conducted during a routine reassessment (see Variations to scope of accreditation) where additional effort is necessary (e.g. additional time and/or technical assessors are required). Fees will be charged where signatory interviews are conducted as a separate activity.

Adequate notice of requests for signatory interviews must be provided by the facility. For calibration facilities, measurement audits may be arranged as part of this process.

## Reports and use of the NATA endorsement

Accredited facilities are encouraged to apply the NATA endorsement to reports on those activities covered by their accreditation. In addition, the NATA endorsement may need to be applied due to customer request, legislation, regulation or contract requirements or in the case of calibration certificates being supplied to an accredited facility.

Additional details relating to the appropriate forms of endorsement and the reproduction of endorsed reports are provided in the relevant schedule of the NATA Rules.

The inclusion of certification body 'marks' (i.e. logos or emblems) on test reports and calibration certificates is a contravention of clause 8.4.2 of AS ISO/IEC 17021 Conformity assessment – Requirement for bodies providing audit and certification of management systems.

The endorsement may not be applied to reports on activities outside the facility's scope of accreditation. Such documents must not include the NATA emblem, reference to the accreditation or any other reference to NATA. Also refer to NATA's Rules and Policy Circular 18 for further details of the circumstances under which the endorsement must not be applied.

Where unendorsed reports are issued on work covered by the scope of accreditation, all aspects of the testing and/or calibration, including the reports, must meet the accreditation requirements outlined in this document.

## Proficiency testing

Each applicant or accredited facility is required to participate in appropriate proficiency testing or equivalent activities.

Participation in proficiency testing may be required, as follows:

- prior to gaining accreditation with NATA;
- when requesting significant extensions or variations to the scope of accreditation;
- when requesting additional signatory approvals;
- as identified by the Accreditation Advisory Committee.

Facilities' performance and response to proficiency testing results will be reviewed during on-site visits.

Facilities are encouraged to participate in as broad a range of proficiency testing activities as practicable and available, but ideally, at least once every two years for each major area of test or measurement (unless a different frequency is specified in Section 3 of this document). NATA's Proficiency Testing Policy, available from the NATA website, provides further detail.

## Non-compliance with accreditation requirements

In accordance with the NATA Rules, non-compliance with the accreditation requirements may lead to the accreditation status of a facility being suspended or cancelled.

In these circumstances the facility is not able to issue endorsed reports or claim to be accredited for those services affected by the change in status. The NATA Rules define the reasons, processes and the appeals mechanisms that will be followed.

## Provision of information on scope of accreditation and approved signatories

Details of a facility's scope of accreditation are posted on the NATA website once accreditation has been granted and are also made available to enquirers. The names of approved signatories will also be made available upon request.

## Complaints and feedback

NATA encourages and welcomes feedback from facilities. Such feedback, for example, may relate to the apparent inconsistent application of the requirements for accreditation, compliments regarding NATA staff, etc.

NATA maintains a complaints procedure for the investigation of concerns which may be raised against applicant or accredited facilities, or any aspects regarding the services or activities which NATA offers or the conduct of its staff.

All such feedback should be referred to the Field or Program Manager.

## **Confidentiality**

All information provided by a facility in connection with an enquiry or an application for accreditation, and all information obtained in connection with an assessment, is treated as confidential by NATA staff, technical assessors, Committee and Board members. All such personnel are made aware of this requirement and have signed confidentiality agreements.

## **Privacy**

NATA respects and upholds the rights of individuals to privacy protection under the National Privacy Principles contained in the Privacy Amendment (Private Sector) Act 2000. A copy of NATA's Privacy Policy can be obtained from the NATA website ([www.nata.com.au](http://www.nata.com.au)) or by contacting one of the NATA offices. This policy describes how NATA manages the personal information we hold.

The following is a summary of the personal information collected from individuals in applicant and accredited facilities and the disclosure of that information.

### **Authorised representative**

The personal information collected will include name; position; business address, business telephone, mobile phone and fax numbers; e-mail address. Credit card details may also be held for those purchasing NATA services.

This information may be used to:

- administer and manage your accreditation;
- seek feedback from you on ways to improve NATA's services;
- provide you information on NATA's activities and services.

The information may also be made available to enquirers requiring the services of NATA accredited facilities.

Personal information may be disclosed to organisations outside NATA. Such organisations may include:

- government and regulatory authorities and other organisations, as required or authorised by law and/or with which NATA has a Memorandum of Understanding or similar formal agreement;
- accreditation bodies with which NATA has a Mutual Recognition Agreement (MRA);
- professional advisers including accountants, auditors and lawyers;
- credit providers;
- outsourced service providers managing NATA services.

### **Facility contact**

The personal information collected will include name; position; business address, business telephone, mobile phone and fax numbers; e-mail address. This information may be given to enquirers and is included in the on-line Directory.

### **Facility personnel**

The personal information collected on personnel of the applicant or accredited facility may include name, position, professional, technical or other relevant qualifications, membership of professional associations, employment history.

This information is used for the conduct of the assessment, reporting on the assessment and the process of granting/continuing accreditation. It may be disclosed to NATA staff members, assessors, assessment observers and NATA committee members, all of whom have signed confidentiality agreements. It may also be disclosed to agencies to which NATA has a legal obligation or with which NATA has a formal agreement.

### **Disclosure of personal information by applicant and accredited facilities at assessments**

In order for NATA to determine compliance with some accreditation criteria, it will be necessary to sight personal information at assessments. Examples might include personal information held in training records, complaints records, lists of approved suppliers etc. It is the responsibility of the facility to ensure that, in accordance with The Commonwealth Privacy Act 1988 National Privacy Principle 1.3(d)], it has appropriate arrangements in place to advise individuals that personal information collected may be disclosed to NATA.

## Section 3

### Supplementary requirements for accreditation

This section provides interpretation of the application of ISO/IEC 17025 for Chemical Testing, together with the supplementary requirements applicant and accredited facilities must comply with.

The clause numbers in this section follow those of ISO/IEC 17025 but since not all clauses require interpretation the numbering may not be consecutive.

#### 4 Management requirements

##### 4.1 Organisation

**4.1.4** For facility staff who may also have production or marketing-related responsibilities, clear policies must be available to define how impartiality is assured for their testing responsibilities.

##### 4.2 Management system

**4.2.1** Quality documentation must include or reference approved signatories, scope of accreditation and the policy on the use of the NATA endorsement.

##### 4.5 Subcontracting of tests and calibrations

This clause applies in those cases where a facility is required to subcontract part of its normal service (e.g. due to temporary incapacity, excess workload) or where a facility subcontracts due to the need for further expertise and the results of the subcontracted service(s) are incorporated into the facility's test reports (refer also 5.10.6).

**4.5.1** A competent subcontractor is for example, an appropriately accredited NATA facility or a facility accredited by a signatory to a Mutual Recognition Arrangement. Where reports are obtained from an accredited facility, these must be endorsed.

**4.5.4** The accreditation status of subcontractors should be regularly reviewed to ensure currency.

**Note:** Information on the accreditation status and scope of accreditation may be found at NATA's website or by contacting one of NATA's offices.

##### 4.6 Purchasing services and supplies

**4.6.2** Consumable materials must be appropriately stored. Shelf lives of perishable materials must be set, documented and applied.

The following details of standard solutions must be recorded and retained along with other analytical data:

- all raw data relating to preparation (weights, volumes, etc);
- results of standardisation, if applicable (including standard curves);
- date of preparation and preferably an expiry date;
- the identity of the preparer.

Each batch of purchased standard solution must be similarly verified before use (and records retained). Each container must be labelled with the date of opening.

##### 4.12 Preventive action

Preventive action is a proactive process to identify improvement opportunities, rather than a reaction to the identification of problems or complaints.

Consideration should also be given to providing staff with a formal mechanism for contributing suggestions for improvement.

##### 4.13 Control of records

All records must include the identity of the person making the record.

It is recognised that a number of staff may be involved in test processes or other laboratory procedures. It is the facility's responsibility to identify the critical steps(s) in the procedure and ensure that the identities of the staff concerned are recorded.

#### 4.13.1.2

Unless otherwise prescribed by legislation or contractual obligation, retention times will not be less than three years or, in the case of equipment records, the maximum recalibration interval of equipment (whichever is the longer period).

### 4.13.2 Technical records

#### 4.13.2.1

- a) The records system must include a copy of each report or certificate that contains work covered by the scope of accreditation, or must allow one to be reproduced, including details such as the endorsement (if applicable) and identification of the person who authorised the report.
- b) In general, the records system must include the following:
  - i) the sample identification;
  - ii) the test or calibration document identification;
  - iii) date of test or calibration;
  - iv) the identity of the test or calibration method;
  - v) the identity of the test or calibration equipment;
  - vi) original test or calibration observations and calculations;
  - vii) the identity of the person performing the test or calibration;
  - viii) an indication that calculations and manual data transfers have been checked;
  - ix) any other information specified in the test or calibration method, other contractual documents or relevant statutory regulations.
- c) As far as practicable, all records must be indelible and data or observations recorded in such a manner that prevents amendment or loss of the original.

4.13.2.3 Alterations to data must also include the date the change was made.

### 4.14 Internal audits

The internal audit schedule must cover, ideally within a twelve-month period, both the management and technical requirements of ISO/IEC 17025.

**Note:** Refer to NATA Technical Note 27 for additional information.

### 4.15 Management reviews

The effectiveness of the management system shall be reviewed by management at least once per year.

**Note:** Refer to NATA Technical Note 27 for additional information.

## 5 Technical requirements

### 5.2 Personnel

Facilities carrying out a range of complex tests are normally expected to be under the control of an officer who is qualified to gain 'Member' category of an appropriate professional body such as the Royal Australian Chemical Institute.

Any testing conducted away from the base facility (such as in field laboratories, in a mobile testing facility or in the field) must also be under adequate technical control. This would normally require either the location of an approved signatory at each facility or having an approved signatory visit each facility at least once each week, and the maintenance of a diary recording the dates and relevant activities of each visit. An approved signatory must be involved in the setting up of a field or site laboratory.

## Approved signatories

Approved signatories must have and demonstrate a sound knowledge of:

- the principles of the calibrations, measurements and/or tests they perform or supervise;
- the standards or specifications for which accreditation is sought or held;
- the facility's management system;
- ISO/IEC 17025, NATA Rules, this document and pertinent NATA Policy and Technical Circulars;
- measurement ranges and the estimation of the uncertainties of measurement associated with the test or calibration results for which the facility is accredited or seeking accreditation.

Approved signatories shall hold a position within the organisation which provides authority over the calibration and/or testing activities and, where necessary, results to be rejected when they consider them to be inadequate.

Consultants who are nominated for signatory approval shall have the knowledge necessary to allow them to have authority over the testing and/or calibration activities. Consultants must also hold a written contract or agreement with the facility in which their role and authority is clearly defined and that they agree to hold confidential information relating to customers of the facility. The agreement should further indicate that the facility is responsible for work performed by the consultant including acceptance of the indemnity responsibilities detailed in NATA Rules.

## Delegation of signatory approval

Facility management may appoint and approve other staff as signatories for all or part of their facilities' scope of accreditation, i.e. signatory approval may be delegated from the NATA 'approved signatory(ies)'. However, delegation of signatory approval is not mandatory. Facilities may continue with the current system of NATA approved signatories.

In facilities that test for asbestos, a delegated signatory must be a NATA approved counter and/or identifier. Approved counter or identifier status cannot be delegated.

Delegated signatories have the same roles and responsibilities as signatories approved by NATA. Accordingly, the criteria for NATA approved signatories also will apply to delegated signatories.

Delegation of signatory approval may be for all or part of the facility's scope of accreditation. Those staff that have not been recommended by NATA for signatory approval may not subsequently be granted delegated approval by the facility without first demonstrating that the concerns raised in the NATA assessment report have been satisfactorily addressed.

Consultants may be appointed as delegated signatories, provided they satisfy the same criteria as the signatories approved by NATA (see above).

## Procedure for appointing delegated signatories

Facility management is responsible for the delegation process in accordance with a documented policy and procedure. These must cover the following points as a minimum:

- A definition of the role and responsibilities of a delegated signatory;
- The role and responsibilities of the facility's management and the NATA approved signatory in the delegation process;
- The delegation process must include technical evaluation of the proposed delegate signatory by the NATA approved signatory(ies);
- Approved signatories may only evaluate delegation of activities that they themselves have NATA signatory approval for.

## Corporate accreditations

Delegated signatories appointed by facilities with corporate accreditation may fulfill their signatory role across different sites, providing they are familiar with each site's operations, conduct regular site visits and have access to relevant records e.g. training, calibration, quality control.

The frequency of visits to corporate sites must be commensurate with the complexity of tests and/or calibrations covered but must be at least once every three months.

Delegated signatories operating at multiple sites must maintain records of visits.

## Records

A list of delegated signatories must be maintained and kept current by the facility and include the range of tests and/or calibration for which delegation has been approved.

Records of delegate signatories must include as a minimum:

- The date that signatory approval was delegated and by whom it was approved;
- Evaluation of the principles of the test, measurements and/or calibrations by the NATA approved signatory(ies);
- The list of test and/or calibration methods for which approval has been delegated;
- Changes to delegation of approval.

## 5.3 Accommodation and environmental conditions

**5.3.1** A facility undertaking analyses at trace concentrations may need to take special precautions to prevent sample contamination. It may also be necessary to monitor the testing environment to demonstrate that contamination does not occur. Where dedicated clean rooms are required, they must also be monitored for contamination.

When testing in the field, testing sites must be chosen to minimise the effects of environmental conditions and contamination. All relevant environmental conditions must be recorded and the records retained with other test data.

## 5.4 Test and calibration methods and method validation

### 5.4.1 General

A facility seeking accreditation for a more open scope of accreditation (where groups of analytes, for example, 'organochlorine pesticides' are specified rather than individual analytes) must have fully documented procedures covering such elements as: method selection, method development, method validation or verification, acquisition of appropriate reference standards or reference materials and staff training. Records of the application of these procedures will be reviewed as part of each assessment.

Facilities accredited for testing to standard test methods must maintain records of all interpretive decisions which they may make as a response to ambiguities in the test methods or specifications contained in standards.

**Note:** Facilities must make all reasonable efforts to ensure that interpretations made are consistent with those of other facilities and regulatory authorities. The appropriate Standards Australia committee should be advised of any interpretive issues. Other facilities accredited for the same test should also be consulted. Attendance at relevant fora where such interpretations are discussed is strongly encouraged.

In some circumstances NATA may impose additional requirements on standard test methods. This action is only taken where testing in accordance with the stated requirements of a standard is likely to cause an inappropriate interpretation of the results appearing in a test report and thereby bring NATA into disrepute. Such a requirement would only remain in place until the standard was appropriately amended.

Where a standard does not adequately define the testing methods or contains ambiguities which would make it impossible to consistently apply the requirements, NATA may refuse accreditation.

### 5.4.2 Selection of test methods

As well as test methods published by Standards Australia, common sources of methods include the American Society for Testing and Materials (ASTM), the American Public Health Association (APHA) and the USEPA (including USEPA Conditional Test Methods (CTM)). Published test methods must be verified by the facility to demonstrate it can achieve the expected results. Records of the verification must be retained. Refer to NATA Technical Note 17 for guidance on method verification. For published test methods that do not include precision data, the facility must determine its own precision data based on test data. All methods must include criteria for rejecting suspect results.

Facilities performing analyses according to standard test methods such as those mentioned above, must strictly follow the test procedures described in the methods. Only those deviations approved within the method are allowed. The facility must comply with all quality assurance and within-batch quality control measures stipulated in the method.

Facilities intending to apply a method based on a standard method should discuss the modifications to the standard method with customers, and obtain their agreement to the modifications, prior to testing. Modifications to standard methods must be validated.

There must be documented criteria for method selection. Where relevant, the degree of correlation between the methods must be established and documented.

Annex 3.4 provides detail of specific requirements relating to the determination of trace concentrations of dioxins, furans and dioxin-like PCBs.

### 5.4.3 Laboratory-developed methods

Methods must be documented, and details of validation studies recorded in a manner to ensure consistent application of the method within its scope and defined performance parameters. Document control must be exercised to restrict unofficial copying and to ensure that only the current versions of authorised methods are used for analysis.

AS 2929: Test methods – Guide to the format, style and content provides guidance on the documentation of test methods. ISO 78-2-Chemistry-Layouts for standards-Part 2: Methods of chemical analysis also provides useful guidance. AS 2706 –Numerical values-rounding and interpretation of limiting values provides guidance on the presentation of numerical values.

Documentation of laboratory-developed methods must include criteria for rejection of suspect results.

NATA will consider requests for accreditation for a test kit method provided that the facility has records of its own verification and/or validation of the method for all applicable matrices.

Accreditation for draft standards is not available. Facilities may however be accredited for such methods if they are documented and validated as in-house developed methods.

### 5.4.5 Validation of methods

**5.4.5.2** Methods may be validated by comparison with other established methods using reference materials, preferably certified reference materials. In developing and validating test methods, the following parameters require consideration:

- a) selectivity;
- b) linearity of response;
- c) sensitivity;
- d) accuracy (trueness and precision);
- e) limit of detection and limit of quantitation;
- f) range;
- g) ruggedness;
- h) measurement uncertainty of results;
- i) traceability of results.

The facility must have documented procedures for method validation. The procedures need to include details of the statistical analysis to be applied when deriving precision data. Records of the application of these procedures must be retained and will be reviewed at each assessment.

**Note:** Reference to NATA Technical Note 17 is recommended in formulating procedures for validation.

### 5.4.6 Estimation of uncertainty of measurement

NATA will not grant extensions to a facility's scope of accreditation until the facility has estimated the measurement uncertainty (MU) of the test results to be reported under the proposed extension to their scope.

In estimating MU, a facility needs only to account for those factors under its direct control. For example, if a facility is not responsible for the original sampling, then it does not have to estimate the uncertainty associated with this process.

NATA Technical Note 33 Guidelines for estimating and reporting measurement uncertainty of chemical test results provides information and references regarding the estimation of MU.

Laboratories are also referred to the Eurachem/CITAC Guide - Quantifying Uncertainty in Analytical Measurement. This is available on the internet at [www.eurachem.ul.pt](http://www.eurachem.ul.pt) or [www.measurementuncertainty.org](http://www.measurementuncertainty.org). NATA Technical Note 17, and references therein, provide further guidance. Further information is available at the NATA website.

**5.4.6.2** Estimation of uncertainty of measurement only applies, at present, to quantitative tests. This includes those tests where a numerical value is reported as a qualitative result e.g. detected or not detected. As indicated in 5.4.6, in estimating the measurement uncertainty, the facility needs to consider those components under its control. It should however be clear what components have been included in the uncertainty estimation.

