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Standard Practice for Competence of Air Emission Testing Bodies[1]

This standard is issued under the fixed designation D7036; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This Practice specifies the general requirements for the competence to carry out sampling and analysis for air emissions tests of stationary sources. It covers testing and calibration performed using standard methods, non-standard methods and methods developed by the AETB.

1.2 This Practice is applicable to all bodies engaged in air emission testing regardless of the number of personnel or the scope of testing activities. When an AETB does not undertake one or more of the activities covered by the Practice such as developing test methods, the requirements of those clauses do not apply.

1.3 The notes given provide clarification of text, examples, and guidance. The notes do not contain requirements and do not form an integral part of this Practice.

NOTE 1—ISO/IEC 17025:2005 has been considered when elaborating this Practice. Several, but not all, statements of this Practice are consistent with ISO/IEC 17025:2005.

NOTE 2—This Practice is a specification for competence. It does not address accreditation or any activities specific to accreditation such as on-site inspections/audits by external assessors or proficiency testing.

2. Referenced Documents

2.1 *ASTM Standards:*

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

2.2 *Other Documents*

NCSL RP-1 Establishment and Adjustment of Calibration Intervals[2]

ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories[3]

3. Terminology

3.1 For air quality and other terms not defined here in, please refer to ASTM D1356-15 Standard Terminology Relating to Sampling and Analysis of Atmospheres.

3.2 *Terms Specific to this Standard:*

3.2.1 *air emission testing*—the direct testing of emissions to the atmosphere from stationary sources by sampling, measurement, and analysis including determination of the relative accuracy and QA/QC auditing of continuous monitoring systems. This definition excludes fuel sampling, visible emission evaluations, and daily operation and maintenance of continuous monitoring systems.

3.2.2 *air emission testing body (AETB)*—a company or other entity that conducts Air Emission Testing.

3.2.3 *approved test protocol*—a statement, approved by the relevant regulatory authority or other receiving party, of the objectives of a specific test program and the test methods (and deviations) to be used to achieve those objectives. Also referred to as "sampling plan" or "test plan."

3.2.4 *competence*—for an AETB, competence is the ability to consistently produce acceptable data of known and documented quality. An AETB shall be considered competent if it has in place and continually operates under a Quality System meeting the requirements of this Practice.

3.2.5 *contract*—any oral or written agreement between an AETB and a customer to provide services to that customer.

3.2.6 *external qualification exam*—a Qualification Exam meeting the requirements of 6.2.3.4 and administered by an Independent Proctor. In addition, an External Qualification Exam must be: *(1)* approved with regard to content and format by a Qualification Exam Provider. This test will be administered in accordance with rules established by the Provider; and *(2)* administered and scored by an Independent Proctor.

3.2.7 *independent proctor*—a person not employed by or associated with the AETB who oversees the administration of the External Qualification Exam according to the rules established by the qualification exam provider.

3.2.8 *internal qualification exam*—a Qualification Exam meeting the requirements of 6.2.3.4 and administered by the AETB.

3.2.9 *known and documented quality*—for the purposes of this Practice, data will be of known and documented quality if

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[2] NCSL International, Wilderness Place, Suite 107, Boulder, Colorado 80301-5404.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

collected under a Quality System meeting the requirements of this Practice (including adherence to approved test protocols and deviations).

3.2.10 *performance data*—data generated or collected or both by the AETB indicating conformance with customer and regulatory requirements and with the requirements of this Practice. Such data may include feedback from regulatory agency observers, customers, internal and external audit results, results from participation in proficiency testing programs and any other data that provides direct, objective documentation of the quality of data collected by the body.

3.2.11 *performance issue*—a Performance Issue (or Quality System problem) may be of two types: *(1)* some aspect of a test program or test data failed to meet expectations; and *(2)* failure to follow the Quality Manual or a required component of the manual is absent.

3.2.12 *preventive action*—preventive action is a proactive process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints. Apart from the review of the operational procedures, the preventive action might involve the analysis of data, including trends and risk analysis.

3.2.13 *proficiency test*—a means of evaluating an AETB's performance relative to a given set of criteria.

3.2.13.1 *Discussion*—A proficiency test, for example, may be a blind determination of a reference sample, comparison of paired sampling trains, or recovery from dynamic spiking.

3.2.14 *qualification credentials*—evidence that the Qualified Individual meets the requirements of 6.2.3 and that clearly states the scope of the Qualification for example, a certificate from an AETB.

3.2.15 *qualification exam*—a test to evaluate the knowledge of the individual to become qualified.

3.2.16 *qualification exam provider*—a recognized association who oversees, maintains, and approves the format and content of Qualification Exams meeting the requirements of this Practice. A Qualification Exam Provider also develops policies and procedures for the administration of the Exams.

3.2.17 *qualified individual (QI)*—an individual who meets the requirements specified in 6.2.3 of this Practice.