Where results of tests are not numerically derived i.e. qualitative, estimates of uncertainty are not required. This should not however preclude the facility from developing an understanding of the components that contribute significantly to the variability of results of such tests.

## **5.6 Measurement traceability**

Requirements relating to equipment calibration and checks are detailed in Section 4.

Appendix J covers major analytical instrumentation that is calibrated primarily in-house by use of reference materials of known composition.

The results of all tests, measurements and calibrations that have a significant effect on the reported result and associated uncertainty of measurement must be traceable, where possible, to national or international standards. Facilities must, therefore, ensure that equipment or instruments are calibrated by one (or more, if relevant) of the organisations below:

- a NATA accredited calibration facility and the results reported on a NATA endorsed document;;
- a calibration facility accredited by one of NATA's mutual recognition arrangement (MRA) partners, when the MRA recognition covers calibration and the results reported on an endorsed document;
- Australia's National Measurement Institute (NMI) or a national metrology institute that is a signatory to the Comité International des Poids et Mesures (CIPM) MRA<sup>1</sup>.

**Note:** 1. The calibration and/or measurement must actually be done by the NMI. Unendorsed reports from organisations claiming traceability to a NMI or those bearing only an ISO 9000 series certification logo are not acceptable.

For details of NATA's current MRA partners, refer to the NATA website.

### **Note: National Measurement Act**

Where measurement traceability in accordance with Section 10 of the National Measurement Act 1960 is required, facilities performing such measurements must have Regulation 13 Certificates for their reference standards. Regulation 13 Certificates are issued by calibration facilities appointed as Verifying Authorities under the National Measurement Regulations. Further information can be obtained from the National Measurement Institute (NMI).

The National Measurement regulations contain schedules listing the maximum permissible variations and maximum permissible uncertainties that are required for various reference standards and measuring instruments.

## **5.6.2 Specific requirements**

### **5.6.2.2 Testing**

Reference standards and equipment shall be calibrated over the range and to the appropriate level of accuracy specified in relevant test methods.

A facility performing its own calibrations may also be subject to proficiency testing and technical assessment for these activities to ensure that all the relevant requirements of ISO/IEC 17025 are met (e.g. adequately documented procedures, procedures to estimate the uncertainty of measurement and complete records of calibration data). See NATA Policy Circular 12 and Technical Note 28.

### 5.6.3 Reference standards and reference materials

#### 5.6.3.2 Reference materials

Facilities must demonstrate suitable traceability of assigned values of reference materials, where possible, through:

- a) a NATA accredited reference material provider and the results reported on a NATA endorsed document;
- b) a reference material provider accredited by one of NATA's mutual recognition arrangement (MRA) partners, when the MRA recognition covers reference material providers and the results are reported on an endorsed document;
- c) Australia's National Measurement Institute (NMI) or a national metrology institute that is a signatory to the Comité International des Poids et Mesures (CIPM) MRA<sup>1</sup>.

or where there are no readily available reference material providers as described in 2a) to c):

- d) a competent supplier who can demonstrate traceability of its reference material(s) using specified methods and/or consensus standards that are clearly described and agreed by all parties concerned.

**Note:** 1. The calibration and/or measurement must actually be done by the NMI. Unendorsed reports from organisations claiming traceability to a NMI or those bearing only an ISO 9000 series certification logo are not acceptable.

For details of NATA's current MRA partners, refer to the NATA website.

### 5.7 Sampling

Sampling may be conducted by the facility, by another section in the organisation or by a separate organisation. Routine sampling falls within the scope of ISO/IEC 17025, so that where ISO/IEC 17025 uses the word 'laboratory' it is also referring to bodies conducting sampling. The phrase 'testing and/or calibration' includes sampling activities. Bodies responsible for sampling are encouraged to seek accreditation with NATA for this activity. In organisations where responsibility for sampling lies outside the currently accredited facility, NATA's corporate accreditation provisions may be used to accommodate the broader range of accredited activities. Facilities that only perform sampling may hold accreditation for this activity and issue endorsed sampling reports. Depending upon the structure of the organisation, the assessment of sampling activities may be included as an element of the facility's assessment, or may demand a different assessment team. In conducting an assessment of an organisation's sampling activities, all the management and technical requirements of ISO/IEC 17025, as relevant to sampling, will be assessed.

In some cases appropriate sampling activities demand the development of job-specific sampling plans and/or the use of professional judgement. Sampling may also be performed as part of a wider inspection activity. Accreditation for these activities is possible under NATA's Inspection Accreditation Program. Interested bodies are invited to contact NATA to discuss accreditation of these sampling activities.

Where a sampling body samples materials that are to be tested by another facility, the sampling body should issue an endorsed report carrying the information of ISO/IEC 17025 5.10.3.2. (For testing facilities to include sampling data in endorsed test reports, the sampling report must be endorsed.)

Facilities responsible for sampling are encouraged to gain accreditation for sampling. The following conditions must be met to gain accreditation for sampling.

- a) Documented sampling procedures must be maintained. These may be national or international standards. If in-house methods are used, their validity for the intended purpose must be demonstrated by appropriate data.
- b) The sampling procedure must be cited on the test report whenever the facility wishes to extend the test results from a sample to an entire batch.

When the facility has partial or no control over sampling the following issues must be addressed:

- a) Test documents must include details of the supplier of the sample and other relevant historical information such as condition on receipt, reported date of sampling. If a sample has a characteristic that casts doubt on its validity, but it is not possible to reject the sample, a clear statement of the perceived deficiencies must be made on the report.
- b) When non-facility staff such as customers, suppliers or factory personnel take samples, they should be provided with written sampling instructions. It may be necessary for the facility to supply

appropriate clean and labelled sampling containers and/or training in sampling techniques. Sample containers provided need to be checked to ensure they are not a source of sample contamination.

- c) If the test method specifies the use of a particular sampling method, and the facility has no evidence as to whether the sampler followed this method, this fact must be acknowledged on reports.

## 5.8 Handling of test and calibration items

**5.8.1** Sample containers must be leak-proof and impervious to contamination during transport. Any temperature or other environmental tolerances specified in the method must be satisfied during transport and storage. It may be necessary to test containers before use to ensure freedom from contamination.

**5.8.2** Identification labels must be secure and legible. Labelling on caps or lids alone is not acceptable because of the risk of wrongly replacing lids during testing like batches.

## 5.9 Assuring the quality of test and calibration results

See also Section 2 of this document for additional information relating to proficiency testing.

NATA Technical Circular 6 details Chemical Testing's proficiency testing policy.

Programs offered by industry or professional groups may be suitable. If there are no commercial proficiency testing programs available laboratories may be able to organise their own inter-laboratory or intra-laboratory proficiency programs. Inter-laboratory programs should ideally be conducted using a standard procedure such as *AS 2850 Chemical analysis - Interlaboratory test programs - For determining precision of analytical method(s) - Guide to the planning and conduct*.

The program for monitoring the reliability of test results must include criteria for rejecting suspect results. Factors that influence the design of the program include the availability of reference materials, the nature and range of the tests, and the number of testing staff.

The on-going competence of facility staff to perform infrequent tests which are covered by the facility's scope of accreditation must be demonstrated and records must be maintained. A documented procedure must be available describing how the facility assures the results generated by infrequently performed tests. If, for example, suitable reference materials are analysed with each infrequent batch of samples for this purpose, acceptance criteria must be established for the results of such tests and the criteria must be met prior to reporting results for samples.

## 5.10 Reporting the results

### 5.10.2 Test reports and calibration certificates

Reports must include the name in which accreditation is held, the relevant accreditation number of the facility and the date of issue.

In instances where results of tests or calibrations not covered by the scope of accreditation are included on reports, the notation 'NATA accreditation does not cover the performance of this service' shall be applied.

Preliminary reports (however named) may be issued when components of a test or suite of tests have not yet been completed. However, those results which are reported must be checked and authorised and the status of the report evident i.e. preliminary.

Where an accredited facility issues a preliminary report prior to the final report, the final report shall contain a reference to the preliminary report.

No report, whether preliminary or final, shall include results not authorised for release.

**5.10.2 (j)** Reports issued on activities covered by the scope of accreditation must be signed by an approved signatory or a person to whom signatory approval has been delegated (refer to 5.2.1).

#### Note: Verifying Authorities

NATA accredited facilities that have been appointed as Verifying Authorities by the National Measurement Institute (NMI) must comply with reporting, calibration and test method requirements of NMI where relevant and hold Regulation 13 certificates for their reference equipment. Such facilities should contact NMI to ensure that they are aware of current requirements for Verifying Authorities.

### 5.10.3 Test reports

#### 5.10.3.1 Reporting totals

When required to report a 'total' result, for example 'total polynuclear aromatic hydrocarbons', 'total microcystins' or 'total phenols', a facility must ensure that:

- a scientifically valid method is used to calculate the total result;
- the 'total' is clearly defined in the test method;
- the way the total is calculated, in particular the value attributed to compounds included in the total that are measured at less than their limit of quantitation, is clearly described in the test method;
- the test report clearly defines 'total' in the context of the reported result. This information may be provided by reference to a Standard method;
- the customer fully understands all aspects of the test result.

#### 5.10.3.1(b) Statements of compliance

Compliance statements shall reference those sections or clauses of the specification to which the compliance statement relates.

When statements of compliance are made, the uncertainty of measurement shall be taken into account.

A compliance statement may be made if:

- a) the measurement results fall within the specification limits by an amount at least equivalent to the uncertainty of measurement; or
- b) the measurement results fall within the specification limits and the uncertainty of measurement is within the maximum permissible uncertainty prescribed in the specification; or
- c) the test specification defines the compliance decision rule to be used and the measurement results meet the specified criteria; or
- d) the customer and facility have agreed to a compliance decision rule. When this applies, it should be detailed in the report and reference to the compliance statement made.

The facility shall state the measurement results and uncertainties of measurement.

Testing facilities may not make compliance statements in the situations described by d) above, if the testing is for the purposes of regulatory compliance.

**5.10.3.1(e)** When reporting the results for organic analytes, for which no reference material is available and the result is reported on the basis of a GC-MS database match, the following apply:

- e) for identity, the report must cite the database used, the library ranking (in-house, commercial (specify)), and the percentage match. The match must be done on the basis of full scan mode only.
- a) Quantitation must not be reported on the basis of a database match.

Approved signatories for such work must demonstrate extensive experience and knowledge in the interpretation of mass spectral data.

### 5.10.5 Opinions and interpretations

Test documents must not include interpretations and expressions of opinion, except statements of compliance as described under 5.10.3.1. Submissions addressing all the requirements included in the Standard can however be forwarded to NATA for review and consideration. Written approval can be granted in specific circumstances.

### 5.10.6 Testing and calibration results obtained from sub-contractors

An endorsed test document may include the results of sub-contracted work from an accredited facility, provided that it is not the sole result(s) included on the endorsed report and includes the following information from the original document:

- a) identification of the accredited facility by the name in which accreditation is held and the accreditation number;
- b) report/document identification;
- c) results and any other relevant information as issued by the sub-contracted facility.

#### **5.10.7 Electronic transmission and remote issue of results**

Test reports may be electronically issued (including from a site other than the accredited facility) provided that the reports have been appropriately authorised for release. The adequacy of such arrangements will be reviewed at assessment.

The facility must be able to demonstrate appropriate controls over the electronic generation, access, storage and back-up of results and reports and program controls such as password protection. If the report is to be accessed from a web site by the customer there must be an appropriate control in place to ensure the report can only be accessed and downloaded in a protected format.

Any information normally included in a hardcopy report must be included on the electronically transmitted version and appear in any hardcopy printed by the recipient. Flexible pagination to accommodate formatting changes when printed by the recipient, may also be required.

It must be ensured that any handwritten comments included on issued reports are also included in the copy of the reports retained by the facility.

## **Annex 3.1**

### **Asbestos identification in bulk samples**

#### **4.13 Control of records**

##### **4.13.2 Technical records**

###### **4.13.2.1 General**

Records must include all raw data and observations, so that the conclusions as to the identification can be checked.

#### **5.2 Personnel**

##### **5.2.5 Approved identifiers**

Each accredited facility must have at least one approved identifier. Each nominated identifier will be assessed initially and must participate in, and receive a satisfactory score in one round of the identifier proficiency testing program. A score of <5 must be achieved for an identifier to be approved. If the first round is not passed satisfactorily then the nominated identifier must pass a second round along with a satisfactory on-site assessment. The continued competence of each approved identifier will be assessed at each reassessment and via proficiency testing programs as described below.

In general, the status of an approved identifier is restricted to one accredited facility. Identifier approval is usually not directly transferable from one facility to another.

Asbestos identification work performed under the scope of NATA accreditation must be done by an approved identifier. The name of the approved identifier must be included on test reports.

##### **Approved signatories**

An approved identifier is not by default an approved signatory. An approved signatory must be an approved identifier. Only under specific circumstances will consideration be given to continuing signatory approval once a person ceases to be an approved identifier, such as the person holding a more senior position within the facility and having extensive experience in that area of testing (eg. an assessor). In such a circumstance, the approved signatory must continue to participate in the facility's internal quality control program for asbestos identification.

When staff have been on leave for 3 months or more, the following requirements for the reinstatement of signatory approval apply:

###### **1. Absence 3 to 6 months**

Participation and satisfactory performance in internal quality assurance program, with submission of QA results to NATA for review.

**2. Absence 6 to 12 months**

Participation in internal quality assurance program, plus satisfactory performance in one round of a proficiency testing program.

**3. Absence greater than 12 months**

Participation in internal quality assurance program, satisfactory performance in one round of a proficiency testing program, and satisfactory performance during a counter/identifier interview.

**5.3 Accommodation and environmental conditions**

**5.3.1 Field sites**

To qualify as a field site an operation must satisfy the following four criteria.

- a) It must be established to service one specific project, not several non-specific ones.
- b) It must have a life of no more than 12 months.
- c) It must be on the site of (or in very close proximity to) the project it is servicing.
- d) It must be staffed by approved identifiers and signatories who work out of the base facility.

If the operation does not meet all of these criteria, a separate accreditation must be obtained.

Each facility must have documented procedures to be applied when setting up a field site.

An approved signatory must be on site to supervise the establishment of a field site. In addition, if an approved signatory is not working full-time at the field site then each site must be visited by an approved signatory at least once a week to supervise work adequately. This applies to all field sites. The approved signatory must keep a diary of these visits to each field site. The diary must record the date of the visit, the length of the visit and brief details of what was done (eg. rechecked samples, checked calibration records, etc). All diaries must be available for review during each assessment of the base facility.

NATA must be notified in writing of any field site that operates for longer than two months. NATA reserves the right to assess any long term field site, either as part of the assessment of the base facility or as a separate exercise. Approval is only given for the duration of a specific project, the details of which need to be provided by the facility. If the life of the field laboratory is found to exceed the agreed-upon period, NATA must be notified of this situation prior to the expiry date.

In the situation of a facility wishing to continue the operation of the field laboratory after 12 months, the facility will have to apply for accreditation and pay the required fee.

**5.3.4 Access to field sites**

Special precautions may need to be taken at field sites to define and control access.

**5.4 Test and calibration methods and method validation**

**5.4.2 Selection of methods**

The test method used must be able to:

1. differentiate between asbestos fibres and the non-fibrous parent mineral;
2. be applied for the analysis of both homogenous and heterogeneous matter;
3. unequivocally identify chrysotile, amosite and crocidolite asbestos;
4. determine the levels of the above three types of asbestos fibres in accordance with the principles described in AS4964;
5. determine the presence of synthetic mineral fibres (SMF) and organic fibres;
6. contain the limits of detection, which have been established as part of method validation;
7. be validated in accordance with NATA technical Note #17 – Guidelines for the Validation and Verification of Chemical Test Methods.

If accreditation is sought for the identification of anthophyllite, actinolite and tremolite asbestos, a fully validated method including limits of detection must be available.

If a facility does not want to develop its own test method, a suitable method that conforms to the principles described above and, that uses polarised light microscopy with dispersion staining is given in AS 4964 – *Method for the qualitative identification of asbestos in bulk samples*. If AS 4964 is adopted by a facility, then it must have a supporting work instruction/procedure to ensure consistent application of the Standard. This supporting documentation is to include appropriate definitions of SMF and organic fibres.

The methodology of AS4964 is based on an implicit, mandatory requirement for non-asbestos and non-mineral fibres such as SMF and organic fibres, if present, to be analysed and identified. Without this, the method is invalid when these types of fibres are present and not able to be formally identified, as is the case for laboratories not accredited for this aspect of the analysis.

Therefore, it is a NATA requirement that all laboratories accredited for asbestos identification must analyse and report the presence of SMF and organic fibres when present. In order to gain accreditation, the method must include a definition of these materials and the criteria to be applied for identification of these fibres. Identifiers must also satisfactorily identify these fibres in an identification proficiency test. It should be noted that SMF and organic materials should only be described in generic terms. This means that the specific types of SMF and organic fibres such as glass fibres, ceramic fibres, wool fibres, cotton fibres and so on, are not to be analysed or reported.

An adequate definition of SMF is any fibre exhibiting isotropic optical characteristics. This group includes glass fibres, glass wool, rock wool, slag wool, ceramic fibres, and 'bio-soluble' fibres of all types now being produced by most SMF manufacturers.

Organic fibres can be defined as fibres which ash at approximately  $400\pm 30^{\circ}\text{C}$ . These include natural organic fibres such as cellulose, hemp, cotton, flax, jute and wool; man-made organic fibres such as polypropylene, polyester, nylon, kevlar and acrylics.

## **5.5 Equipment**

### **5.5.5 Field site equipment**

Records must be kept of the location of each microscope used outside the base facility, and the dates on which it was at each site.

All microscopes used in field sites must be available for inspection during assessments of the base facility.

## **5.7 Sampling**

### **5.7.1 Sample collection and preparation**

The design of sampling strategies is outside the scope of accreditation because each situation is unique, which does not allow for an objective assessment of this aspect of the work (See Section 3, clause 5.7).

When the facility is responsible for sample collection, the sample must be representative of the larger bulk material, including a full cross section. As complete a sample history as possible must be recorded.

In general, a facility should not sub-sample because of the high probability that small amounts of asbestos materials may be unintentionally omitted due to the sampling process.

If sub-sampling is conducted on an homogeneous sample, only validated methods are to be used; they must be contained in the facility's method, and be summarised on the test report. Sub-sampling must not be conducted on non-homogeneous samples unless an appropriate qualifying statement is included in the test report, warning customers of the possibility of invalid results.

## **5.9 Assuring the quality of test and calibration results**

An adequate quality control program must be in place and include the use of samples covering the three asbestos types. Each identifier must analyse at least two quality control samples per month.

Each nominated identifier is required to participate satisfactorily in an identification proficiency test prior to the initial on-site assessment, and once approved, to participate satisfactorily in an annual identification proficiency program (see Annex 3.2).

### Criteria for monitoring performance of asbestos identifiers participating in proficiency programs

NATA requires all facilities accredited for asbestos identification to participate in a formal proficiency testing program. Any program used must meet NATA's specification for asbestos identification.

If used by a facility, the asbestos identification program, which is conducted on a continuing basis, schedules each participant to a particular month in each round, during which ten samples are analysed. NATA approved identifiers and identifiers seeking approval are required to participate.

1. Each identifier receives 10 samples every 12 months (1 round per annum).
2. Each identifier receives a total score for each round made up of the sum of the scores for individual samples within a set.
3. The individual fibres in each of the samples has been categorised into the fibre categories, 'easy', 'medium' and 'difficult'. This includes chrysotile, amosite and crocidolite as well as synthetic mineral fibres (SMF) and organic fibres – whilst AS 4964 does not provide examples for reporting SMF and organic fibres, it is sufficient to report that SMF and/or organic fibres have been detected, where appropriate. The scoring system takes into account the difficulty level for the particular fibres within each sample, and scores heavily against false results, especially samples that contain easily identifiable fibres.

In general, scores are allocated as follows:-

Condition	Score (asbestos)	Score (SMF and organic fibres)
when an 'easy' category fibre is not found	2	1
when a 'medium' category fibre is not found	1.5	0.5
when a 'difficult' category fibre is not found	1	0.5

If a fibre type is found when it is not present (false positive), then the appropriate score in the above table is given for each incorrect fibre type found.

4. If the total score for the 10 samples is 5 or more, the identifier will be requested to undertake investigative action, and to report the findings to NATA. A further set of 10 'follow-up' samples will then need to be analysed before the next round of the program. If a score of 5 or more is obtained in a 'follow-up' round, approval will be suspended. If a score of <5 is obtained in a 'follow-up', performance is graded as 'questionable', and a count of <5 must be obtained in the subsequent round to maintain a 'satisfactory' grading (see also point 5 below).
5. If any identifier receives two scores of 5 or more during a cycle (ie. any two consecutive rounds), the performance category for the cycle will be classified as 'unsatisfactory' and his or her status as a 'NATA approved identifier' will be reviewed and approval may be suspended even if the score for any 'follow-up' samples has been <5.
6. If an identifier's performance is classified as unsatisfactory at the end of a cycle and approval has been subsequently suspended, the identifier normally has to achieve two scores of <5 (ie. on each of two additional sets of ten samples) before identifier status is reviewed to lift the suspension. These two additional sets of samples are referred to as 'special follow-up'.
7. The cause of the unsatisfactory performance must be investigated and appropriate corrective action, including re-training, must be conducted and recorded. Once this has been done, the results of the investigation must be forwarded to NATA and a first set of 'special follow-up' samples will need to be analysed. Should the results for those samples be satisfactory, a second set will be sent out within 2-4 weeks by the proficiency testing provider .

**Table 1: Criteria for monitoring performance of identifiers**

(Based on a continuing cycle ie. two consecutive rounds)

Round 1	Follow-Up	Round 2	Follow-Up	Satisfactory	Questionable	Unsatisfactory
If results are $\geq 5$	$< 5$	$< 5$	-	✓	-	-
		$\geq 5$	-	-	-	✓
	$\geq 5$	any score *	-	-	-	✓
If results are $< 5$	-	$< 5$	-	✓	-	-
		$\geq 5$	$< 5$	-	✓	-
		$\geq 5$	$\geq 5$	-	-	✓

\*The score ( $< 5$ ) will be examined in conjunction with the scores in the next round (Round 3) before the unsatisfactory category can be reviewed.

## 5.10 Reporting the results

### 5.10.1 General

Only factual observations can be reported. All terms used to describe fibres must be defined in the method.

Reports must specify the type(s) of asbestos detected, viz. amosite, chrysotile, crocidolite.

Reported details of sample history, including size and /or weight and position in relation to the area from which it was taken, when known, must be such as to provide sufficient information to ensure that results can be correctly interpreted.

Reference to the presence of non-asbestos or non-mineral fibres (eg. synthetic mineral fibres (SMF) and organic fibres (OF)) cannot be included on reports unless the facility is accredited for their identification. In order to gain accreditation, the method must include a definition of these materials and the criteria to be applied for identification of these fibres. Identifiers must also satisfactorily identify these fibres in an identification proficiency test.

If identification is not possible due to adhering resins or cements or because of degradation of the fibres, an explanatory note to that effect must be included on the report.

Quantitative estimates cannot be included on reports.

Facilities must have prepared the slides used to obtain the results included in reports.

Authorisation of reports, including preliminary reports, must include who is the 'Approved Identifier' and 'Approved Signatory'.

### 5.10.2 (e)

The method used must be included on test reports. Unless this is an accredited facility method (see 5.4.2 above), the method stated must be AS 4964 and any supplementary work instruction used to ensure consistent application of AS 4694.

## Annex 3.2

### Asbestos fibre counting

#### 4.13 Control of records

##### 4.13.2 Technical records

##### 4.13.2.1 General

Records must include the individual count for each field examined. When fields are blank it is acceptable to keep a mental tally of up to ten 'blank' fields before an entry is made on the count sheet (eg. by drawing a line through the ten fields).

## 5.2 Personnel

### 5.2.5 Approved counters

Each accredited facility must have at least one approved counter. Each nominated counter will be assessed initially and must participate in, and receive a satisfactory score in one round of a proficiency testing program. If the first round is not passed satisfactorily then the nominated counter must pass a second round along with a satisfactory on-site assessment.

The continued competence of each approved counter will be assessed at each reassessment and monitored by means of their participation in a proficiency testing program. Approved counters must maintain a satisfactory performance in the program according to the criteria described below.

In general, the recognition of an approved counter is restricted to one accredited facility. Counter approval is not directly transferable from one testing authority to another.

Asbestos fibre counting, performed under the scope of NATA accreditation, must be done by an approved counter. The name of the approved counter must be included on test reports.

#### Approved signatories

An approved counter is not by default an approved signatory. An approved signatory must be an approved counter. Only under special circumstances will consideration be given to continuing signatory approval once a person ceases to be an approved counter, such as the person holding a more senior position within the facility and having extensive experience in that area of testing (eg. an assessor).

In such a circumstance, the approved signatory must continue to participate in the facility's internal quality control program for asbestos fibre counting.

Poor performance in the proficiency testing program, leading to a review of an approved signatory's counter status, will also lead to a review of signatory approval.

When staff have been on extended leave, the following requirements for the reinstatement of signatory approval apply:

1. **Absence 3 to 6 months**  
Participation and satisfactory performance in internal quality assurance program, with submission of QA results to NATA for review.
2. **Absence 6 to 12 months**  
Participation in internal quality assurance program, plus satisfactory performance in one round of the proficiency testing program.
3. **Absence greater than 12 months**  
Participation in internal quality assurance program, satisfactory performance in one round of the proficiency testing program, and satisfactory performance during a counter/identifier interview.

#### Third parties conducting volume measurement

Third parties can conduct the sample collection for asbestos fibres in air, leading to the issue of a report including a concentration, as long as the following requirements are met by the accredited facility:

- A formal training (and retraining) program for each third party staff member is conducted, including practical and theoretical exams;
- The name of the third party (person and their company) is included on test reports;
- A note is included on test reports stating that trained third parties did the volume measurement and that the facility is responsible for the data;
- The accredited facility obtains written approval from NATA to have third parties undertake sample collection under the above conditions

## **5.3 Accommodation and environmental conditions**

### **5.3.1 Field sites**

To qualify as a field laboratory an operation must satisfy the following four criteria.

- a) It must be established to service one specific project, not several non-specific ones.
- b) It must have a life of no more than 12 months.
- c) It must be on the site of (or in very close proximity to) the project it is servicing.
- d) It must be staffed by approved counters and signatories who work out of the base facility.

If the operation does not meet all of these criteria, a separate accreditation must be obtained.

Each facility must have documented procedures to be applied when setting up a field laboratory.

An approved signatory must be on site to supervise the establishment of a field site. In addition, if an approved signatory is not working full-time at the field site then each site must be visited by an approved signatory at least once a week to supervise work adequately. This applies to all field sites. The approved signatory must keep a diary of these visits to each field site. The diary must record the date of the visit, the length of the visit and brief details of what was done (eg. recounted 'x' slides, checked calibration records, etc). All diaries must be available for review during each assessment of the base facility.

NATA must be notified in writing of any field laboratory that operates for longer than two months. NATA reserves the right to assess any long term field laboratory, either as part of the assessment of the base facility or as a separate exercise. Approval is only given for the duration of a specific project, the details of which need to be provided by the facility. If the life of the field laboratory is found to exceed the agreed-upon period, NATA must be notified of this situation prior to the expiry date.

A copy of the National Occupational Health and Safety Commission Guidance Note on the membrane filter method for estimating airborne asbestos and a copy of all associated facility documentation must be kept in each field laboratory.

### **5.3.4 Access to field sites**

Special precautions may need to be taken at field sites to define and control access.

## **5.4 Test and calibration methods and method validation**

### **5.4.2 Selection of methods**

The method to be used as the basis of the facility's procedures is that set out in the National Occupational Health and Safety Commission Guidance Note. At least one copy of this document must be held in the facility and in any field laboratory.

**5.4.6.2** Assistance in determining an estimation of measurement uncertainty is provided in the National Occupational Health and Safety Commission Guidance Note.

### **Supporting procedures**

The facility's procedures for microscope set-up and other associated test activities must be documented, and available in the facility and any field laboratory.

## **5.5 Equipment**

### **5.5.1 Sampling pumps**

Pumps must have a mechanism (eg. fault light or automatic facility to stop the pump) to indicate flow interruption during the sampling period. Calibration Appendices H and I in Section 4 set out the requirements and a calibration procedure for pumps.

### **5.5.5 Field site equipment**

Records must be kept of the location of each microscope used outside the base facility, and the dates on which it was at each site.

All microscopes used in field laboratories must be available for inspection during assessments of the base facility.

## 5.7 Sampling

### 5.7.1 Collection of samples

The design of sampling strategies is outside the scope of accreditation because each situation is unique, which does not allow for an objective assessment of this aspect of the work. (See Section 3, clause 5.7)

## 5.9 Assuring the quality of test and calibration results

Each counter proposed for recognition must perform satisfactorily in a proficiency testing program before being granted counter approval (ie. by passing one round). Each approved counter must continue to perform satisfactorily in the program. The criteria for monitoring performance in the proficiency testing program are provided below.

An adequate internal quality control program must also be in place and must cover all staff, including those involved in any field laboratories. The program must include as a minimum:

- a) monitoring the performance of each counter relative to the facility mean performance, with each counter counting at least two selected slides (either retained slides or slides obtained from external sources) each two months;
- b) slides must contain greater than approximately 10 fibres per 100 graticule fields (ie. be statistically countable);
- c) acceptance and rejection criteria for QC results must be developed and documented.

In addition, the facility must establish limits on the number of slides to be counted by a counter in a specified period. These limits will be influenced by the number of difficult slides being counted. (It is considered that 12 'average' slides per day is reasonable, but this limit can be in the range of 10 to 20 per day).

Field blanks, as described in section 8.2 of the National Occupational Health and Safety Commission Guidance Note, must be used. It is suggested that analytical blanks, as also described in section 8.2 of the National Occupational Health and Safety Commission Guidance Note, be used.

### Criteria for monitoring performance of counters participating in the asbestos proficiency testing program.

(Based on a counting cycle ie. two consecutive rounds)

SCORES				CATEGORY		
Round 1	Follow-Up	Round 2	Follow-Up	Satisfactory	Questionable	Unsatisfactory
≥4	0-2	0-2	-	✓	-	-
	-	≥ 3 #	-	-	-	✓
	≥ 3 #	any score *	-	-	-	✓
3	-	0-2	-	✓	-	-
	-	≥ 3 #	-	-	-	✓
0-2	-	0-2	-	✓	-	-
	-	3	-	-	✓	-
	-	≥ 4	0-2	-	✓	-
		-	≥ 3 #	-	-	✓

\* The score (0-2) will be examined in conjunction with the score obtained in the next round, Round 3, before the unsatisfactory category can be reviewed.

# Please see note 7

### Notes

1. Each counter receives a set of 6 slides every 12 months (1 round per annum).
2. Each counter receives a score out of 12 for each round made up of the sum of the scores for individual slides counted within a set.
3. The scores for individual slides are :
  - 2 if the count is extreme
  - 1 if the count is marginal
  - 0 otherwise (satisfactory count)

4. If the total score for the 6 slides is 4 or more, the counter will be sent a further set of 6 'follow-up' slides before the next round of the program.  
If a score of 3 or more is obtained in a 'follow-up' round, approval will be reviewed and may be suspended.
5. If a counter receives two scores of 3 or more during a cycle (ie. any two consecutive rounds), the performance category for the cycle will be classified as 'unsatisfactory' and the status as a 'NATA approved counter' will be reviewed. Approval may be suspended even if the score for any 'follow-up' slides has been 0-2.
6. If a counter's performance is classified as unsatisfactory at the end of a cycle and counter approval has been subsequently suspended, the counter normally has to achieve two scores of 0-2 (ie. On each of two additional sets of 6 slides) before the counter status is reviewed to lift the suspension.
7. The cause of the unsatisfactory performance must be investigated and appropriate corrective action, including retraining, must be done and recorded. Once this has been done, the results of the investigation must be forwarded to NATA and further slides will then be sent out for counting by the proficiency testing provider. Should the counts on those slides be satisfactory, a second set will be sent out within 2-4 weeks.

Unless there is a valid reason, the late return of results to the proficiency testing provider will be classed as an unsatisfactory performance for the round.

## **5.10 Reporting the results**

### **5.10.1 General**

Test documents must include the results reported as 'x' fibres per 'y' fields.

Only when the facility is accredited for volume measurement (sub-class of test 7.82.81), has been fully responsible for the collection of the sample, and has applied all volume measurement requirements to the sample collection, can results be reported as 'z' fibres per mL of air.

Laboratories must have prepared the slides used to obtain the results included in the report.

Authorisation of the report must include who is the 'Approved Counter and 'Approved Signatory'.

### **5.10.2e**

As most asbestos counting work is performed for regulatory purposes, test documents must include the NOHSC Membrane Filter Method (MFM) and any supplementary facility work instruction used to ensure consistent application of the MFM, unless the facility has valid reasons for not doing so.

## **Annex 3.3**

### **Positive identification of trace amounts of organic compounds**

The fact that a compound detected in a sample extract exhibits the same retention time as a reference compound on a single chromatographic system does not guarantee that the two compounds are identical. Further evidence is required to identify the compound detected in the sample beyond reasonable doubt and to ensure that analytical results are fit for purpose.

NATA's Chemical Testing Accreditation Advisory Committee maintains that all organic residues must be 'confirmed' before results are reported. 'Confirmation' applies to both the identity and concentration of residues.

The following requirements are mandatory for all accredited laboratories analysing samples for low concentrations of organic compounds including pesticide residues and other organic contaminants in food and environmental samples, and drugs and their metabolites in animal tissues and fluids.

## **5.4 Test and calibration methods and method validation**

### **5.4.5 Validation of methods**

'Confirmation' in this context applies to the determinative procedure applied to the final sample extract. If separate systems are used for qualitative confirmation, both the identity of the analyte and the amount present must be confirmed. Laboratories must define acceptance criteria for the agreement between the concentrations as determined by the original and confirmatory techniques and how the final quantitative result is calculated.

With the exception of the specific qualitative criteria described below for full scan mass spectrometry, laboratories must use a suitable reference standard for each analyte for qualitative and quantitative confirmation.

A minimum of 10% of positive samples must be confirmed for those samples that produce the same chromatographic profile and are from the same customer and the same source eg. the same clean-up site or the same chimney stack. When there are changes in the chromatographic profile, confirmation must be done to re-establish the identity(ies) of detected compounds. Samples from a different customer or from a different source must be considered separately with respect to confirmation requirements.

BTEX results must be suitably confirmed. GC-FID/PID is not always sufficient for this purpose.

Laboratories carrying out tests for residue trials, where the 'target' compound is known, must carry out initial confirmation for each trial and also confirm at least 5% of positives.

For residues in foodstuffs, confirmation must be done on all different sample types for results above the level of reporting (LOR). Due to the normal nature of this work (one-off sample types as opposed to numerous samples of the same type from the same source), this may well mean that 100% of positives needs to be confirmed.

The facility must establish the limits within which it can achieve positive identification of a compound. This must be demonstrated by analysis of reference materials or typical sample matrices spiked with reference compounds at concentrations at which they might reasonably be expected to occur in actual samples. The limit of detection for a residue analysis is the highest of the limits of detection determined for the initial and confirmatory test procedures.

The techniques used to confirm the identity of a compound must be able to differentiate the analyte from all other compounds likely to be present in the sample matrix. This can be achieved by using a variant of the original test procedure relying on a different means of separation or detection or a more specific response to the target compound. The means of confirmation can include but is not limited to:

- two columns - one detector (GC and/or LC)
- one column - two detectors (GC and/or LC)
- analysis by both LC and GC (if applicable to the analytes in question)
- mass spectrometry (MS); SIM or full scan (GC and/or LC)
- mass spectrometry-mass spectrometry (MSMS); (GC and/or LC)
- derivitisation and reanalysis
- characteristic chromatographic profile (limited cases only), eg. PCB arochlors
- diode array detection (LC)
- response or absorbance ratios at different wavelengths. (UV and IR spectroscopy)
- different separation mode eg. Ion exchange and reverse phase (LC)
- different mobile phase (LC)
- different methods

The selectivity of the above techniques varies considerably and in some cases a combination of two or more techniques will be required for positive identification. For instance, low resolution diode array detection alone may not be sufficient to distinguish between compounds with similar chromatographic behaviour and UV spectrums. Laboratories must be able to demonstrate, as part of the method validation, that the combination of procedures used for confirmation provides adequate sensitivity and selectivity for the analyses in question.

Positive results from Microbial Inhibition Tests must be confirmed by reanalysis of the sample by another validated method. In general, the same requirement applies to test kit methods, for example immunoassays, aimed at reporting either qualitative or quantitative results for individual compounds. However, for test kit assays shown to be highly specific, quantitatively accurate and afforded official status through collaborative studies conducted by authoritative bodies, for example, AOAC Official (performance tested) Methods, NATA will consider, on a case-by-case basis, accreditation without the requirement for confirmation. NATA will also consider accreditation of bio-assays designed to measure effects or responses, for example 'total toxic equivalence', rather than the concentration of identified individual compounds.