3.2.18 *request*—any request of an AETB by a customer for services. A request may be verbal or in writing. (for example, request for proposal).

3.2.19 *tender*—any formal or informal response to a customer's request by an AETB (for example, proposal).

3.2.20 *test method*—an externally or internally published procedure for sampling or analysis or both of emissions from stationary sources.

4. Significance and Use

4.1 This Practice establishes general criteria for a Quality System that, when followed, helps ensure consistently acceptable data quality from an AETB. The relevant criteria contained in this Practice shall be addressed in the AETB's Quality Manual, which shall contain or refer to additional specific criteria and requirements where relevant and necessary. The Quality Manual and its implementation (including test protocols, reports, and personnel testing) shall provide the sole basis for determining the conformance of the AETB with this standard.

NOTE 3—This Practice assesses the overall ability of an AETB to deliver data of known and documented quality on a consistent basis regardless of the test method used. There is no requirement to define a scope of testing. It is a requirement of this Practice that prior to performing a test method for the first time, the AETB has in place resources, training, and QA/QC consistent with this Practice to insure data of acceptable quality are produced.

4.2 This Practice is for use by AETBs in developing the quality, administrative, and technical systems that govern their operations. Clients, regulatory authorities, and accreditation bodies may also use it in confirming or recognizing the competency of AETBs.

NOTE 4—This Practice is performance-based; that is, it focuses on the actual performance (in other words, consistent generation of data of known and documented quality) of the AETB rather than on an extensive collection of prescriptive criteria that may or may not be relevant to a particular AETB. It also focuses on the education and qualifications of the individual tester.

NOTE 5—There has been an effort in the development of this Practice to keep the paperwork and administrative burdens on affected AETBs to the minimum required for an effective program.

5. Organization and Management

5.1 *Organization:*

5.1.1 The AETB shall have in place a structure, including a Quality System that enables it to continually monitor and improve its ability to deliver its scope of services. This ability shall be measured by Performance Data.

5.1.2 The organization of the AETB shall be clearly defined including its place in any parent organization, and the relationships between quality management, technical operations, and support services.

5.1.3 It is the responsibility of the AETB to carry out its activities in such a way as to meet the requirements of this Practice, the requirements of local, state and federal laws and regulations, and to meet the needs of the client and regulatory authorities.

5.1.4 The AETB shall:

5.1.4.1 Have in place a system to collect and document Performance Data from all relevant sources.

5.1.4.2 Provide its employees with the resources and authority to initiate corrective actions and to verify and document their effectiveness.

5.1.4.3 Be legally identifiable, that is, it shall meet the applicable legal requirements of the governmental jurisdiction in which it conducts business. It shall be organized and shall operate so that its facilities and resources meet the requirements of this Practice.

5.1.4.4 Be organized so that staff members are not subject to undue pressure or inducement that might inappropriately influence their judgment or results of their work, including quality issues.

5.1.4.5 Be organized so that confidence in its independence of judgment and integrity is maintained at all times.

5.1.4.6 Be organized so that staff members are aware of both the extent and limitations of their responsibilities.

5.1.4.7 Provide adequate supervision of technical staff, including trainees, by persons familiar with relevant methods and procedures, the purpose of the test project, and with assessment of testing results. Only Qualified Individuals may supervise a test.

5.1.4.8 Have a Technical Manager or Director (however named) who has overall responsibility for the technical operations of the AETB and has demonstrated competence in air emissions testing activities through education or professional experience, or both.

5.1.4.9 Have a Quality Manager (however named) who has responsibility for the Quality System and its implementation. The quality manager shall have authority and responsibility for ensuring that the requirements of this Practice are implemented and maintained. The quality manager must have direct access to the highest levels of management at which decision are made on policies affecting the AETB.

NOTE 6—The Quality Manager may also be the Technical Manager in AETBs with limited staff. Whenever possible, the quality and technical manager positions should be filled independently.

5.1.4.10 Have a Qualified Individual on-site for each test project who is qualified for each test method performed.

5.1.4.11 Be able to provide documentation or otherwise demonstrate, on request from the persons or organizations evaluating its competence, that it complies with the relevant and appropriate federal, state, and local requirements for conducting testing procedures under its scope, including compliance with this Practice.

5.1.4.12 Be able to provide documentation or otherwise demonstrate, on request from the persons or organizations evaluating its competence, that it complies with applicable local, state, and federal requirements governing health and safety, transportation, shipping and other relevant requirements.

5.2 *Management System:*

5.2.1 *Quality Policy*—The AETB shall develop and disseminate a quality policy. A quality policy is a formal statement signed by top management that states the commitment by top management and staff to conform to the requirements documented in the Quality Manual and to this Practice.

5.2.1.1 The management of the AETB shall define and document its quality policy, quality objectives, and commitment to quality.