When MS is used as a confirmatory technique the following points apply:

- For SIM, the ions for each analyte covered by the method must be defined and identified in the method. Acceptance/rejection criteria for the use of the ions (eg. ion ratios) must be included in the method. Method validation must include why those ions are used; it is not acceptable to state in the method, for example, 'the three best ions will be used'.
- When quantitation is performed in full scan mode, the method must define which ion(s) are to be used to quantify the analytes covered by the method.

Only full scan MS can be used to identify a compound based on a database match, if an analytical reference material is not available. In such cases the report must include the identity of the database used to identify the compound (in-house, commercial), the database ranking and the percentage match. Quantitative results cannot be reported if an analytical standard is not available.

The practice of reporting tentatively identified compounds (ie. not confirmed due to the lack of an appropriate standard) as 'equivalents' quantified against another compound will not be covered by the scope of accreditation. The exceptions are situations such as VOCs in stack samples or TPHs in environmental samples where the method defines the 'equivalent' compound (eg. hexane) and there is no implication of the identification of individual compounds.

Results for the analysis of stacks emissions are subject to the same confirmation requirements as other trace organic analyses, except in the case where VOCs are reported as hexane equivalents.

While information from the customer about the compounds used in the process is useful background information, this does not relieve the facility from responsibility to confirm the identity of the analytes. Information provided by the customer is outside the facility's control and thus is outside the scope of accreditation.

## Annex 3.4

### Specific requirements relating to the determination of trace and ultra-trace concentrations of dioxins, furans and dioxin-like PCBs

Results for the determination of trace or ultra-trace concentrations of polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and 'dioxin-like' polychlorinated biphenyls (DL-PCBs) in animal and human tissues or fluids, food, feed, and environmental samples must be fit for purpose. For most purposes, the test method must provide data for all toxic 2,3,7,8-chlorinated PCDD (seven) and PCDF (ten) isomers plus the twelve polychlorinated biphenyls (PCBs), four non-ortho and eight mono-ortho substituted PCBs, designated by the World Health Organization (WHO) as having 'dioxin-like' properties. Results for environmental samples should be reported using the appropriate toxicity equivalency factors (TEFs) with the dioxin toxicity equivalence (TEQ<sub>DF</sub>) defined as both the lowerbound<sup>1</sup> and mediumbound<sup>2</sup> concentrations. An identical treatment of the data must be used when reporting the PCB toxicity equivalence (TEQ<sub>P</sub>) for the 'dioxin-like' PCBs. The combined toxic equivalence (TEQ<sub>DFP</sub>) is calculated as the sum of TEQ<sub>DF</sub> + TEQ<sub>P</sub>. For foods and feedstuffs, upper bound<sup>3</sup> concentrations must also be reported.

A generally accepted method for performing ultra-trace analyses for PCDDs/PCDFs and DL-PCBs on a congener specific basis is isotope dilution coupled with a high-resolution gas chromatograph/high-resolution mass spectrometer (HRGC/HRMS). For monitoring food, feed and human samples, the instrument should be capable of achieving a sensitivity of at least 10 fg (femtogram) for 2,3,7,8-TCDD (2,3,7,8-tetrachlorinated dibenzo-*p*-dioxin) with a signal to noise ratio of 10:1 at a minimum mass resolving power of 10,000 (10% valley).

Other methods, for example two-dimensional gas chromatography (GCxGC) coupled with a time-of-flight (TOF) mass spectrometer or GC with tandem mass spectrometry such as quadrupole-quadrupole, magnetic sector-quadrupole or quadrupole-time of flight geometries, may be validated alternatives to HRGC/HRMS for analysis of PCDDs/PCDFs and DL-PCBs at trace and/or ultra-trace levels providing they achieve the selectivity and sensitivity required by customers and satisfy all other requirements for accreditation.

Ideally, results for the analysis of food and feedstuffs should comply with the relevant requirements specified in the following European Commission directives and regulations, or other equivalent documents, taking special note of the maximum allowed contribution of non-detected congeners to upperbound results. EC Directives 1986/363/EC, 2001/201/EC, 2001/2375/EC, 2002/69/EC 2003/806/EC and regulation 2006/199/EC set limits for PCDDs/PCDFs and DL- PCBs in foods and feedstuffs. EC directive 2002/69/EC defines sampling methods and performance criteria for methods of analysis. EC regulation 2006/1833/EC describes methods suitable for screening/monitoring purposes and requirements for confirmation.

Guidance on the requirements for environmental analyses are provided in the US EPA performance-based methods 23, 0023A, TO-9A, 8290A, 1668B and 1613B.

Numerous rapid and relatively inexpensive bioanalytical approaches have been developed that are capable of detecting and estimating the relative potency of complex mixtures of halogenated aromatic hydrocarbons (HAHs) and can be used as rapid pre-screening assays to identify samples for subsequent analysis. These bioanalytical methods include immunoassays and bioassays. These assays are normally designed to estimate a TEQ value for PCDDs/PCDFs or a combination of PCDDs/PCDFs/DL-PCBs rather than results for individual congeners. Whilst these methods are capable of generating quantitative results with reasonable uncertainties, the ultimate confirmation of samples exceeding a regulatory level should still come from analytical techniques using a combination of chromatography and mass spectrometry. However, NATA will consider, on a case-by-case basis, accreditation of bio-assays designed to measure 'total toxic equivalence'; ( $TEQ_{DFP}$ ), rather than the concentration and toxic equivalence of identified individual PCDDs/PCDFs and DL-PCBs congeners.

NATA's policy regarding the requirements for these analyses will change in keeping with international developments.

**Note 1:** Lowerbound concentrations are calculated assuming that all values of the different congeners less than the limit of determination are equal to zero.

**Note 2:** Mediumbound concentrations are calculated assuming that all values of the different congeners less than the limit of determination are equal to the half the limit of determination.

**Note 3:** Upperbound concentrations are calculated assuming that all values of the different congeners less than the limit of determination are equal to the limit of determination

## Section 4

### Measurement traceability

All parameters that contribute to the overall quality of a test or calibration require measurement traceability. This includes measurements that have a significant effect on the accuracy or validity of the result being reported. Therefore equipment that is used to provide a measurement of these parameters must be calibrated.

A facility must demonstrate how it has determined which parameters are critical (and non critical) to the overall quality of test and calibration results. As an example, critical parameters may be analytical or quantitative data, or measurements which have a significant contribution to the final result and associated measurement uncertainty.

#### Definitions

'**Metrological Traceability**' is the property of a **measurement result** whereby the result can be related to a reference through a documented unbroken chain of **calibrations**, each contributing to the **measurement uncertainty** (ISO/IEC Guide 99 (2007) – 2.41).

Applying this definition, the measurement uncertainty must be determined for each link of the traceability chain back to a realised standard. The last step of the link must also be included e.g. equipment calibrated in-house through use of a reference item or reference material.

To demonstrate evidence of measurement traceability, each link of the traceability chain, including its measurement uncertainty, must be reviewed.

NATA's policy for measurement traceability is detailed in Policy Circular 11.

'**Calibration**' is an operation that, under specified conditions, in a first step, establishes a relation between the **quantity values** with **measurement uncertainties** provided by **measurement standards** and corresponding **indications** with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a **measurement result** from an indication (ISO/IEC Guide 99 (2007) – 2.39).

As detailed in Policy Circular 11 and under clause 5.6, Section 3 of this Application Document, calibrations are normally carried out by an external calibration authority and an endorsed test report is obtained for this work. For calibrations performed in-house, a facility must demonstrate the capability to do so according to the criteria set out in ISO/IEC 17025 sub-clause 5.6.2.1 and NATA Policy Circular 12.

**Note:** Some items of equipment such as sound level meters are designed to have a level **adjustment** before each use by applying a known source to the input of the instrument. Although sometimes called a 'calibration' or 'internal calibration' by the manufacturer, it is a single point level adjustment and is not to be confused with a full calibration which provides measurement traceability across the instruments full measurement range.

'**Check**' is a measurement of at least one point in a range of a measuring instrument or system or material against a known value to confirm that it has not deviated significantly from its original calibrated value. It is also an examination of the condition of an artefact i.e. the reference of known value, to determine that it has not been adversely affected by constant use.

Checks are usually carried out in-house by the facility staff. If, however, the checks are carried out by an external authority then an endorsed report must be obtained.

By performing a check on an instrument, a facility is able to determine if the instrument has changed since its last calibration. By performing regular checks, the interval between periodic calibrations may be extended.

In some applications, where an instrument is used for comparative results and it has been determined that measurement traceability is not required, a check of the instrument's measurement functionality may be deemed acceptable.

### **Calibration and checking intervals**

Facilities are responsible for establishing their own equipment assurance program. This is to ensure that all equipment used satisfies the need to produce consistent and reliable and where appropriate, traceable results. Where such a program is not established, then the minimum requirements for calibrations and checks are as detailed in the following table.

When establishing an equipment assurance program, consideration must be given to the following:

- history of stability;
- frequency of use;
- accuracy required;
- requirement for traceability of measurement;
- ability of staff to perform in-house checks;
- satisfactory participation in proficiency testing programs.

The table includes the most common items of equipment and it should not be assumed that measurement traceability, and thus calibrations (and checks), are not applicable for equipment not listed.

The frequencies indicated in the table are considered to be maximum allowable intervals based on the assumption that:

- typical uses of the equipment and the required accuracy have been considered;
- the equipment is of good quality, of proven adequate stability and is properly used and housed;
- the facility has both the equipment capability and staff expertise to perform the requisite in-house checks;
- all of the subsidiary checks indicate satisfactory operation.

Shorter intervals between calibrations and/or checks may be required when the equipment operates under less than ideal conditions. If any suspicion of damage arises, the equipment must be recalibrated immediately and thereafter at reduced intervals until it is shown that stability has not been impaired. Furthermore, reduced intervals between calibrations and/or checks may also be required in particular testing applications or with particular equipment configurations.

In order to assist facilities to demonstrate good control of their tests and measurements and to reduce their operating costs, NATA encourages facilities to develop equipment assurance programs. These programs move the emphasis from a high reliance on demonstration of equipment conformance at the time of calibration to:

- having a greater contribution from more frequent checks against reference items or materials;
- cross-checking against similar systems;
- the checking of particular critical features.

Equipment calibration and check programs should cover:

- commissioning of new equipment (including initial calibration and checks after installation);
- operational checking (checking during use with reference items or materials\*);
- periodic checking (interim but more extensive checking, possibly including partial calibration);
- scheduled maintenance by in-house or specialist contractors;
- complete recalibration.

**Note:** \* If no appropriate reference items or materials are available, then the facility shall demonstrate that the alternatives used have sufficient traceability, stability, homogeneity and accuracy such that the method and subsequent results can be deemed fit for purpose.

## Calibration Appendix A

### Calibration intervals for commonly used Chemical Testing equipment

Item of equipment	Period between successive calibrations (years)	Period between checks (months)	Procedures and references
<b>Air flow nozzles</b>		12	Check throat diameter.
<b>Autoclaves</b>	Initial and after major repairs		Temperature profiling of typical loads.
		12	Check temperature distribution with no loading.
		Each cycle	Record the temperature, pressure, time and type of load. The user facility must define typical loads of use and then ask the calibration facility to calibrate the autoclave at that load/those loads. The autoclave must always be used with that/those loads.
<b>Balances</b>	3		NATA Accredited facility or <i>The Calibration of Weights and Balances</i> EC Morris and KMK Fen.

		12	Service. The service must be carried out by competent personnel, for example a balance supplier. Where the facility can demonstrate that the balance is used in a suitable environment (eg. dust free, chemical free) AND results of user checks consistently demonstrate good performance and ability, this requirement may be waived.
		6	Repeatability check. NATA Technical Note 13.
		1	One point check. NATA Technical Note 13.
		Each weighing	Zero point check. <b>Note 1:</b> Balances with in-built calibration check facilities must also have monthly and 6-monthly checks carried out. <b>Note 2:</b> Electronic balances with more than one range must have monthly and 6-monthly checks on all ranges.
<b>Barometers</b>			
Fortin		60	One point check with transfer instrument. (see NATA Technical Note 8).
Aneroid barometers	1		
<b>Callipers (vernier)</b>	2		AS 1984
<b>Centrifuges</b>		12	Tachometer (mechanical stroboscope or light cell type, or by other approved means) where operating speed is specified. Note: Calibration of the timing device and, where appropriate, the temperature measurement device will also be required.
<b>Comparators</b>		24	Check condition of discs (this check could be done with a spectrophotometer referenced to standards).
<b>Density bottles, pycnometers</b>		12	AS 2378; BS 733-2;
<b>Density meters</b>		Initial and whenever test temperature is changed or cell cleaned  Daily  1 week	ASTM D4052 or ASTM D5002  With pure substance of known density and stability  Air and double-distilled water.
<b>Dial gauges</b>	2		AS 2103

<b>Digestion blocks</b> e.g. blocks or mantles used for Kjeldahl, Chemical Oxygen Demand or metal digestions			Temperature variation check across working spaces using either an appropriately calibrated temperature indicating device, e.g. thermocouple or liquid in glass thermometer, or recovery check with a difficult to digest standard/sample e.g. nicotinic acid for TKN digestion.
		12 and after repair or maintenance	Temperature variation check across working spaces using either an appropriately calibrated temperature indicating device, e.g. thermocouple or liquid in glass thermometer, or recovery check with a difficult to digest standard/sample e.g. nicotinic acid for TKN digestion.
<b>Electrical instruments</b>			
Digital multimeters	1		Calibrate over all ranges and parameters of use. Calibration must include linearity.
		6	Compare with meters of similar resolution.
Analog meters	2		
		6	Compare with meters of similar resolution.
Data loggers	1		
		6	Check at zero and the maximum point.
<b>Environmental conditioning chambers</b>	3		IEC 60068 -1,-2,-3,-33,-38,-39, AS 2853 (Dry Chamber)
		On use	Check at the working temperature.
<b>Flowmeters</b>			
Rotameters (Reference)			
- High flow, ie. >1 L/min		24	ASTM D3195
- Low flow, ie. <1 L/min		24	Soap bubble flow meter
Rotameters (Working)		Each time on use	Soap bubble flow meter
Orifice plates			ISO/TR 15377 (calibration by an approved testing authority).
		6	Visual inspection for damage, wear or contamination.
Wet test meters		24	ASTM D1071
Anemometers	2		Calibration by an approved testing authority.
Pitot tubes			Check dimensional compliance with ISO 10780.
		On use	Inspect tip for damage, blockage, etc as required by ISO 10780
Electronic soap film-like flow meter (eg. <i>Gilibrator</i> , <i>Mini-buck</i> )		Monthly for 3 months then, if measurements are within $\pm 3\%$ of the expected result, the interval can be lengthened to 6 months.	Against primary flow meter over the range of use (including high flow rates where used).
<b>Furnaces</b>		12	Check variation within the working zone at the working temperature. AS 2853
		On use	Monitor temperature with the appropriate sensor.

<b>Gas meters</b>		24	
<b>Gauge blocks</b>	4 (reference)		
		24 (working)	Check against reference blocks.
<b>Glassware</b>			
<b>Note:</b> Volumetric plasticware may not be acceptable because it is prone to irreversible volume changes and deformation.			
(1) Pipettes, burettes, volumetric flasks		On commissioning, and subject to nature of intended use	AS 2162.1; BS 1797 Grade A glassware distillation receivers should be used where a high degree of accuracy is required.
(2) Specialised calibrated glassware water traps, sulphonation flasks, centrifuge tubes etc)			AS 2162.1
(3) Piston operated volumetric apparatus (POVA) Note 1:			
a) Pipetters	Note 2		AS 2162.2
		3	Check precision and accuracy of volume delivered at settings in use. (refer to AS 2162.2).
b) Dispensers	Note 2		AS 2162.2
		3	Check precision and accuracy of volume delivered at settings in use. (refer to AS 2162.2).
c) Diluters	Note 2		AS 2162.2
		6	Check sample and diluent volumes or dilution ratio and total volume (refer to AS 2162.2).
d) Displacement burettes	Note 2		AS 2162.2
		When barrel/plunger is changed	Check precision and accuracy of volume delivered at maximum and two other settings. (refer to AS 2162.2).
<b>Hydrometers</b>			
Reference	5		
Working – glass		12	Check against reference hydrometer or in newly prepared solutions of known density. AS 2026, ASTM-E126
Working - metal		6	ISO 649.1, .2, ISO 650
		On use	Check that scale has not slipped.
<b>Hygrometers</b>			
Assmann and sling psychrometers	10		
		6	Compare thermometers at room temperature with wick dry. AS 2001.1 Appendix C
Thermohygrographs		Weekly	Check against a calibrated psychrometer, if capacitance type.
Electronic types (eg. digital psychrometer)	1		Check against a calibrated thermometer at ambient temperature.
<b>Manometers</b>			
Reference, liquid	10		
		36	Check the cleanliness of the fluid.
Working, liquid	3		

		36	Check the cleanliness of the fluid.
Electronic	1		
<b>Masses</b>			
Reference – of integral stainless steel or nickel chromium alloy	3 then 6 subsequent		
Working – stainless steel, nickel chromium alloy		36	
Working – other alloy		12	
<b>Micrometers</b>	5		AS 2102
		1	Check zero and one point against gauge block. Inspect anvils.
<b>Penetration cones and needles</b>	5		Calibration by an approved testing authority. ASTM D217; IP 50; ASTM D5; ASTM D1321.
		On use	Visually inspect needle tips.
<b>Plate Readers</b> Eg. ELISA with a calibration verification plate		12	A standardised plate must be run on the plate reader at least annually (minimum) but preferably six monthly. For plate readers without an in-built checking system, the standardised plate may need to be run more frequently.
		Each test	Appropriate QC with each test
Verification Plates		24	Stability check by plate manufacturer
<b>Potentiometers</b>			
Reference	5		Calibration by an approved testing authority.
Working		12	Check against reference potentiometer.
<b>Pressure equipment</b>			
Test gauges used for calibration of industrial gauges	1		AS 1349
Industrial gauges not subject to shock loading	1		AS 1349
Industrial gauges subject to shock loading.	6 months		AS 1349
Pressure transducers	1		
Calibrators	1		
<b>Pyrometers</b>			
Reference	3		BS 1041: Part 5. Calibration by an approved testing authority.
Electronic	1		
Working		6	Check against reference pyrometer.
<b>Refractometers</b>		6	Check against bromonaphthalene or other reference compound of known refractive index.
		On use	Check against distilled water.
<b>Sieves</b>			Compliance certificate to AS 1152, BS 410.
		12	Depending on the accuracy required, more or less frequent checks may be required against a reference set or a suitable reference material.