5.2.1.2 The AETB shall ensure that its quality policy includes recognition of the needs and expectations of its customers. The AETB shall also ensure that its quality policy is understood, implemented, and maintained at all levels within the AETB.

5.2.2 *Quality System*—The AETB shall establish, maintain, and operate under a documented Quality System as a means of ensuring that its operations are appropriate to providing air emission testing services and meet the requirements of this Practice.

5.2.2.1 The Quality System shall be designed to ensure the required degree of completeness, representativeness, comparability, and uncertainty (within the limits of uncertainty documented in the test method) needed to meet the data quality objectives of each project undertaken by the AETB.

5.2.2.2 The Quality System and the AETB's conformance to the Quality System shall be documented to the extent necessary to ensure consistent achievement of data quality objectives for projects undertaken by the AETB.

NOTE 7—Data quality objectives (however named) have always been a part of any test program. Subsections 5.2.2.1 and 5.2.2.2 do not establish new requirements. Data quality objectives may be defined in the testing method (for example, bias <5 %, leak rate ±0.6.5 in. H2O, conversion efficiency > 6.30%) or may be defined by regulation or by the client.)

5.2.3 *Quality Manual*—The Quality System shall be documented in a Quality Manual and supporting Quality System documentation. If an existing, Quality Manual adequately addresses each of these topics in the standard, it should not need to be rewritten. Portions not relevant to the scope of the AETB's services may be eliminated. This documentation shall be available for use by the AETB staff and for review by clients, regulatory authorities, and accreditation bodies upon request. The Quality System documents shall be maintained current under the responsibility of the Quality Manager.

NOTE 8—The following link provides one option for structuring a Quality Manual, but AETBs will be audited against this standard and should consider addressing the elements of this standard in the AETB's QA Manual in the order in which they are presented in the standard to simplify the process of conducting an audit against this standard. (Link: http://www2.epa.gov/quality/epa-qar-2-epa-requirements-qualitymanagement-plans)

5.3 *Document Control:*

5.3.1 *General*—The AETB shall establish and maintain procedures to control all documents that form part of its Quality System (internally generated or from external sources), such as regulations, standards, other normative documents, test or calibration methods or both, as well as drawings, software, specifications, instructions and manuals. These procedures shall be sufficient to preclude the use of invalid or obsolete documents or both.

5.3.2 Quality system documents generated by the AETB shall be uniquely identified. Such identification shall include the date of issue or revision or both identification, page numbering, the total number of pages or a mark to signify the end of the document, and the issuing authority(ies).

5.3.3 Changes to documents shall be reviewed and approved by the same organizational group that performed the original review unless specifically designated otherwise. Personnel conducting the review shall have access to pertinent background information upon which to base their review and approval. Where practicable, the altered or new text shall be identified in the document or the appropriate attachments.

5.3.4 If the AETB's documentation control system allows for the amendment of documents by hand pending the re-issue of the documents, the procedures and authorities for such amendments shall be defined. Amendments shall be clearly marked, initialed and dated. A revised document shall be formally re-issued as soon as practicable.

5.3.5 Procedures shall be established to describe how changes in documents maintained in computerized systems are made and controlled.

5.4 *Review of Requests, Tenders, and Contracts:*

5.4.1 The AETB shall establish and maintain procedures for the review of requests, tenders and contracts. The policies and procedures for these reviews leading to a contract shall ensure that:

(a) The requirements, including the methods to be used, are adequately defined, documented and understood by the AETB;

(b) The AETB has the capability and resources to meet the requirements of the customer;

(c) The appropriate test methods are selected and are capable of meeting the customer's requirements.

Any differences between the request or tender and the contract shall be resolved before any work begins. Each contract shall be acceptable both to the AETB and the customer.

5.4.2 Records of reviews, including any changes, shall be maintained. Records shall also be maintained of pertinent discussions with a customer relating to the customer's requirements or the results of the work during the period of execution of the contract.

5.4.3 The review shall also cover any work that is to be subcontracted by the AETB.

5.4.4 The customer shall be informed of any deviation from the contract prior to or during its execution.

5.4.5 If a contract needs to be amended after work has commenced, the amendment shall be reviewed and any amendments shall be communicated to all affected personnel.

5.5 *Subcontracting:*

5.5.1 When an AETB subcontracts work it normally performs whether because of unforeseen reasons (for example, workload, need for further expertise or temporary lack of capacity) or on a continuing basis (for example, through permanent subcontracting, agency or franchising arrangements), this work shall be placed with a competent subcontractor. A competent subcontractor is one that, for example, complies with this Practice for the work in question.

5.5.2 The AETB shall advise the client of the arrangement in writing and, when appropriate, gain the approval of the client, preferably in writing.

5.5.3 The AETB is responsible to the client for the subcontractor's work, except in the case where the client or a regulatory authority specifies which subcontractor is to be used.

5.5.4 The AETB shall maintain a register of all subcontractors that it uses and a record of the evidence of compliance with this Practice for the work in question.

5.6 *Purchasing of Services and Supplies:*

5.6.1 The AETB shall have a policy and procedure(s) for the selection and purchasing of services and supplies it uses that affect the quality of the tests. Procedures shall exist for the purchase, reception and storage of reagents and laboratory consumable materials relevant for the tests.

5.6.2 The AETB shall ensure that purchased supplies and reagents and consumable materials that affect the quality of tests are not used until they have been inspected or otherwise verified as complying with standard specifications or requirements defined in the methods for the tests concerned. These services and supplies used shall comply with specified requirements. Records of actions taken to check compliance shall be maintained.

5.6.3 Purchasing documents for items affecting the quality of AETB output shall contain data describing the services and supplies ordered. These purchasing documents shall be reviewed and approved for technical content prior to release.

5.7 *Service to the Customer:*

5.7.1 The AETB shall be willing to cooperate with customers or their representatives in providing access to the AETB's facilities for the purpose of witnessing the tests performed for that customer provided that the AETB ensures confidentiality to other customers.

5.7.2 The AETB shall seek feedback, both positive and negative, from its customers for example by customer satisfaction surveys or during review of test reports or both. The feedback shall be used and analyzed to improve the Quality System, services provided by the AETB and customer service.

5.8 *Complaints:*

5.8.1 The AETB shall have a policy and procedure for the resolution of complaints received from customers or other parities.

5.8.2 Records shall be maintained of all complaints, the investigations undertaken and the corrective actions taken by the AETB.

5.9 *Non-conforming Work:*

5.9.1 The AETB shall have policies and procedures that shall be implemented when any aspect of its testing or calibration work or both, or the results of this work, do not conform to its own procedures or the agreed requirements of the client. The policies and procedures shall ensure that:

(a) The responsibilities and authorities for the management of nonconforming work are designated and actions (including halting of work and withholding of test reports, as necessary) are defined and taken when nonconforming work is identified;

(b) An evaluation of the significance of the nonconforming work is made;

(c) Corrective actions are taken within an appropriate time period, together with any decision about the acceptability of the nonconforming work;

(d) Where necessary, the client is notified and work is halted or re-done.

5.9.2 Where the evaluation indicates that the nonconforming work could recur or that there is doubt about the compliance of the AETB's operations with its own policies and procedures, the corrective action procedures given in 5.11 of this Practice shall be followed.

5.10 *Improvement:*

5.10.1 The AETB shall continually improve the effectiveness of its Quality System through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management reviews.

5.11 *Corrective Action:*

5.11.1 *General*—The AETB shall establish a policy and procedure and shall designate appropriate authorities for implementing corrective action when nonconforming work or departures from the policies and procedures in the Quality System or technical operations have been identified.

NOTE 9—Causes of non-conforming work may be of two types: *(1)* Common causes are attributed to random variation in any system and are not correctable through a corrective action process. Common causes are not likely to be repeated. An example may be an experienced field technician forgetting to sign a data sheet. *(2)* Special causes are the result of some systematic flaw in the Quality System and are thus likely to be repeated. While in some instances a special cause can be identified after a single instance (for example, inadequate technician training) sometimes an analysis of performance feedback must be made to determine which quality problems are of a systematic nature. It is these systematic problems that should be addressed by the corrective action procedures in this section.

5.11.2 *Cause Analysis*—The procedure for corrective action shall start with an investigation to determine the root cause(s) of the problem.

5.11.3 *Selection and Implementation of Corrective Actions*—Where corrective action is needed, the AETB shall identify potential corrective actions. It shall select and implement the action(s) most likely to eliminate the problem and to prevent recurrence.

5.11.4 Corrective actions shall be to a degree appropriate to the magnitude and the risk of the problem. The AETB shall document and implement any required changes resulting from corrective action investigations.

5.11.5 *Monitoring of Corrective Actions*—The AETB shall monitor the results to ensure that the corrective actions taken have been effective.

5.11.6 *Additional Audits*—Where the identification of nonconformances or departures casts doubts on the AETB's compliance with its own policies and procedures, or on its compliance with this Practice, the AETB shall ensure that the appropriate areas of activity are audited in accordance with this Practice as soon as possible.

5.12 *Preventive Action:*

5.12.1 Needed improvements and potential sources of nonconformities, either technical or concerning the Quality System, shall be identified. When improvement opportunities are identified or if preventive action is required, action plans shall be developed, implemented and monitored to reduce the likelihood of the occurrence of such nonconformities and to take advantage of the opportunities of improvement.

5.12.2 Procedures for preventive actions shall include the initiation of such actions and the application of controls to ensure that they are effective.

5.13 *Control of Records:*

5.13.1 *General:*

5.13.1.1 The AETB shall establish and maintain procedures for handling and storage of quality and technical records. Quality records shall include reports from customer and regulatory authority feedback, internal audits and management reviews as well as records of corrective and preventive actions.