		On use	Visual check for wear and binding.
<b>Tachometers</b>			
Reference	5		BS 3403. Calibration by an approved testing authority.
Working		12	Check against reference tachometer.
<b>Tape measures, rules</b>			
Tape measures			AS 1290.1, .4, BS 4035
		24 - 60	Check at maximum length, depending on use and accuracy required.
Steel rules			BS 4372
<b>Temperature controlled enclosures</b>			
Ageing	5		AS 2853
		Daily	Monitor temperature with appropriate sensor.
BOD			Temperature variation must be checked AS 2853
		On use	Check the temperature at the start of the test. The maximum and minimum temperature of the laden chamber must be monitored for the test period.
Drying			Temperature variation and evaporation rate must be checked. AS 2853, AS 1289.0, BS 2648.
		24	Check temperature variation within the working zone.
		On use	Monitor temperature with appropriate sensor.
Refrigerators			Where critical, the temperature of the working space must be monitored by an appropriate temperature sensor throughout use.
Vacuum		24	Check temperature variation and pressure in the working space. AS 2853
<b>Thermometers</b>			
Reference, liquid-in-glass	10		NATA accredited facility
		Before use	Check at ice point. NATA Tech. Note 19
Working, liquid-in-glass	5		NATA accredited facility
		6	Check at ice point. NATA Tech. Note 19, or Check at one point in the working range against a reference temperature measuring device.
Platinum Resistance Thermometers (PRT), Probe or sensor only			
-40 to 250 °C	5		NATA accredited facility
		6	Check at ice point
< -40 °C and > 250 °C	2		NATA accredited facility
		6	Check at ice point
Measuring instrument AC Bridge type, Reference and Working	5		NATA accredited facility.

Measuring instrument DC bridge type	2 (working) 1 (reference)		NATA accredited facility
Reference digital indicating systems, hand held or bench type, single and multi-channel (Note 3)	1		NATA accredited facility
		6	Check at ice point
Working, digital indicating systems, hand held or bench type, single or multi-channel; includes temperature loggers.	2		NATA accredited facility
	1		Calibrate every 12 months if the facility does not have a reference device.
		6	Check against a reference device at the temperature of use. If used at more than one temperature, choose the most critical temperature. Check at ice point if the facility does not have a reference device. (for data loggers the reference device can not be another data logger of the same type).
Infra red	1		
		6	Check at ice point
<b>Thermocouple Systems</b>			
'Base metal' type, sheathed	2		For use up to 400°C. For use from 400°C to 1300 °C the same immersion depth must always be used or a greater depth of immersion). Homogeneity must be assessed as part of their calibration.
'Base metal' type, wire	2		For use up to 300°C. Replace if used above 300°C.
Stored Reels	10		Reel of wire - four samples of wire from end points and middle of reel.
'Rare metal' type	3		3 years or after 100 hours above 500 °C, whichever is sooner.
<b>Timing devices</b>			
Stop watches, clock		6	Test aurally against a speaking clock. Two measurements separated by an appropriate interval.
<b>Viscometers</b>			
<b>U-tube</b>			
Reference		120	Against reference oils. ASTM D2162
Working			Using quality oils against reference tubes or using reference oils.
		24	ASTM D2162/D445; IP 71
<b>Others</b>			
Brookfield <b>Note:</b> As well as the spindle number, laboratories need to report the temperature of the test and the revolution per minute.		24	Against reference oils.

		1	Against quality (i.e. manufacturers') oils.
Ferranti		3	Against reference oils.
Zahn		12	Against reference oils.

Note 1. All POVA variable volume pipettes must be checked at a minimum of two settings within the working range. Ideally, pipettes should be checked at three volumes – maximum volume, 10% maximum volume and mid point. Variable and single volume pipettes require 10 replicate measurements with calculation of the CV% to be performed. An acceptable CV% dependent on the application of the pipette and the required accuracy must be stated. In addition, a drip check (to ensure a tight fit of disposable pipette tips) must be performed by filling the pipette tip with the maximum volume in common use and suspending the pipette vertically for two minutes to ensure that all of the fluid is retained.

Note 2. Where pipettes are used for critical measurements/test inputs and where traceability of the volume dispensed is required, a calibration program must be established, with the frequency of calibration based on the performance of the pipettes, including the results of regular checks.

Note 3. In general, the uncertainty of calibration of the reference thermometer should be 1/5<sup>th</sup> of the uncertainty of calibration required of the working thermometer.

## Calibration Appendix B

### Periodical calibration of equipment for monitoring standard operating conditions for ASTM methods D2699, D2700 (RON and MON)

Checks as specified in Calibration Appendix A must be carried out on all thermometers, burettes, viscometers, dial gauges and other items of equipment. Maintenance and standardisation checks must be done at the intervals specified in ASTM methods D2699 and D2700.

## Calibration Appendix C

### Calibration of equipment for tests on coal and coke

Item of equipment	Maximum period between successive calibrations (years)	Maximum period between checks	Procedures <sup>+</sup> and comments
<b>Bomb calorimeters</b>			
Pressure, mechanical and dimensional tests on bombs	3 years or 1000 firings (depending on use) then every 500 firings.		Checks as prescribed in AS 1038 (see also BS 4791). More frequent checks required if calorimeter is damaged or used repeatedly. Calibration by an appropriate testing authority.
		On use	Checks on calorimeter dimensions and for thread slackness.
		3 months	Determination of the water equivalent (bomb factor). Refer to AS1038.5
<b>Crucible swelling number burners</b>		1 month	Heating profiles of all burners Refer to AS 1038.12.1.
<b>Density bottles</b>		3 months	Refer to AS 1038.21.1.1, 21.1.2.
<b>Dilatometer</b>		6 months	Temperature (absolute and gradient), piston assembly mass and tube wear. Refer to AS 1038.12.3.

<b>Froth flotation cells</b>		12 months	Check cell block and impeller dimensions. Refer to AS 4156.2.1.
<b>Furnaces</b>			Measure and record test zone temperature by the use of a certified reference thermocouple, a working thermocouple* or a calibrated electronic thermometer or refer to AS 1038.3,. 6.1, .6.3.2, .12.2, .15.
Ash		12 months	
Gray-King		12 months	
Tube		12 months	
Volatile Matter		6 months	
Ash Fusion		3 months	
<b>Gieseler plastometer</b>			
Bath temperatures		6 months	Remove thermocouple and check against reference. Refer to AS 1038.12.4.1.
Torque Test		On use	Check against torque meter.
Rabble Arms		Initial	Check dimensions.
		50 determinations	Check for wear.
<b>Hardgrove grindability</b>			
Apparatus		12 months	Calibrate against four national reference coal samples with certified grindability indices. Refer to AS 1038.20.
Mill revolutions		12 months	Check number of revolutions per minute.
<b>Hydrometers</b>			
Working, for float and sink testing		12 months	Preferably check side by side against certified reference hydrometers. If not available check against freshly prepared solutions of known density. Refer to AS 2026. Facility may isolate own reference set of hydrometers after in-house calibrations.
<b>Instrumental analysers</b>			
For carbon, hydrogen, nitrogen		On use	Check precision (refer to AS 1038.16) against Standard Method or sulphur (AS 1038.6.1, .6.3.2) or against certified reference materials which cover the full working range.
<b>Microscope photometer</b>			
For reflectance measurements		Prior to each sample, at fifteen minute intervals and at end of sample measurement	Calibrate using glass or mineral reflectance standards. Refer to AS 2856.3.
<b>Ovens</b>			
Direct gravimetric		12 months	Check temperature gradient over sample area.
Drying		12 months	Check temperature of working space.
Minimum free-space		12 months	Check temperature.
<b>Rotary Sample Divider (RSD)</b>			

		12 months	Measure ash and mass % for each segment
<b>Shale breakdown apparatus</b>			
Andreasen sizing apparatus		Initial	Check flask volume, height of stem and pipette volume. Refer to AS 4156.1.
Drum tumbler		12 months	Check revolution counter on tumbler. Refer to AS 4156.1.

+ Refer to the relevant standard for which accreditation is held. For convenience, only Australian Standards (when available) have been quoted here.

\* Check every six months against certified reference thermocouple. (A Gray-King furnace is quite convenient as a heat source).

#### Notes

- i) The period given between successive calibrations is a maximum period. More frequent calibrations may be required if the equipment is repaired, moved, is in constant use or a change in operating circumstances occurs.
- ii) Accredited coal laboratories must maintain adequate quality control in supervision of equipment performance by the use of appropriate reference materials on a regular basis.
- iii) Whenever possible, unless otherwise stated in the relevant standard, equipment should contain all items of apparatus specified in the test method when being calibrated.
- iv) The calibration requirements for other general items of equipment used in coal and coke testing (eg. balances, thermometers, thermocouples, volumetric glassware, etc) are found in this booklet in Calibration Appendix A.

## Calibration Appendix D

### Periodical recalibration of equipment for physical tests on paints to AS 1580

Item of equipment	Maximum period between successive calibrations (years)	Maximum period between checks	Procedures and comments
<b>Method 101.1</b>			
Thermohygrograph		1 month (retain charts)	Against calibrated psychrometer.
Anemometer	2 to 5 years depending on use		Calibration by approved authority.
Viewing conditions			Typically 350 lux.
<b>Methods 101.4, 101.5</b>			
Thermohygrograph		1 month (retain charts)	Against calibrated psychrometer.
Viewing conditions			Typically 350 lux.
<b>Method 101.3</b>			
Forced draught oven		6 months	Check oven thermometer against reference thermometer.
Stoving	5 years OR		Temperature variation in working space (refer AS 2853). By approved testing authority.
	2 years		Temperature variation in working space (refer AS 2853). Calibration by facility staff.
<b>Method 107.3</b>			
Reference wheel or comb gauge	10 to 20 years depending on use		Calibration by an approved testing authority.
Working wheel gauges	2 years		Calibration by an approved testing authority.

		1 year	Check against reference wheel gauge.
Reference comb gauge	10 years		Calibration by an approved testing authority.
Working comb gauges		1 year	Check against reference comb gauge or wheel gauge.
<b>Method 108.1</b>			
Shims	Initial	Frequent visual examination	Shims bearing ASTM or NIST stamps do not require initial external calibration.
Magnetic instruments		On use	Against calibrated shims.
<b>Method 108.2</b>			
Paint inspection gauge		Initial only	Graticule and cutting angle of cutting tip.
		Annual	Visual inspection for wear and damage.
<b>Methods 202.1, 202.2</b>			
Pyknometer (at least 50 ml capacity)		Initial	Check capacity.
		6 months	Check capacity.
<b>Method 202.4</b>			
Pressure Cup Pyknometer (at least 50 ml capacity)		Initial	Check capacity.
		6 months	Check capacity.
<b>Method 204.1</b>			
Fineness of grind gauge block			
- Reference	10 to 20 years depending on use		Calibration by approved testing authority.
- Working		1 year plus frequent visual examination	Against reference using at least two paints covering the working range.
- Scraper		1 year	Visual check.
<b>Methods 211.1, 211.2</b>			
Settling spatula		Initial only	Dimensions and mass.
		Annually	Re-examine for wear and change.
<b>Method 213.1</b>			
Test panels		Initial	Checks to be carried out on a representative sample from the batch of test panels.
<b>Method 213.2</b>			
Gloss panels		Initial	Black area <5%, white areas 80% ± 5%
<b>Method 214.1</b>			
Krebs-Stormer Viscometer	Initial only		+Masses and paddle dimensions.
<b>Note:</b> A Krebs-Stormer viscometer is considered acceptable as long as it gives a value within ± 15% of the expected load for 200 rpm for a given oil and within ± 5% of the consistency in Krebs units.			
		Initial, then 1 year	++Against standard oils stored in sealed container.
Reference oils		2 years	Store as directed, well sealed, clean. Replace if 5% change from initial value.
<b>Method 214.2</b>			
Flow cup		Initial only	Dimensions
		Initial, then	++ Against standard oils stored in sealed container.

		3 months (for cups in constant use), OR	++ Against standard oils stored in sealed container.
		1 year (other)	++ Against standard oils stored in sealed container.
Reference oils		2 years	As for 214.1.
<b>Method 214.3</b>			
Cone and plate viscometer	Initial		Verification of plate temperature.
		3 monthly	Reference oils can be used for performance checks.
Reference oils		2 years	As for 214.1.
<b>Method 214.4</b>			
Rotoviscometer		Initial, then 1 year	++ Against standard oils stored in sealed container.
Reference oils		2 years	As for 214.1.
<b>Method 214.5</b>			
Brookfield viscometer		Initial, then 1 year	++ Against standard oils stored in sealed container.
		1 month	Against manufacturer's oils.
Reference oils		2 years	As for 214.1.
<b>Methods 301.1, 301.2</b>			
Forced draught oven		6 months	Check oven thermometer against reference thermometer.
	5 years OR		Temperature variation in working space (refer AS 2853). By approved testing authority.
	2 years		Temperature variation in working space (refer AS 2853). Calibration by facility staff.
<b>Method 401.1</b>			
Spoon		Initial	Dimensions and mass of beads delivered.
<b>Method 401.3</b>			
BK-type recorder		Initial	Check on drive mechanism +/- 2% of scale value, travel time and length.
Pins		1 year	Check of cleanliness, shape, dimensions and orientation of pins.
<b>Method 401.6</b>			
Mechanical thumb		Initial only	Masses (those that cannot be disassembled must be checked against one known to conform).
		5 years	Hardness of rubber plunger.
<b>Method 401.8</b>			
Ramp/roller		Initial	Dimensions and mass.
Roller rubber bands	5 years		Hardness.
<b>Method 402.1</b>			
Bend test apparatus and mandrels		Initial only	Dimensions.
<b>Method 403.1</b>			
Scratch test apparatus	Initial only		Mass and needle dimensions.
		1 year	Inspect under microscope for wear and damage.
<b>Method 403.2</b>			
Abrasion resistance			
- Taber abrasion		Initial	Check masses and turntable speed.
- Abrasive wheel		Initial	Before use (retest hardness or discard).
<b>Method 408.5</b>			
Adhesion tester		Initial	Check spring strength.
Circular hole cutter		5 to 10 years	Depending on use.

<b>Method 409.2</b>			
Temperature controlled enclosure		On use	Monitor and record temperature
<b>Method 410.1</b>			
Oven		2 yearly	As for 301.1.
		On use	Record temperature.
Freezer		On use	Record temperature.
Thermometer		6 months	Against reference thermometer at ice-point.
<b>Method 459.1</b>			
Sponge and holder machine		Initial	Length and rate of travel.
		5 years	Check to ensure that machine is level.
<b>Methods, 461.1, 481.1.12, 482.1</b>			
Grey scales			
- Reference		10 years	Check against ISO 105 coordinates.
- Working		1 year	Check against reference set.
<b>Method 601.1</b>			
Light booth	500-1000 hours or annually		Check lamps, voltage and illumination levels.
Colour blindness test		Initial check of staff	See <a href="http://www.toledobend.com/colorblind/Ishihara.html">http://www.toledobend.com/colorblind/Ishihara.html</a> .
<b>Methods 601.2, 601.3</b>			
Colour spectrophotometer		On use	Calibration of photometer scale using reference tiles supplied by manufacturer.
<b>Method 602.2</b>			
Gloss tiles			
- Reference			Supplied by manufacturer.
- Working		6 months	Against reference gloss tiles or original gloss coordinates.
- Instrument		On use	Against working gloss tiles.

+ If dimensions do not conform, the instrument must be calibrated with two standard viscosity oils to ASTM D562

++ Standard oils need to be correctly stored (in the dark, at room temperature, in closed glass or tinned metal containers, free from contaminants).

**Note: Determination of colour and viscosity of resins**

Accreditation for colour and viscosity of resins using Gardner colour standards and Gardner-Holdt viscosity standards (to Federal Test Method Standard No 141a and ASTM Methods) is granted on the basis that the applicant can obtain results comparable with laboratories already accredited for these tests, as an alternative to fundamental calibration of these standards.

## Calibration Appendix E

Calibration of gas analysers (except for motor vehicle emission testing to Australian design rules – See Appendix F)

Item of equipment	Maximum period between successive checks/calibrations	Procedures and comments
Gas detection Instruments	Prior to use check	Physical damage, zero and single point span check on individual sensors on portable devices at approximately 60%-90% of full scale of range being used.

	<p>Weekly check</p> <p>Monthly check</p> <p>6 Monthly calibration</p>	<p>Physical damage, zero and single point span check at approximately 60%-90% of full scale of range for fixed monitors used for continuous monitoring on mobile equipment. (See note vii)</p> <p>Physical damage, zero and single point span check at approximately 60%-90% of full scale of range for fixed monitors used for continuous monitoring on non-mobile equipment. (See note vii)</p> <p>Physical damage, zero and six point span check for NDIRS (with recommended values of 15, 30, 45, 60, 75 and 90% of the full range being used) (See note xii)</p> <p>Physical damage, zero and three point span calibration (see note vi) for other fixed or portable sensor types including UV, chemiluminescence, interferometer, refractive index, catalytic, FID, electrochemical, thermal conductivity, paramagnetic and zirconium oxide detectors.</p> <p>Physical damage, zero and two point span calibration (see note vii) for fixed or stationary instruments with combustible sensors used in explosive or potentially explosive atmospheres a with an output scale of zero to 100% lower explosive limit.</p> <p>One point for single point alarm instruments (see note viii).</p>
<b>Reference gases</b>		
Reactive reference Gases	2 years or once the cylinder pressure drops below 700kPa (100psi) whichever comes first.	
Non-reactive reference gases at a concentration greater than 0.01% (100ppm)	4 years or once the cylinder pressure drops below 700kPa (100psi), whichever comes first.	
Non-reactive reference gases at a concentration of 0.01% (100ppm) or less	2 years or once the cylinder drops below 700kPa or less whichever comes first.	

**Notes**

- (i) Frequency given is the MAXIMUM periods between checks/ calibrations.
- (ii) Instruments must be completely recalibrated after significant maintenance.
- (iii) The calibration history for each instrument must be recorded and retained.
- (iv) The initial calibration must check interferences. The laboratory should be aware of the contaminants that may create cross-sensitivities.