5.13.1.2 All records shall be legible and shall be stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss. Retention times of records shall be established.

5.13.1.3 All records shall be held secure and in confidence.

5.13.1.4 The AETB shall have procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records.

5.13.2 *Technical Records:*

5.13.2.1 The AETB shall retain records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each test report or calibration certificate issued, for a defined period. The records for each test or calibration shall contain sufficient information to facilitate, if possible, identification of factors affecting the uncertainty and to enable the test or calibration to be repeated under conditions as close as possible to the original. The records shall include the identity of personnel responsible for the sampling, performance of each test or calibration or both and checking of results.

5.13.2.2 Other records include but are not limited to quality records, results of internal and external audits, training and qualification records for personnel, performance feedback, gas certifications, and chain of custody records.

5.13.2.3 Observations, data and calculations shall be recorded at the time they are made and shall be identifiable to the specific task.

5.13.2.4 When mistakes occur in records, each mistake shall be crossed out, not erased, made illegible or deleted, and the correct value entered alongside. All such alterations to records shall be dated and signed or initialed by the person making the correction. In the case of records stored electronically, equivalent measures shall be taken to avoid loss or change of original data.

5.14 *Internal Audits:*

5.14.1 The AETB shall annually conduct internal audits of its activities to verify that its operations continue to conform to the requirements of the Quality System. Such audits shall be carried out by qualified personnel who, whenever practical, are independent of the activity audited.

NOTE 10—Nothing in this section should be inferred to require or allow a breach of client confidentiality.

5.14.2 *Internal Audit Procedure:*

5.14.2.1 Conformance to this Practice shall be determined in stages as follows:

(a) An evaluation of the AETB's Quality Manual to ensure that it addresses all relevant requirements of this Practice.

(b) A determination of the AETB's conformance to its Quality Manual as indicated by a review of the AETB's Performance Data and subsequent corrective actions.

5.14.2.2 Deficiencies identified from internal audits must be linked to specific Performance Issues.

5.14.2.3 Determination of effective corrective actions undertaken in response to deficiencies is at the discretion of the AETB. The AETB shall document the effectiveness of any corrective actions undertaken..

5.14.3 The AETB shall participate in third party Proficiency Testing programs if available and relevant to their scope of

work (as determined by organizations requiring use of Proficiency Testing). Results from these programs shall be used to assess the effectiveness of the quality program. Upon failure of any Proficiency Test, the AETB shall initiate corrective action.

5.14.4 The AETB shall collect Performance Data. Results of this data, along with any testing company comments, shall be accessible to clients, potential clients, and regulatory authorities. The AETB shall inform clients that this data is available for review.

NOTE 11—Nothing in this section should be inferred to require or allow a breach of client confidentiality.

NOTE 12—If a national database for dissemination of AETB performance data becomes available, AETBs are encouraged to make use of this tool to meet the requirements of 5.14.4.

NOTE 13—AETBs are encouraged to seek a periodic, independent, external assessment of conformity to this Practice. Because air emission testing is a field intensive activity, a thorough assessment may consist solely of a field audit (rather than a "home base" audit) if adequate documentation is available in the field.

5.15 *Management Reviews:*

5.15.1 The AETB's top management shall periodically conduct a review of the AETB's Quality System and services to ensure their continuing suitability and effectiveness. The review shall include assessing opportunities for improvement and the need for changes to the Quality System.

5.15.1.1 Management review shall take into account the following inputs:

(a) Tesults of recent internal and external audits;
(b) Status of corrective and preventive actions;
(c) Changes in the volume and type of work;
(d) Customer feedback;
(e) Follow-up actions from previous management reviews;
(f) Recommendations for improvement.

5.15.1.2 Management review shall include any decisions and actions related to:

(a) Improvement of the effectiveness of the Quality System;
(b) Improvement of the services offered by the AETB;
(c) Any resource needs.

5.15.2 Findings of management reviews and the actions that arise from them shall be recorded. The management shall ensure that those actions are carried out within an appropriate and agreed timescale.

6. Technical Requirements

6.1 *General:*

6.1.1 Many factors are involved in determining the effectiveness and reliability of the services provided by the AETB. These factors include contributions from:

(a) Personnel (see 6.2);
(b) Accommodation and environmental (see 6.3);
(c) Test methods and method validation (see 6.4);
(d) Equipment (see 6.5);
(e) Measurement traceability (see 6.6);
(f) Sampling (see 6.7);
(g) The handling of test items (see 6.8).

6.1.2 These factors affect the total uncertainty of measurement depending on the type of test method. The AETB shall take into account these factors in developing and implementing test methods and procedures, in training and qualification of personnel and in the selection of equipment.

6.2 *Personnel:*

6.2.1 The AETB management shall ensure the competence of all who operate specific equipment, perform tests or calibrations or both, evaluate results, and sign test reports and calibration certificates. When using staff undergoing training, appropriate supervision shall be provided. Personnel performing specific tasks shall be qualified on the basis of appropriate education, qualification, training, experience, examination, or demonstrated skills or combination thereof, as required.

NOTE 14—The personnel responsible for the opinions and interpretation included in test reports should, in addition to appropriate qualification, training, experience and satisfactory knowledge of the test methods carried out, also have understanding of the processes tested and the significance of any deviations occurring in test data.

6.2.2 The management of the AETB shall formulate requirements with respect to the education, training and skills of the AETB personnel. The AETB shall have a policy and procedures for identifying training needs and providing training to personnel. The AETB shall also have procedures to evaluate the effectiveness of such training. The training program shall be relevant to the present and anticipated tasks of the AETB.

6.2.3 The AETB shall provide Qualified Individuals to oversee and supervise test projects. The AETB must provide a least one Qualified Individual on-site at all times during a test project who is qualified in the test methods employed for that test project.

6.2.3.1 To initially qualify as a Qualified Individual under this Practice an individual shall:

(a) Meet the experience requirements of 6.2.3.3;
(b) Pass a Qualification Exam meeting the requirements of 6.2.3.4;
(c) Sign a statement, to be kept on file with the AETB, agreeing that all test projects conducted under his/her supervision will conform to the AETB's Quality Manual and to this Practice in all respects.

6.2.3.2 A Qualified Individual must requalify every five years for the methods for which he or she is qualified, by retaking and passing a qualification exam that meets the requirements of 6.2.3.4 covering the methods for which the individual is seeking requalification.

6.2.3.3 At a minimum, an individual seeking Qualification shall meet the following experience requirements

(1) Participation in at least ten tests that employ the Method(s) for which they are seeking qualification, or
(2) Completion of at least one year of general air emissions testing. Such experience should include, where applicable:

(a) Instrument calibration;
(b) Equipment Preparation and Packing;
(c) Field set up;
(d) Equipment operation and data recording;
(e) Sample recovery, handling, and custody;
(f) Sample analysis;
(g) Data Reduction including relevant calculations;
(h) Quality Control;
(i) Reporting.

6.2.3.4 Each Qualification Exam shall:

(1) Define clearly the scope of knowledge and experience it is designed to evaluate. This shall include the Method or Methods covered.

(2) Be sufficiently rigorous to assess not only knowledge of the applicable Method(s) as written but also degree of field experience.

(3) Consist of questions covering (where relevant):

(a) Knowledge of the Methods as written;

(b) Limitations of the Methods;

(c) Potential field conditions that may affect results;

(d) Any special considerations needed for low-level measurements;

(e) Shipping and packing considerations;

(f) Sources of uncertainty associated with Methods;

(g) Knowledge of proper operation and calibration of equipment.

6.2.3.5 External Qualification Exams shall be used if available. An individual that has been qualified with an Internal Qualification Exam shall requalify with an External Qualification Exam within three years of the initial availability of the External Exam, or when the individual requalifies within five years after prior qualification, whichever is sooner.

6.2.3.6 The Qualification Credentials of each Qualified Individual shall be available for inspection at the test site.

NOTE 15—Qualification of individuals by itself, does not ensure quality data. It remains the responsibility of the AETB to ensure that all personnel, equipment, and other resources deployed on any testing project are appropriate to the specific circumstances and conditions of that project and that the total requirements of this Practice are followed at all times. Also, having a Qualified Individual on-site should not relieve the regulatory authority from their established observation and oversight role.

6.2.4 The management of the AETB shall authorize specific personnel to perform particular types of sampling, test or calibration or both, to issue test reports, to give opinions and interpretations and to operate particular types of equipment. The AETB shall maintain records of the relevant authorizations(s), competence, educational and professional qualifications, training, skills and experience of all technical personnel, including contracted personnel. This information shall be readily available and shall include the date on which authorization or competence or both is confirmed.

NOTE 16—The term "contracted personnel" includes only personnel not directly employed by the AETB but under the direct supervision of the AETB. It is not necessary to maintain records for personnel employed by and supervised by outside contractors or sub-contractors.

6.2.5 The AETB shall use personnel who are employed by, or under contract to, the AETB. Where contracted and additional technical and key support personnel are used, the AETB shall ensure that such personnel are supervised (see 6.2.3.1) and competent and that they work in accordance with the AETB's Quality System.

6.2.6 The AETB shall maintain current job descriptions for managerial, technical and key support personnel involved in tests or calibrations or both.

NOTE 17—Job descriptions are dependent on a company's operational model and for that reason can be defined in many ways. A company should consider identifying key functions within its operations and writing job descriptions that convey the duties, responsibilities, authorities, and expertise (in other words, experience, education, and or training) of an individual performing the required function. Job descriptions need not be linked to specific individuals, but may be developed for categories of jobs performed (in other words, crew leader, technician, and so forth).