- (v) Calibrations must be performed more frequently if poisons/ contaminants are likely to be present in the atmosphere that is monitored by a catalytic sensor.
- (vi) Calibrations at three points (and zero) must adequately cover the full scale of the range. One point must be between approximately 60% and 90% of full scale, except for fixed or stationary flammable sensor instruments that are calibrated in situ in explosive or potentially explosive atmospheres with scales of 0 - 100% lower explosive limit (see note vii).
- (vii) Calibrations at two points may be used for calibration of in situ fixed or stationary flammable sensor instruments in explosive or potentially explosive atmospheres with scales of 0 - 100% lower explosive limit. In these situations a highest calibration point of approximately 50% lower explosive limit may be used. For weekly/ monthly single point span checks, a span gas concentration of approximately 50% lower explosive limit may be used.
- (viii) For single point instrument alarms, a one-point calibration is performed at the level at which the instrument alarms.
- (ix) Fixed instruments with a remote sensor head should be calibrated in-situ where possible. If these devices are removed for calibration (i.e. in a laboratory), suitable connection leads with the same impedance must be used. For remote sensors that do not permit calibration adjustment at the actual head/sensor, and the calibration adjustment is performed at the transmitter/ readout unit, the sensor head and transmitter/ readout unit must be calibrated as a matched system.
- (x) The gas flow rates necessary for optimum response of flame ionisation detectors should be checked regularly. Zero checks must be made with high purity gases (depending on precision and accuracy required). Oxygen-quenching effects must be determined on commissioning.
- (xi) For low level alarms (and semiconductor type detectors) all operating parameters must be included on the calibration certificate and the instrument must be calibrated with the gas type that the instrument is to measure.
- (xii) A non-dispersive infrared analyser, which has a linearising circuit, is not considered to be a linear instrument. A nominally linear instrument is linear if its response is within 2% of linearity over its full range of detection.
- (xiii) Wosthoff pumps, mass flow controllers and gas dividers must be checked annually. The checks should cover the full range of the devices. This should preferably be carried out by an accredited laboratory.

### **Method of reporting**

Test documents relating to the calibration of gas analysers must meet NATA's accreditation requirements set out in this booklet. The conditions of tests (temperature, gas mixtures, laboratory, in-situ, etc.) must be clearly stated and the meaning of the test result must be unambiguous.

Endorsed test documents must only relate to the calibration of the instrument. Any opinions on the performance of the instrument must appear on a separate, non-endorsed attachment. However, brief comment on any service or repair that does not offer opinions may be included provided that a disclaimer is made on the report stating that these comments are not part in the endorsed test document information.

In addition, there must be traceability to the reference gases used for calibration or the method of generating references (eg. Wosthoff Pump). This must be stated, either on the report or on the relevant work sheets.

## **Calibration Appendix F**

### **Periodic recalibration of equipment for vehicle emission testing laboratories**

The following table lists the requirements for periodical calibration of instruments and test equipment used for motor vehicle emission testing by laboratories holding accreditation for:

- 7.90 Motor Vehicles  
 .01 Vehicle emissions  
 .02 Fuel consumption tests

It also shows the reference standards for calibration and, where available, the standards describing detailed procedures for calibration. These are taken from National Standards and from Australian Design Rules, and also from current emission laboratory testing practice in Australia. In general, NATA will accept checks carried out by facility staff of items listed in the 'Check' column below, provided that the facility is equipped with the required calibration standards and the staff is competent to perform such checks.

Item of equipment	Maximum period between successive calibrations (years)	Maximum period between checks	Procedures and comments
<b>Constant volume sampler</b>			
Positive displacement pump	500 hours of use after stabilising period or major maintenance		
Critical Flow Venturi	As indicated by CVS system verification		Reference Standard; Air Flow Meter (Laminar Flow Element, Subsonic Venturi or orifice plate). Calibration traceable to NIST. Accuracy 1% of air flow.
System verification - Propane - Carbon Monoxide - Carbon Dioxide		1 week or after maintenance or servicing of system	Using CP Propane (C <sub>3</sub> H <sub>8</sub> ) or Carbon Monoxide or Carbon Dioxide.
			System accuracy in the order of 2% critical flow orifice or 'bomb' method. <b>Note:</b> Precautions with use of pure carbon monoxide.
Correlation car	As required to supplement other methods		Approved in-house laboratory methods.
<b>Dynamometers</b>			
<b>Chassis</b>			
Load scale			AS 2193. NML Class B Certified Masses.
Knife edge	5 years		
Pneumatic/ Hydraulic link	2 years		
Electronic	2 years		
Bourdon tube	6 months		
Roller speed		3 months	Digital counter with stop watch.
Power absorption		1 month	
Performance check		1 week	
Distance measurement		6 months	
<b>Engine</b>			
Load scale			AS 2193. NML Class B Certified Masses.
Knife edge	5 years		
Pneumatic/ Hydraulic link	2 years		
Electronic	2 years		
Bourdon tube	6 months		
Speed		3 months	Digital counter with stop watch.
<b>Dynamic gas blending device</b>			
Standard gas dividers		1 year	Using gas analyser and primary gas standards for each gas type.
		Each use	Single point.

<b>Fans</b>			
Engine cooling		On commissioning or major overhaul	Anemometer.
<b>Flowmeters</b>			
<u>Air Flow Meter</u>			
- Laminar Flow Element (LFE)		100 hours of use or more frequently if drift occurs	Visual inspection for damage, wear and contamination.
- Orifice Plate	10 years		Calibration traceable to NIST. Master within $\pm 1\%$ , ADR 37/00, Appendix 5
- Venturi Flow Meter	10 years		
- Anemometers	2 years		
Rotameters (see Note below)			
Reference			
- High flow, >1 L/Min		2 years	ASTM D3195
- Low flow, <1 L/Min		2 years	Soap bubble flow meter.
Working		On use	Soap bubble flow meter.
Fuel Flowmeters		6 months	
Gas analyser for motor vehicle exhaust emissions <b>Note:</b> In vehicle emission testing (gas analyser and CVS) rotameters are used as indicators of flow rather than as flow measuring devices.		Span and zero check before and after each analysis on each analyser.	
		Complete recalibration of all analysers at one month intervals	6 points at 15, 30, 45, 60, 75, 90 % of range, plus zero for calibration on all instruments.
			Using reference gases traceable to national or international standards.
			Dynamic gas blending devices such as standard gas divider accurate within $\pm 1\%$ may be used to generate the points for a calibration.
NOx Convertor efficiency		1 week	
HC Optimisation of performance		On first commissioning; 1 year and after major maintenance	
HC oxygen quenching effect		On first commissioning; 1 year and after major overhaul	SAE J1094a Constant Volume Sampler Systems for Exhaust Emissions or instrument manufacturer's recommendations.
CO Analyser interference of CO <sub>2</sub> , H <sub>2</sub> O		On first commissioning; 1 year and after major overhaul	
Exhaust emissions of engines at idle NDIR CO, CO <sub>2</sub> , HC		Electrical check before each reading	
<b>Note:</b> Non-linear instruments such as NDIR are not considered to be 'linear' when fitted with linearising circuits.		1 week span and zero	Gas check.

		1 month	Multi-point calibration using standard gases.
<b>SHED</b> (Sealed housing for evaporative determinations)			
Background emissions		1 year	
HC retention check		1 month	
HC analyser (FID)		1 month	Six point calibration not including zero (see gas analysers).
Homogeneity test		On commissioning and after major service	
Homogeneity response time		On commissioning and after major service	Time to achieve homogeneity.
Recovery or validation test		On commissioning and after major service	
Volume of SHED		On commissioning and after major service	
<b>Reference gases</b>			
Non reactive Reference gases: at a concentration greater than 100ppm	4 years or once the cylinder pressure falls below 700kPa (100psi), whichever occurs first		
Non-reactive gases: at a concentration of 100ppm or less.	2 years or once the cylinder pressure falls below 700kPa (100psi), whichever occurs first		
Reactive Reference gases	2 years or once the cylinder pressure falls below 700kPa (100psi), whichever occurs first		

## Calibration Appendix G

### Calibration data measurement for a constant volume sampler (CVS) for positive displacement pump (PDP) type or critical flow venturi (CFV) type

Parameter	Symbol	Tolerance	Instrument
Atmospheric pressure	P <sub>B</sub>	± 0.03 kPa	Barometer
Ambient temperature	T <sub>A</sub>	± 0.3°C	Thermometer
Air temperature into LFE	E <sub>Ti</sub>	± 0.15°C	Thermometer
Pressure depression upstream of LFE	E <sub>PI</sub>	± 0.01 kPa	Manometer

<b>Pressure differential across LFE</b>	$E_{DP}$	$\pm 0.001$ kPa	Manometer
<b>Air temperature at:</b>			
PDP inlet;	$P_{ti}$	$\pm 0.3^{\circ}C$	Thermometer
or CFV inlet	$T_v$	$\pm 0.3^{\circ}C$	Thermometer
<b>Pressure depression at:</b>			
PDP inlet; or CFV inlet	$P_{Pi}$	$\pm 0.01$ kPa	Manometer
<b>Pressure at PDP outlet</b>	$P_{PO}$	$\pm 0.01$ kPa	Manometer
<b>Air temperature at PDP outlet (optional)</b>	$P_{TO}$	$\pm 0.3^{\circ}C$	Thermometer
<b>PDP revolutions during test phase</b>	N	$\pm$ one	Revolution counter
<b>Elapsed time for test phase</b>	t	$\pm 0.1$ s	Stopwatch or equivalent
<b>Air flow (litres/minute)</b>	$Q_s$	$\pm 0.5\%$	Laminar flow element or sub-sonic venturi flowmeter

## Calibration Appendix H

### Calibration of equipment for asbestos (fibre counting and identification and other workplace environment monitoring)

Item of equipment	Maximum period between successive calibrations (years)	Maximum period between checks	Procedures and comments
<b>Effective Filter Area</b>		On commissioning and whenever the filter, filter holder or any aspect of the filter clearing is changed.	NOHSC Guidance Note: 3003
<b>Furnaces</b>	Initial		
		12 months	Check variation within the working zone at the working temperature. AS 2853.
		On use	Monitor temperature with the appropriate sensor.
<b>HSE/NPL test slide</b>		On use	Used when setting up the microscope prior to counting each batch of slides. . Only slides with the 5 <sup>th</sup> set of lines fully visible and the 6 <sup>th</sup> set partially visible are suitable. Use to be recorded.
<b>Manual soap film flow meter</b>		On commissioning	Check volume using an appropriate measuring device.
<b>Microscope</b>	Yearly service		Details at end of table.
		Regular cleaning	The microscope, lenses and objectives must be kept clean.
<b>Pumps</b> (Where accreditation is held/sought for volume measurement)			

Direct automatic flow- control		After 2 consecutive tests, each 12 months apart (ie. 1 year), showing results within $\pm 5\%$ of the expected result, the interval can be lengthened to 3 years.	Constant flow compensation. Refer to calibration Appendix I.
Indirect automatic flow-control		After 3 consecutive tests, each 6 months apart (ie. 1 year), showing results within $\pm 5\%$ of the expected result, the interval can be lengthened to 12 months	As above.
All pumps		On use	Where accreditation for volume measurement is held, the flow rate must be checked in the field before and after use.
		Regular maintenance and battery checks	Records must be kept.
<b>Refractive Index Oils</b>		1 year	If high grade proprietary oils to be used.
		3 months	If chemical blends are mixed by facility.
<b>Rotameters</b>			
Small bore, long flow meter, spherical float		Initial, then every 12 months	Against primary flow meter over the range of use (including high flow rates where used). If the difference between indicated and 'true' flow rate exceeds $\pm 3\%$ , then the indicated flowrate must be corrected.
Large bore, short/medium flow meter, cylindrical float.		Initial, then every 2 years	Against primary flow meter over the range of use (including high flow rates where used). If the difference between indicated and 'true' flow rate exceeds $\pm 3\%$ , then the indicated flowrate must be corrected.
Electronic soap film-like flow meter (eg. <i>Gilibrator, Mini-buck</i> )		Monthly for 3 months then, if measurements are within $\pm 3\%$ of the expected result, the interval can be lengthened to 6 months.	Against primary flow meter over the range of use (including high flow rates where used).

<p><b>Walton-Beckett graticule</b></p>		<p>Measured on installation then every 12 months and whenever the interpupillary distance, objective, intermediate magnification, or, on some microscopes, the eyepieces are changed.</p> <p><b>Note:</b> For microscopes embodying a magnification change, the graticule must be measured prior to counting each batch of slides.</p>	<p>NOHSC Guidance Note No: 3003</p>
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### Servicing of microscopes

The following servicing must be done on microscopes annually and all defects rectified as necessary. The service may be carried out either in-house by trained facility staff or externally.

#### 1. Phase contrast microscopes

- Checking, lubricating (as necessary) and adjusting all mechanical moving parts, such as condenser rack, stage controls and field diaphragm.
- Checking all optical alignments such as oculars, objectives, binocular tube, condenser and illumination system for surface and mount defects.
- Cleaning all optical components as necessary.
- Checking for vertical, horizontal and rotational displacement of images in binocular tube. If any observable vertical displacement of the image is detected, the microscope must be removed from use and corrected before being placed back into service.

#### 2. Polarising light microscopes

- Checking, lubricating (as necessary) and adjusting all mechanical moving parts, such as condenser rack, stage controls and field diaphragm.
- Checking all optical alignments such as oculars, objectives, binocular tube, condenser and illumination system for surface and mount defects.
- Cleaning all optical components as necessary.
- Checking for vertical, horizontal and rotational displacement of images in binocular tube.
- Checking directions of polariser, analyser and accessory plate.
- Checking correct operation of iris diaphragm in relation to dispersion staining.

#### 3. Stereo microscopes

- Checking, lubricating (as necessary) and adjusting all mechanical moving parts, such as focusing rack and zoom controls.
- Checking all optical alignments such as oculars, binocular tube, objective and illumination system for surface and mount defects.
- Cleaning all optical components as necessary.
- Checking and adjusting for parfocal operation throughout zoom range.

## Calibration Appendix I

### Workplace pump calibration checks

#### 1. Indirect automatic flow-control pumps

Before being placed into service, after six months, and then after a further six months, the following tests must be done on every indirect automatic flow-control pump used by the facility.

- a) For 25mm diameter membrane filters (eg. 0.8µm pore size, mixed esters of cellulose). Test each pump at each flow rate that is used. For example, if the pump is used at 1.0, 2.0 and 4.0 litres/minute, then it must be tested at 1.0, 2.0 and 4.0 litres/minute.
- b) Set the pump flow rate to the chosen flow rate using a flow meter. No other flow resistance should be in the circuit.
- c) By inserting an adjustable or specially chosen flow resistance, select the resistance so that the pressure drop equals or exceeds approximately 2 kPa for each one litre/minute flow rate. (For example, for 4 litres/minute, the pressure drop must be 8 kPa or greater). This pressure drop can be determined by using devices such as a simple 'U' tube water manometer or a Magnehelic differential pressure gauge.
- d) Without adjusting the pump, re-measure the flow rate.
- e) If the flow rate changes by more than 5%, the pump's constant flow compensation must be reset.
- f) Repeat steps a) to e) with the pump set to each relevant flow rate.
- g) If the above tests produce results inside the  $\pm 5\%$  range for tests on three consecutive occasions, ie. 12 months, then future tests need only be done at twelve-monthly intervals.
- h) If any internal components of the pumps have been serviced or changed, the test must be repeated before the pump is placed back into service and must meet the requirements of section g) above before going on to a 12 monthly calibration interval. Pumps that have the circuit board flow compensation potentiometers accessible must not be used until the access is blocked so as to prevent accidental adjustment.
- i) Some manufacturers of indirect automatic flow control pumps specify that flow rates of 1.0 and 2.5 litres/minute are to be used when electronically adjusting for correct 'constant flow compensation'. This should not be confused with the mandatory requirements stated in paragraph (a) above, where pump testing is to be done at every flow rate used.
- j) For pumps using 13mm diameter filters, conduct the same tests as for the pumps using 25mm diameter filters, except to apply a pressure drop criteria of 10kPa for each 1 litre/minute of flowrate. This takes into account the fact that a 13mm diameter filter has an effective filter diameter (ie. dust deposit area) 5 times smaller than that of the effective filter area of a 25mm diameter filter and, therefore, a pressure drop 5 times larger.

#### 2. Direct automatic flow control pumps

- a) Before any 'direct' automatic flow control pump is placed into service, and after a twelve month period, the tests as described in section 1 above (with the exception of paragraphs g) and i)), must be conducted on every direct automatic flow control pump used in the facility.
- b) If any internal components of the pumps have been serviced or changed, the test must be repeated before the pump is placed back into service.
- c) If these tests produce results inside the  $\pm 5\%$  range after two consecutive tests (ie. one year), then future tests need only be done at three yearly intervals.

#### 3. Automatic pump timers

The above mentioned calibration procedures must be adhered to for automatic pump timers.

In addition to these requirements, the following aspects must also be demonstrated to check that automatic pump timers:

- a) reliably deliver the correct flow rate immediately after automatic switch-on
  - i) set pump at initial 'nominal' flow rate
  - ii) program pump to start at least 1 hour later
  - iii) measure and record pump flow rate within 5 minutes of auto switch-on

- iv) repeat steps i to iii for each flow rate used
  - v) repeat steps i to iv for each pump used
  - vi) repeat steps i to v on three separate occasions
  - vii) accept a pump if any flow rate is within +/-5% of initial 'nominal' reading
  - viii) reject a pump if any flow rate is more than +/-5% of initial 'nominal' reading.
- b) reliably deliver the correct flow rate immediately before automatic switch-off over the time cycle chosen
- i) set pump at initial 'nominal' flow rate
  - ii) program pumps to finish at least 1 hour later
  - iii) measure and record 'final' pump flow rate within 5 minutes before auto switch-off
  - iv) repeat steps i to iii for each flow rate used
  - v) repeat steps i to iv for each pump used
  - vi) repeat steps i to v on three separate occasions
  - vii) accept a pump if any 'final' flow rate is within +/-5% of initial 'nominal' reading
  - viii) reject a pump if any flow rate is more than +/-5% of initial 'nominal' reading
- c) reliably display the sample duration to +/-1% or better
- i) time in-built pump timer over a typical sampling period and record timer's 'elapsed time'
  - ii) repeat step i for each sampling period likely to be used
  - iii) repeat steps i to ii for each pump used
  - iv) repeat steps i to iii on three separate occasions
  - v) accept a pump if pump timer elapsed time is within +/-1% of actual elapsed time.
- d) reliably switch off automatically in the event of a flow fault such that the final flow rate is within  $\pm 10\%$  of the initial flow rate
- i) set pump at initial 'nominal' flow rate
  - ii) progressively restrict pump suction so as to cause 'flow fault' condition
  - iii) during step ii measure and record pump flow rate just before auto switch-off
  - iv) repeat steps i to iii for each flow rate used
  - v) repeat steps i to iv for each pump used
  - vi) repeat steps i to v on three consecutive occasions
  - vii) accept a pump if final flow rate is within  $\pm 10\%$  of initial 'nominal' reading
  - viii) reject a pump if any final flow rate is more than  $\pm 10\%$  of initial 'nominal' reading
- e) reliably switch off automatically in the event of a low battery such that the final flow rate is within +/-10% of the initial flow rate.
- i) set pump at initial 'nominal' flow rate
  - ii) progressively reduce voltage supply to pump so as to cause 'low battery' fault
  - iii) during step ii, measure and record pump flow rate just before auto switch-off
  - iv) repeat steps i to iii for each flow rate used
  - v) repeat steps i to iv for each pump used
  - vi) repeat steps i to v on three consecutive occasions
  - vii) accept a pump if final flow rate is within +/-10% of initial 'nominal' reading
  - viii) reject a pump if any final flow rate is more than +/-10% of initial 'nominal' reading.

Each pump must be tested and records kept of all of the aspects described above.

If the tests described under d) and e) above have not been done, any sample subject to automatic switch-off due to a flow fault or low battery must be rejected.

A facility can submit to NATA for review and approval an alternative series of tests to those described above, provided that they achieve the same aim. One alternative may be the measurement of air volumes actually sucked by a pump during automatic operation. The test procedures for any alternative would need to be described in detail.

## Calibration Appendix J

### Calibration of instrumentation (comparative techniques)

The reference and working equipment listed in previous appendices are calibrated (in most cases) by reference to fundamental physical standards of measurement and their derivatives. Other techniques have been included in the previous appendices to be consistent with the grouping of equipment for specific testing procedures.

This Appendix lists major analytical instrumentation used in the facility, that are calibrated primarily in-house by use of reference materials of known composition.

In the field of Chemical Testing the following general principles apply to the use of analytical instrumentation.

- a) Sufficient and appropriate reference materials must be used to calibrate instruments over the full analytical range required to establish the measurement characteristics of the instrument (linearity, sensitivity, etc).
- b) Stability of measurement must be assessed with reference materials to establish the required frequency of calibration.
- c) Effects of interfering substances and differing matrices must be assessed.
- d) Limits of detection must be established if the instrument is to be used at concentrations approaching the limit of detection.
- e) Operating parameters as set in manufacturer's instructions and maintenance schedules must be available and details of critical checks must be recorded.

Where Australian Standards have been published for particular instrumental techniques it is expected that these will be used in the facility. Where this is not the case, relevant ASTM or other verified procedures must be used. In many cases published procedures for the operation of analytical instrumentation are unavailable or are specific to a particular application. NATA will then require a facility to document its practice for use of analytical instrumentation. For example, this may include a description of the operation of the instrument, calibration procedures, specification of error-boundaries on the nominal values of calibration standards, frequency of use and nature of quality control samples, the analytical precision at various concentration levels, and maintenance procedures.

Specific items of instrumentation are listed below together with some guidelines for their in-house calibration, operation and maintenance.

#### Calorimeters

Determine water equivalents using certified benzoic acid at six monthly intervals

#### Conductivity meters

Conduct a one-point check on use and check the complete scale each year. Refer ASTM D1125.

#### Dissolved oxygen meters

On use, conduct a zero check and a one-point check by one of the following check procedures:

- i. Check against water saturated air;
- ii. Check against oxygen saturated water
- iii. Check against the value obtained by the Winkler titration.

A zero check can be carried out by measuring the dissolved oxygen (DO) for a prepared solution containing 1g sodium sulfite and a few crystals of cobalt chloride in 1 L of water. If the meter is properly calibrated the DO reading should be less than 0.2 mg/L.

## **pH meters**

Consult manufacturer's instructions for selection and preparation of an electrode system suitable for measuring the pH of the type of sample to be tested. Follow the manufacturer's instructions for the maintenance and use of the pH meter and the storage of the electrode system.

Calibrate the pH system according to manufacturer's instructions for measuring pH using at least two buffer solutions with traceable pH values. The buffer solutions should have similar ionic strengths to the test solutions. When practical, the pH of the buffers should bracket (i.e. be either side) of the pH of the test solution and ideally at least 3 pH units apart. Note that some meter systems require one of the buffers to be at pH 7.

The pH measuring system must be calibrated on each day it is used. The frequency of re-checking the calibration during use will be dependent on the purpose and required accuracy of the measurement.

Records must be kept of all calibrations and checks, including the temperature of all buffer and sample solutions measured.

Errors will be introduced if the ionic strength of a test solution is different to the buffers used to calibrate the electrode system. In some cases, for example pure water or salt brine solutions, these errors may be greater than a pH unit. Use of an electrode with a liquid junction designed to minimize the liquid junction potential will improve the accuracy of pH measurement for samples of this nature.

Tests for checking the performance of an electrode system may include measuring the slope response of the system, measuring the pH at zero potential, checking the junction potential or running other tests recommended by the instrument manufacturer. Note that the slope response is a check of the sensing electrode, while the junction potential is a check of the reference electrode.

Clogged liquid junctions are a common cause of erroneous pH readings, particularly when test samples include emulsions, suspensions, solids or semi-solid materials. It is important to ensure that the liquid junction remains free-flowing to provide a good electrical contact with the test sample. AS 2300.1.6 (1989) Appendix B describes a test for checking the effectiveness of the liquid junction of an electrode. The pH of a pH 7 phosphate buffer is measured and compared with the pH of the same buffer diluted 1:9 with freshly boiled de-ionised water. The pH of the diluted buffer should be  $0.20 \pm 0.05$  pH units higher than the original buffer. If this is not the case, manufacturer instructions for the care and maintenance of electrodes should be followed to clean electrodes and un-clog liquid junctions.

References: APHA Standard Methods for the Examination of Water and Waste Water, 21<sup>st</sup> Edition (2005), Method 4500-H<sup>+</sup>; AS 2300.1.6 – 1989, and references therein.

## **Turbidimeters**

Conduct a one-point check appropriate to the anticipated turbidity of the sample being measured, and a complete calibration each year. Refer APHA 2130B. (Reference standards may be purchased or made up in the laboratory. Check manufacturer supplied standards annually against formazin standards.)

## **Autoanalysers (eg. DFA, FIA, SFA, Discrete Analysers)**

The total system must be calibrated on use and monitored during each run with quality control measures such as reference materials, calibration/drift checks and blanks. The scheduled use of duplicates and recovery checks by spiked samples is also recommended.

Quality control procedures need to verify the efficiency of any chemical reactions which are part of the method (eg. cadmium reduction column used for nitrate analysis).

In general the equipment must be maintained in accordance with manufacturer's specifications. Temperature controlled enclosures (such as water baths) must be monitored with calibrated equipment (working thermometers or thermocouples). Individual components should be checked routinely and whenever quality control measures indicate a problem.

## **Spectrophotometers**

A great number of the quantitative analyses performed in a chemical testing facility involve some form of spectrophotometric or colorimetric measurement. It is essential that a facility carry out regular, recorded calibration checks on all spectrophotometers or automated devices employing spectrophotometers or colorimeters. A new calibration curve must be prepared at least every month.

Such calibrations must include checks on wavelength accuracy, absorbance, linearity, stray light and matching of cells. These calibrations must be carried out in accordance with the manufacturer's instructions and/or the codes of practice listed below at intervals appropriate to the test procedures and the physical environment within which the instrumentation is used (but at least every three months).

All instruments must be checked on use against appropriate reference materials. A blank and at least two points on the calibration curve must also be checked. These calibrations should be compared over time to detect any system deterioration.

Relevant standards for the checking and use of spectrophotometers include:

**a) Ultraviolet / visible**

AS 3753 *Recommended practice for chemical analysis by ultraviolet/visible spectrophotometry.*

ASTM E131 *Standard terminology relating to molecular spectroscopy.*

ASTM E169 *Standard practices for general techniques of ultraviolet-visible quantitative analysis.*

ASTM E275 *Standard practices for describing and measuring performance of ultraviolet, visible and near infrared spectrophotometers.*

ASTM E925 *Standard practice for monitoring the calibration of ultraviolet-visible spectrophotometers whose spectral slit width does not exceed 2nm.*

ASTM E958 *Standard practice for measuring practical spectral band-width of ultraviolet-visible spectrophotometers.*

**b) Infrared**

ASTM E168 *Standard practices for general techniques of infrared quantitative analysis.*

ASTM E275 *Standard practice for describing and measuring performance of ultraviolet, visible and near-infrared spectrophotometers.*

ASTM E932 *Standard practice for describing and measuring performance of dispersive infrared spectrophotometers.*

## **Spectrometers**

Instrument performance must be routinely monitored during use with reference materials. Calibration graphs must be prepared using a blank and three to five solutions of standards covering the expected concentration range of analyte in the sample. This may be adequate for a linear graph, however, for a polynomial fit the graph should be prepared with a blank plus five to six solutions of standards. For atomic absorption, linearity checks must be done in the absorbance mode. Spectrometer components and supporting equipment must also be adequately maintained and checked periodically in accordance with documented procedures to ensure optimal instrument performance. (This may need to be done by external technicians.) Relevant standards for the checking and use of spectrometers include:

**a) Atomic absorption**

AS 2134 *Recommended practice for chemical analysis by atomic absorption spectrometry.*

*Part 1 Flame atomic absorption spectrometry*

*Part 2 Graphite furnace spectrometry*

*Part 3 Vapour generation atomic absorption spectrometry*

ASTM E1184 *Standard practice for electrothermal (graphite furnace) atomic absorption analysis.*

APHA 3111 *Metals by flame atomic absorption spectrometry.*

APHA 3112 *Metals by cold-vapour atomic absorption spectrometry.*

APHA 3113 *Metals by electrothermal atomic absorption spectrometry.*

APHA 3114 *Arsenic and selenium by hydride generation/atomic absorption spectrometry.*

**b) Atomic emission and X-ray fluorescence**

The Association will consider submissions from any facility that proposes the use of a factory calibrated atomic emission (arc-spark) spectrometer. Each case will be considered on its merits.

AS 2563 *Wavelength dispersive X-ray fluorescence spectrometers -Determination of precision.*

AS 2883 *Analysis of metals - Procedures for the setting up, calibration and standardization of atomic emission spectrometers using arc/spark discharge.*

AS 3641 .1 *Recommended practice for atomic emission spectrometric analysis - Principles and techniques.*

ASTM E135 *Standard terminology relating to analytical chemistry for metals, ores and related material.*

**c) Inductively coupled plasma**

AS 3641.2 *Recommended practice for atomic emission spectrometric analysis - Inductively coupled plasma excitation*

AS 4873.1 *Recommended practices for inductively coupled plasma – mass spectrometry (ICP-MS) – Principals and techniques*

APHA 3120 *Metals by plasma emission spectroscopy.*

Direct Current Plasma spectrometric techniques may also be used in laboratories.

**d) Nuclear magnetic resonance**

ASTM E386 *Standard practice for data presentation relating to high resolution NMR spectroscopy.*

## **Chromatographs**

**a) Gas chromatographs (GC)**

Instrument performance must be routinely monitored during use with reference materials. System components (eg. integrators, ovens, electronic amplifiers and detectors) must also be checked periodically, and records kept.

**b) Liquid chromatography, including high performance (or high pressure) liquid chromatographs (HPLC) and ion chromatography:**

The total system must be monitored during use with reference standards. Loss of efficiency may be detected by chronological comparison of reference material measurements. System components (eg. pumping system and detectors) must be subject to periodic checks and details must be recorded.

Relevant standards for the checking and use of chromatographic instrumentation include:

AS 3741 *Recommended practice for chemical analysis by ion chromatography.*

ASTM D1945 *Test methods for analysis of natural gas by gas chromatography.*

ASTM D4626 *Standard practice for calculation of GC response factors.*

ASTM E260 *Standard practice for packed column gas chromatography.*

ASTM E355 *Standard practice for gas chromatography terms and relationships.*

ASTM E516 *Standard practice for testing thermal conductivity detectors used in gas chromatography.*

ASTM E594 *Standard practice for testing flame ionization detectors used in gas or supercritical fluid chromatography.*

ASTM E682 *Standard practice for liquid chromatography terms and relationships.*

ASTM E685 *Practice for testing fixed-wavelength photometric detectors used in liquid chromatography.*

ASTM E697 *Standard practice for use of electron-capture detectors in gas chromatography.*

ASTM E840 *Standard practice for using flame photometric detectors in gas chromatography.*

ASTM E1151 *Standard practice for ion chromatography terms and relationships.*

ISO 10301 *Water quality – Determination of highly volatile halogenated hydrocarbons - gas chromatographic methods.*

ISO 19739 *Natural gas - Determination of sulfur compounds using GC.*

BS 5443 *Recommendations for a standard layout for methods of chemical analysis by gas chromatography.*

## **Particle size analysis**

Instrument performance should be routinely monitored, during use, with reference materials.

ASTM F660 *Standard practice for comparing particle size in the use of alternative types of particle counters.*

## **Section 5**

### **Classes of test**

The following is a listing of the classes and subclasses of tests available in the field of Chemical Testing.

The classes of test shown below are a first order description of a facility's accreditation coverage. Most accreditations are described in more detail and usually include reference to specific determinations, analytical techniques, relevant standard test methods and specifications or in-house test methods and, in some cases, include analytical ranges and limits of reporting. Some tests are listed in the fields of Biological Testing or Mechanical Testing as well as in the field of Chemical Testing. Accreditation for these tests may be granted in whichever field of testing best suits the facility concerned.

Accreditation may be granted for tests performed in mobile laboratories, field laboratories or locations, or marine test rafts as well as in formal laboratory accommodation. Where the existing classes of test do not cover the needs of a facility, the Chemical Testing Accreditation Advisory Committee welcomes proposals for additional classes to be included in this field.

- 7.01 Metals and alloys
  - .01 Ferrous materials
  - .11 Copper and copper alloys
  - .12 Aluminium and aluminium alloys
  - .13 Tin and tin alloys
  - .14 Lead and lead alloys
  - .15 Magnesium and magnesium alloys
  - .16 Zinc and zinc alloys
  - .17 Nickel, chromium, cobalt and their alloys
  - .18 Titanium and titanium alloys
  - .19 Tungsten and tungsten alloys
  - .31 Precious metals
  - .71 Sampling
  - .91 Other tests
  - .99 Other metals and alloys
  
- 7.02 Metallic coatings and treatment solutions
  - .01 Metallic coatings
  - .02 Conversion coatings
  - .11 Plating solutions
  - .21 Anodising solutions
  - .31 Metal finishing materials
  - .71 Sampling
  
- 7.03 Ores and minerals
  - .01 Iron ores
  - .02 Copper ores
  - .03 Aluminium ores
  - .04 Tin ores
  - .05 Lead ores
  - .06 Zinc ores
  - .07 Nickel ores
  - .08 Manganese ores
  - .09 Molybdenum ores
  - .10 Tungsten ores
  - .11 Chromium ores
  - .12 Uranium ores
  - .13 Magnesium ores
  - .18 Precious metal ores
  - .19 Other ores
  - .30 Silicate rocks
  - .31 Mineral sands
  - .32 Silica sands
  - .33 Limestone and dolomite
  - .34 Gypsum
  - .35 Phosphate rock
  - .36 Asbestos
  - .39 Other minerals
  - .61 Metallurgical products
  - .71 Sampling
  - .81 Sieve analysis
  - .82 Heavy liquid tests
  - .91 Thermal analyses
  - .99 Geochemical samples for trace elements
  
- 7.08 Corrosion tests
  - .01 Salt spray tests
  - .02 Dezincification tests
  - .10 Other tests

- 7.11 Cements, concrete and related products
  - .01 Portland cement
  - .02 Blended cement
  - .03 Masonry cement
  - .11 Pozzolans
  - .31 Concrete
  - .32 Mortar
  - .33 Fibre cement
  - .41 Aggregates
  - .51 Other materials
  - .71 Sampling
  
- 7.12 Clays, ceramics and related materials
  - .01 Clays
  - .02 Ceramics
  - .03 Refractories
  - .04 Lime
  - .05 Glass
  - .71 Sampling
  
- 7.14 Oil shale
  - .01 Sampling
  - .11 Chemical tests
  - .99 Other tests
  
- 7.15 Crude petroleum
  - .01 Sampling
  - .11 Chemical tests
  
- 7.16 Fuels
  - .01 Petroleum gaseous fuels
  - .02 Petroleum liquid fuels
  - .03 Coals and coke
  - .04 Charcoal
  - .05 Other solid fuels
  - .06 Biofuels and blends
  - .11 Octane number rating
  - .71 Sampling
  
- 7.17 Lubricants
  - .01 Oils and greases
  - .02 Solid lubricants
  - .71 Sampling
  
- 7.19 Bituminous materials
  - .01 Bitumens and asphalts
  - .02 Tars and tar products
  - .13 Bituminous mixtures
  - .71 Sampling
  
- 7.20 Solvents
  - .11 Chemical tests
  - .12 Physical tests
  - .71 Sampling
  
- 7.21 Miscellaneous petroleum products
  - .01 Waxes
  - .02 Petrolatums
  - .03 White oils
  - .04 Antifreeze and de-icing fluids
  - .05 Hydraulic fluids
  - .06 Additives to fuels and lubricants
  - .07 Temporary corrosion preventives
  - .08 Electrical insulating oils and compounds

- .09 Petrochemical feedstocks
- .10 Soluble and emulsifying oils
- .71 Sampling
  
- 7.22 Trace analyses in petroleum products
  
- 7.26 Paints and related surface coatings
  - .11 Chemical tests
  - .21 Physical tests
  - .31 Outdoor weathering tests
  - .32 Marine underwater tests
  - .33 Fresh water immersion tests
  - .35 Humidity tests
  - .36 Salt spray tests
  - .37 Artificial weathering tests
  - .71 Sampling
  
- 7.27 Resins
  - .01 Sampling
  - .11 Chemical tests
  - .12 Physical tests
  
- 7.28 Pigments
  - .01 Sampling
  - .11 Chemical tests
  - .12 Physical tests
  
- 7.31 Explosives and associated materials
  - .11 Chemical analyses
  - .12 Stability tests
  - .13 Physical tests
  - .71 Sampling
  
- 7.35 Carbon black
  - .01 Sampling
  - .11 Chemical tests
  - .12 Physical tests
  
- 7.36 Rubber
  - .11 Chemical analyses
  - .12 Dispersion of carbon black
  - .13 Resistance to chemicals
  - .14 Swelling in liquids
  - .15 Permeability
  - .16 Water vapour absorption
  - .21 Density and specific gravity
  - .22 Flammability tests
  - .23 Hardness
  - .24 Electrical resistance
  - .31 Accelerated weathering tests
  - .32 Outdoor weathering tests
  - .81 Sampling
  - .99 Other tests
  
- 7.37 Plastics
  - .11 Chemical analyses
  - .12 Resistance to chemicals
  - .13 Water vapour transmission
  - .14 Permeability
  - .21 Density and specific gravity
  - .22 Flammability tests
  - .23 Electrical resistance
  - .24 Thermal properties
  - .25 Flow properties
  - .26 Thermal analyses