6.3 *Accommodation and Environmental Conditions:*

6.3.1 The AETB shall ensure, to the extent practical, that environmental conditions do not invalidate the results or adversely affect the required quality of any measurement. Environmental conditions that can affect the results of tests shall be documented.

NOTE 18—In many cases, the environmental conditions under which an air emission test takes place are not under the control of the AETB. It is the responsibility of the AETB to inform the client or regulatory authority of the possible effects of environmental conditions on data quality. The decision to abort or delay a test due to environmental conditions rests with the client or regulatory authority unless the conditions pose a safety threat to personnel performing the test, in which case, the AETB shall have the authority to abort or delay the test.

6.3.2 To the extent practical, concurrent activities that are incompatible with the collection or analysis of quality data shall be avoided. Measures shall be taken to avoid cross-contamination.

6.3.3 Access to and use of areas affecting the quality of the tests shall be controlled. The AETB shall determine the extent of control based on the particular circumstances and requirements of the test project.

6.3.4 Measures shall be taken to ensure good housekeeping in all locations where testing or analysis activities are conducted. Special procedures shall be prepared where necessary.

6.4 *Test Methods:*

6.4.1 The AETB shall use appropriate methods and procedures for all testing performed. These include sampling, analysis, handling, transport, storage and preparation of items to be tested, and, where appropriate an estimation of the measurement uncertainty as well as statistical techniques for analysis of test data.

6.4.2 Methods for air emission testing performed for compliance purposes are currently defined by applicable regulations. Alternatives or deviations from these methods shall be detailed in the test protocol or the test report or both along with any authorizations for the alternatives or deviations.

6.4.3 A site specific test plan (protocol) shall be used for each test project. All procedures and activities specified in the test plan shall meet the requirements of this Practice and shall, at a minimum, address the following points, unless the AETB has a valid and documented reason for not doing so:

(a) Objectives and summary of test program;

(b) Description of the source, operating conditions and process to be tested;

(c) Description of the test matrix;

(d) Sampling locations;

(e) Test methods to be used, number of runs to be performed, and sampling duration of each run;

(f) Process data to be collected;

(g) QC procedures and audits (including applicable field blanks);

(h) Reporting format, reporting units and other requirements;

(i) Plant entry and safety requirements;

(j) Responsibilities of test personnel;
(k) Tentative test schedule.

NOTE 19—The use of field blanks for quality control is strongly encouraged.

6.4.4 The test plan shall be the primary source of information on testing and quality procedures for the test project. It, along with the AETB's Quality Manual, is the document against which an assessor shall perform any required on-site assessment. The contents of this plan shall be communicated to all personnel participating in the test project prior to the start of the project. Deviation from test plan shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the client or any relevant regulatory authority (as appropriate).

NOTE 20—It is recommended that AETBs adopt a standard test plan format and that this format follow examples provided by regulatory authorities.

6.4.5 The AETB shall have instructions on the use and operation of all relevant equipment, and on the handling and preparation of items for testing where the absence of such instructions could jeopardize the results of tests. All instruction, standards, manuals and reference data relevant to the work of the AETB shall be kept up to date and shall be made readily available to personnel.

6.4.6 The AETB shall use test methods, including methods for sampling, which meet the needs of the client and which are appropriate for the tests it undertakes. Methods established in international, regional or national standards shall be used as practicable. The AETB shall ensure that it uses the latest valid edition of a method unless it is not appropriate or possible to do so. When necessary, the method shall be supplemented with additional details to ensure consistent application. The AETB shall inform the client when the method proposed by the client is considered to be inappropriate or out of date

6.4.7 *AETB-developed Methods*—The introduction of test methods developed by the AETB for its own use shall be a planned activity and shall be assigned to qualified personnel equipped with adequate resources. Plans shall be updated as development proceeds and effective communication amongst all personnel involved shall be ensured.

6.4.8 *Non-standard Methods*—When it is necessary to use methods not covered by standard methods, these shall be subject to agreement with the client and any relevant regulatory authority and shall include a clear specification of the client's requirements and the purpose of the test program. They shall be described in the test protocol and reported in the same way as standard methods. Any validation data shall be included in the test protocol.

6.4.9 When it is necessary for an AETB to perform test methods that it has not performed previously, but which are established, published, or validated test methods, the AETB must take appropriate actions to ensure that the applicable requirements of this Practice are properly addressed before and during the performance of the new method.

6.4.10 *Uncertainty*—AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found.

NOTE 21—In certain cases the nature of the test method may preclude rigorous, metrologically and statistically valid, calculation of uncertainty of measurement. In these cases the AETB should at least attempt to identify all the components of uncertainty and make a reasonable estimation, and should ensure that the form of reporting of the result does not give a wrong impression of the uncertainty. Reasonable estimation should be based on knowledge of the performance of the method and on the measurement scope and should make use of, for example previous experience and validation data.