- .31 Colour fastness
- .41 Accelerated ageing tests
- .42 Outdoor weathering tests
- .81 Sampling
- .99 Other tests
  
- 7.38 Leather
  - .11 Chemical analyses
  - .12 Physical tests
  - .71 Sampling
  
- 7.39 Adhesives and sealants
  - .11 Chemical analyses
  - .12 Physical tests
  - .71 Sampling
  
- 7.46 Textiles and related products
  - .11 Identification of fibres
  - .12 Quantitative analysis of mixtures and blends
  - .13 Chemical tests
  - .21 Electrical resistance
  - .22 Flammability tests
  - .23 Resistance to insect attack
  - .31 Colour fastness
  - .81 Sampling
  - .99 Other tests
  
- 7.47 Paper, paperboard and pulp
  - .11 Fibre composition
  - .12 Chemical analyses
  - .13 Water vapour transmission
  - .81 Sampling
  - .99 Other tests
  
- 7.51 Foods
  - .01 Cereal products
  - .02 Nuts and nut products
  - .03 Dairy products
  - .04 Meat and meat products
  - .05 Fish, crustaceans and molluscs
  - .06 Sugar and sugar products
  - .07 Confectionery
  - .08 Fruit, jams and other fruit products
  - .09 Vegetables and vegetable products
  - .10 Alcoholic beverages
  - .11 Soft drinks and cordials
  - .12 Fruit juices and concentrates
  - .13 Edible fats and oils
  - .14 Margarine
  - .15 Eggs and egg products
  - .21 Pet foods
  - .31 Antioxidants in foods
  - .32 Colorants in foods
  - .33 Preservatives in foods
  - .34 Allergens
  - .35 Other food additives
  - .49 Other food products
  - .51 Vitamins in foods
  - .61 Shelf-life tests
  - .71 Sensory evaluation tests
  - .81 Sampling

- 7.52 Residues and contaminants in foods and agricultural materials
  - .01 Elements
  - .02 Pesticides
  - .03 Veterinary Chemicals
  - .04 Insect infestation
  - .05 Mycotoxins
  - .07 Polyhalogenated biphenyls
  - .23 Chlorinated dioxins and dibenzofurans
  - .71 Sampling
  - .99 Other residues and contaminants
  
- 7.56 Drugs and pharmaceuticals
  - .01 Drugs
  - .02 Medicinal and veterinary preparations
  - .03 Vitamins
  - .04 Antibiotics
  - .05 Hormones
  - .06 Vaccines and sera
  - .07 Enzymes
  - .08 Chemicals used in compounding pharmaceuticals
  - .71 Sampling
  
- 7.57 Cosmetics, perfumes and essential oils
  - .01 Cosmetics
  - .02 Perfumes
  - .03 Essential oils
  - .04 Hygiene products
  - .71 Sampling
  
- 7.58 Fats, oils and waxes
  - .01 Animal sources
  - .02 Vegetable sources
  - .71 Sampling
  
- 7.59 Detergents and related products
  - .01 Soaps
  - .02 Synthetic detergents
  - .03 Wetting and emulsifying agents
  - .06 Biodegradability tests
  - .11 Fire prevention foams
  - .71 Sampling
  
- 7.61 Agricultural products and materials
  - .01 Cereal grains and by-products
  - .02 Oil seeds and by-products
  - .03 Stockfoods
  - .04 Vitamins in stockfoods
  - .05 Wood and timber treatment materials
  - .11 Insecticide and acaricide formulations
  - .12 Herbicide formulations
  - .13 Fungicide formulations
  - .19 Tobacco and tobacco products
  - .21 Fertilizers and liming materials
  - .22 Soils
  - .23 Plant tissue
  - .24 Compost
  - .71 Sampling
  - .99 Other agricultural products

- 7.65 Air
  - .01 Industrial emissions (for stack monitoring)
  - .03 Ambient air
  - .04 Pristine air
  - .06 Meteorological monitoring
  - .71 Sampling
  
- 7.66 Waters
  - .01 Waters for potable and domestic purposes
  - .02 Waters for irrigation and stock
  - .03 Waters for industrial and steam-raising purposes
  - .04 Sewage
  - .05 Trade wastes
  - .06 Saline waters
  - .07 Ground waters
  - .71 Sampling
  - .99 Other waters
  
- 7.70 Gases and aerosols
  - .01 Industrial gases
  - .02 Gases for medical use and diving gases
  - .03 Calibration gases and mixtures
  - .04 Industrial fumes and emissions
  - .05 Atmospheric pollution
  - .06 Air in confined spaces
  - .71 Sampling
  - .99 Other gases and mixtures
  
- 7.71 Biological monitoring
  - .01 Blood alcohol
  - .02 Elements
  - .03 Fluoride
  - .11 Pesticide residues
  - .12 Agricultural chemical residues
  - .21 Drugs and drug metabolites
  - .71 Sampling
  - .99 Other substances
  
- 7.75 Calibration of instruments
  - .01 Gas analysers
  - .02 Breath analysers
  - .03 Particulate air samplers
  - .04 Flow measurement devices
  - .05 Dynamic gas blenders
  - .11 Hydrometers
  - .99 Other instruments to Class of test 7.75
  
- 7.78 Mine safety equipment
  - .01 Gas instruments
  - .02 Respirators
  
- 7.81 Constituents of the environment
  - .11 Waters other than saline
  - .12 Saline waters
  - .21 Air
  - .31 Soils
  - .32 Sediments
  - .33 Solid wastes
  - .34 Biosolids
  - .35 Leachate procedures
  - .41 Atmospheric dust fall
  - 51 Biota
  - .71 Sampling

- 7.82 Workplace environment and hazards
  - .01 Asbestos fibre counting
  - .02 Respirable quartz
  - .03 Inhalable dust
  - .04 Respirable dust
  - .05 Organic vapours
  - .06 Metals and metal compounds
  - .07 Inorganic gases
  - .08 Synthetic mineral fibre counting
  - .09 Welding fumes and gases
  - .10 Air in confined spaces
  - .11 Mine atmospheres
  - .12 Mine roadway dusts
  - .13 Isocyanates
  - .21 Engine emissions
  - .22 Diesel particulates
  - .31 Asbestos identification
  - .71 Sampling
  - .81 Volume measurement (air)
  - .99 Other substances
  
- 7.84 Residues and contaminants in constituents of the environment
  - .01 Elements
  - .02 Pesticides
  - .03 Polyhalogenated biphenyls
  - .04 Halogenated hydrocarbons
  - .05 Phenols
  - .06 Phthalates
  - .11 Hydrocarbons
  - .12 Petroleum hydrocarbons
  - .13 Mineral oils
  - .21 Monocyclic aromatic hydrocarbons
  - .22 Polycyclic aromatic hydrocarbons
  - .23 Chlorinated dioxins and dibenzofurans
  - .24 Polybrominated diphenylethers
  - .31 Asbestos
  - .35 Cyanide
  - .41 Explosives
  - .51 Nutrients
  - .52 Environment level nutrients
  - .71 Sampling
  - .99 Other substances
  
- 7.90 Motor vehicles
  - .01 Vehicle emissions
  - .02 Fuel consumption tests
  - .99 Other tests
  
- 7.94 Particle sizing
  
- 7.95 Laboratory reagents
  - .11 Chemical tests
  - .12 Physical tests
  - .71 Sampling
  
- 7.97 Miscellaneous materials and products
  - .11 Chemical tests
  - .12 Physical tests
  - .71 Sampling
  - .99 Other tests
  
- 7.99 Approval
  - .01 Approved asbestos fibre counters
  - .02 Approved asbestos identifiers

## Section 6

### References

This section lists publications referenced in this document. The year of publication is not included as it is expected that only current versions of the references shall be used.

#### Standards

- AS 1038.3 *Coal and coke-Analysis and testing-Proximate analysis of higher rank coal*
- AS 1038.5 *Coal and coke-Analysis and testing-Gross specific value*
- AS 1038.6.1 *Coal and coke-Analysis and testing-Higher rank coal and coke-Ultimate analysis-Carbon and hydrogen*
- AS 1038.6.3.2 *Coal and coke-Analysis and testing-Higher rank coal and coke-Ultimate analysis-Total sulfur-Higher-temperature combustion method*
- AS 1038.12.1 *Coal and coke-Analysis and testing-Higher rank coal-Caking and coking properties-Crucible swell number*
- AS 1038.12.2 *Coal and coke-Analysis and testing-Higher rank coal-Caking and coking properties Determination of Gray-King coke type*
- AS 1038.12.3 *Coal and coke-Analysis and testing-Higher rank coal-Caking and coking properties-Dilatation*
- AS1038.12.4.1 *Coal and coke-Analysis and testing-Higher rank coal-Caking and coking properties-Plasticity-Continuous-torque Gieseler method*
- AS 1038.15 *Coal and coke-Analysis and testing-Higher rank coal ash and coke ash-Ash fusibility*
- AS 1038.16 *Coal and coke-Analysis and testing-Assessment and reporting of results*
- AS 1038.20 *Coal and coke-Analysis and testing-Higher rank coal-Hardgrove grindability index*
- AS 1038.21.1.1 *Coal and coke-Analysis and testing-Higher rank coal and coke-Relative density-Analysis sample/density bottle method*
- AS 1038.21.1.2 *Coal and coke-Analysis and testing-Higher rank coal and coke-Relative density-Analysis sample/volumetric method*
- AS 1152 *Specification for test sieves*
- AS 1289.0 *Methods for testing soil for engineering purposes – General requirements and list of methods*
- AS 1290.1 *Linear measurement instruments used in construction - general requirements*
- AS 1290.4 *Linear measurement instruments used in construction - retractable steel pocket rules*
- AS 1349 *Bourdon tube pressure and vacuum gauges*
- AS 1580.101.3 *Paints and related materials-Methods of test-Standard procedure for stoving*
- AS 1580.101.4 *Paints and related materials-Methods of test-Conditions of test-Temperature control*
- AS 1580.101.5 *Paints and related materials-Methods of test-Conditions of test - Temperature and humidity control*
- AS 1580.107.3 *Paints and related materials-Methods of test-Determination of wet film thickness by gauge*
- AS 1580.108.1 *Paints and related materials-Methods of test-Determination of dry film thickness on metallic substrates-Non-destructive methods*
- AS 1580.108.2 *Paints and related materials-Methods of test-Dry film thickness-Paint inspection gauge*
- AS 1580.202.1 *Paints and related materials-Methods of test-Density*
- AS 1580.202.2 *Paints and related materials-Methods of test-Density of water dispersed paints subject to foaming*
- AS 1580.202.4 *Paints and related materials-Methods of test-Determination of density by pressure cup*
- AS 1580.204.1 *Paints and related materials-Methods of test-Fineness of grind*
- AS 1580.211.1 *Paints and related materials-Methods of test-Degree of settling*
- AS 1580.211.2 *Paints and related materials-Methods of test-Ease of manual re-incorporation*
- AS 1580.213.1 *Paints and related materials-Methods of test-Relative dry hiding power*
- AS 1580.213.2 *Paints and related materials-Methods of test-Dry hiding power – Contrast ratio*
- AS 1580.214.1 *Paints and related materials-Methods of test-Consistency-Stormer viscometer*
- AS 1580.214.2 *Paints and related materials-Methods of test-Consistency-Flow cup*
- AS 1580.214.3 *Paints and related materials-Methods of test-Viscosity-Cone-and-plate*
- AS 1580.214.4 *Paints and related materials-Methods of test-Consistency-Rotoinner*
- AS 1580.214.5 *Paints and related materials-Methods of test-Consistency-Rotational viscometer*
- AS 1580.301.1 *Paints and related materials-Methods of test-Non-volatile content by mass*
- AS 1580.301.2 *Paints and related materials-Methods of test-Non-volatile content by volume (volume solids)*
- AS 1580.401.1 *Paints and related materials-Methods of test-Surface dry condition*
- AS 1580.401.3 *Paints and related materials-Methods of test-Drying times using a BK-type recorder*
- AS 1580.401.6 *Paints and related materials-Methods of test-Hard dry condition (mechanical thumb test)*
- AS 1580.401.8 *Paints and related materials-Methods of test-No-pick-up-time of road marking paint*
- AS 1580.402.1 *Paints and related materials-Methods of test-Bend test*
- AS 1580.403.1 *Paints and related materials-Methods of test-Scratch resistance*

- AS 1580.403.2 *Paints and related materials-Methods of test-Abrasion resistance*
- AS 1580.408.5 *Paints and related materials-Methods of test-Pull-off test*
- AS 1580.459.1 *Paints and related materials-Methods of test-Resistance to washing*
- AS 1580.461.1 *Paints and related materials-Methods of test-Determination of resistance to yellowing (dark chamber)*
- AS 1580.481.1.12 *Paints and related materials-Methods of test Coatings-Exposed to weathering - Degree of colour change*
- AS 1580.482.1 *Paints and related materials-Methods of test-Determination of fastness to light of interior paint*
- AS 1580.601.1 *Paints and related materials-Methods of test –Colour-Visual comparison*
- AS 1580.602.2 *Paints and related materials-Methods of test-Measurement of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*
- AS 1984 *Vernier callipers (metric series)*
- AS 2001.1 *Methods of test for textiles-Conditioning procedures*
- AS 2026 *Laboratory glassware - Density hydrometers*
- AS 2102 *Micrometer callipers for external measurement*
- AS 2103 *Dial gauges and dial test indicators (metric series)*
- AS 2162.1 *Verification and use of volumetric apparatus-General-Volumetric glassware*
- AS 2162.2 *Verification and use of volumetric apparatus-Guide to the use of piston-operated volumetric apparatus (POVA)*
- AS 2193 *Calibration and classification of force-measuring systems*
- AS 2378 *Density bottles*
- AS 2706 *Numerical values-rounding and interpretation of limiting values.*
- AS 2850 *Chemical analysis - Interlaboratory test programs - For determining precision of analytical method(s) - Guide to the planning and conduct*
- AS 2853 *Enclosures-Temperature controlled-Performance testing and grading*
- AS 2856.3 *Coal petrography - Methods of microscopical determination of the reflectance of coal macerals*
- AS 4156.1 *Coal properties-Higher rank coal-Float and sink testing*
- AS 4156.2.1 *Coal preparation-Higher rank coal-Froth flotation-Basic test*
- AS 4964 *Method for the qualitative identification of asbestos in bulk samples*
- ASTM D5 *Standard test method for penetration of bituminous materials*
- ASTM D217 *Standard test methods for cone penetration of lubricating grease*
- ASTM D445 *Standard test method for kinematic viscosity of transparent and opaque liquids (and the calculation of dynamic viscosity)*
- ASTM D562 *Standard test method for consistency of paints measuring Krebs units (KU) viscosity using a Stormer type viscometer*
- ASTM D1071 *Standard test methods for volumetric measurement of gaseous fuel samples*
- ASTM D1125 *Standard test methods for electrical conductivity and resistivity of water*
- ASTM D1321 *Standard test method for needle penetration of petroleum waxes*
- ASTM D2162 *Standard practice for basic calibration of master viscometers and viscosity oil standards*
- ASTM D2699 *Standard test method for research octane number of spark-ignition engine fuel*
- ASTM D2700 *Standard test method for motor octane number of spark-ignition engine fuel*
- ASTM D3195 *Standard practice for rotameter calibration*
- ASTM D4052 *Standard test method for density and relative density of liquids by digital density meter*
- ASTM E126 *Standard test method for inspection, calibration and verification of ASTM hydrometers*
- BS 733 *Pyknometers. Methods for calibration and use of pyknometers*
- BS 1041: Part 5 *Temperature measurement. Guide to selection and use of radiation pyrometers*
- BS 1042: Sec.2.1 *Measurement of fluid flow in closed conduits. Velocity area methods. Method using pitot static tubes*
- BS 1797 *Schedule for tables for use in the calibration of volumetric glassware*
- BS 2648 *Performance requirements for electrically-heated laboratory drying ovens*
- BS 3403 *Specification for indicating tachometer and speedometer systems for industrial, railway and marine use*
- BS 4035 *Specification for linear measuring instruments for use on building and civil engineering constructional works. Steel measuring tapes, steel bands and retractable steel pocket rules*
- BS 4372 *Specification for engineers' steel measuring rules*
- BS 4791 *Specification for calorimeter bombs*
- IEC 60068 *Environmental testing of electrical components (several parts)*
- IP 50 *Cone penetration of lubricating grease*
- IP 71 (Sect. 1) *Petroleum products–Transparent and opaque liquids–Determination of kinetic viscosity and calculation of dynamic viscosity*
- IP 71 (Sect. 2) *Glass capillary kinematic viscometers-Specification and operating instructions*
- IP 160 *Crude petroleum and liquid petroleum products-Laboratory determination of density-Hydrometer method*

IP 170 *Petroleum products and other liquids-Determination of flash point–Abel closed cup method*  
ISO 649.1 *Laboratory glassware-Density hydrometers for general purposes - Part 1 Specification*  
ISO 649.2 *Laboratory glass ware-Density hydrometers for general purposes - Test methods and uses*  
ISO 650 *Relative density 60/60 degree F-hydrometers for general purposes*

### **NATA publications**

NATA Policy Circular 12 *NATA Accreditation Requirements for the Performance of Calibrations In-house*  
NATA Technical Note 8 *In-situ Calibration of Barometers*  
NATA Technical Note 13 *User Checks of Balance Calibration*  
NATA Technical Note 17 *Guidance on the Validation and Verification of Chemical Test Methods*  
NATA Technical Note 19 *Liquid-in-glass Thermometers-Selection, Use and Calibration Checks*  
NATA Technical Note 23 *Guidelines for Quality Control in the Analytical Laboratory*  
NATA Technical Note 27 *Internal Audits and Management Review*  
NATA Technical Note 28 *In-house Calibrations and Measurement Uncertainty*  
NATA Technical Note 33 *Guidelines for Estimating and Reporting Measurement Uncertainty of Chemical Test Results*

### **Other references**

ISO/IEC Guide 99: 2007, *International vocabulary of basic and general terms in metrology*. (VIM 3)

EURACHEM/CITAC *Quantifying Uncertainty in Analytical Measurement* (2nd Edition).

This is available on the Internet at [www.eurachem.bam.de/guides/pdf](http://www.eurachem.bam.de/guides/pdf)

ISO/IEC Guide 98 *Guide to the Expression of Uncertainty in Measurement* (GUM)

Guidance documents covering the implementation of specific accreditation requirements are also available from the ILAC ([www.ilac.org](http://www.ilac.org)) and APLAC ([www.ianz.govt.nz/aplac/](http://www.ianz.govt.nz/aplac/)) websites.