6.5 *Equipment and Reference Materials:*

6.5.1 The AETB shall have access to all items of sampling, measurement and test equipment required for the correct performance of the tests (including sampling, preparation of test items, processing and analysis of test data). In those cases where the AETB needs to use equipment outside its permanent control, it shall ensure that the requirements of this Practice are met.

6.5.2 Equipment and its software used for testing, calibration and sampling shall be capable of achieving the required accuracy and shall comply with specifications relevant to the tests concerned.

6.5.3 Calibration programs shall be established for key quantities or values of the instruments where these properties have a significant effect on the results. Before being placed into service, equipment (including that used for sampling) shall be calibrated or checked to establish that it meets the AETB's specification requirements and complies with the relevant standard specifications. The AETB shall confirm or establish a new calibration at an interval established by relevant regulations. If relevant regulations do not specify calibration interval, the AETB shall establish a calibration interval sufficient to ensure the equipment continually meets specification.

NOTE 22—The NCSL standard RP-1 is suggested as a reference to establish calibration intervals.

6.5.4 The AETB shall take precautions so that malfunctioning or inoperative equipment is not used in a test project.

6.5.5 Where applicable, all equipment under the control of the AETB and requiring calibration shall be labeled, coded or otherwise identified to indicate the status of calibration, including the date when last calibrated and the date or expiration criteria when recalibration is due.

6.5.6 Equipment shall be operated by trained and authorized personnel. Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) shall be readily available for use by the appropriate AETB personnel.

6.5.7 Records shall be maintained of each item of equipment and its software significant to the tests performed. The records shall include at least the following:

(a) Identity of the item;
(b) Manufacture's information, model and serial number or other unique ID;
(c) Calibration, repair, and maintenance history;
(d) Instruction manual or reference to its location;
(e) Current location, if appropriate.

When rental or loaned equipment is used, relevant records shall be obtained from the equipment provider.

6.5.8 The AETB shall provide for the safe handling, transport, storage, use and planned maintenance of measuring equipment to ensure proper functioning and in order to prevent contamination or deterioration.

6.6 *Measurement Traceability and Calibration:*

6.6.1 All equipment used for tests, including equipment for subsidiary measurements (for example, for environmental conditions) having a significant effect on the accuracy or validity of the result of the test, calibration or sampling shall be calibrated before being put into service. The AETB shall have an established program and procedure for the calibration of its equipment. Such a program shall include a schedule of calibration and a method to insure only properly calibrated equipment is used in the test program.

6.6.2 Reference materials shall, where possible, be traceable to certified reference materials.

6.6.3 Checks needed to maintain confidence in the calibration status of reference, primary, transfer or working standards and reference materials shall be carried out, as far as technically and economically practicable, according to defined procedures and schedules.

6.6.4 The AETB shall have procedures for safe handling, transport, storage and use of reference standards and reference materials in order to prevent contamination or deterioration and in order to protect their integrity.

6.7 *Sampling:*

6.7.1 The AETB shall have a sampling plan or procedures or both for sampling substances, materials or products for subsequent testing. The sampling plan or procedures or both shall be available at the location where sampling occurs. The sampling plan or procedures or both shall address the factors to be controlled to ensure the validity of the test results.

6.7.2 Where the customer requires deviations, additions to or exclusions from the documented plan or procedures or both, these shall be recorded in detail, included in all reports and shall be communicated to the affected personnel.

6.7.3 The AETB shall have procedures for recording relevant data related to sampling that forms part of the testing services. These records shall include the sampling procedure, the identification of the sampler, relevant environmental conditions and a means to identify the sampling location, as necessary.

6.8 *Handling of Test and Calibration Items:*

6.8.1 The AETB shall have procedures for the chain-of-custody, transportation, receipt, handling, protection, storage, retention or disposal or combination thereof of samples, sampling media and calibration materials, including all provisions necessary to protect the integrity of the sample or calibration material, and to protect the interests of the AETB and the client.

6.8.2 The AETB shall have a system for identifying samples, sampling media and calibration materials. The identification shall be retained throughout the life of the item. The system shall be designed and operated so as to ensure that items cannot be confused physically or when referred to in records or other documents. The system shall, if appropriate, accommodate a sub-division of groups of items and the transfer of items within and from the test location or AETB's facility.

6.8.3 Upon receipt of the sample, sampling media, or calibration material, abnormalities or departures from normal or specified conditions, as described in the test method, shall be recorded. When there is doubt as to the suitability of an item for use in a test, or when an item does not conform to the description provided, or the test required is not specified in sufficient detail, the AETB shall consult the client for further instructions before proceeding.

6.8.4 The AETB shall have procedures and appropriate facilities for avoiding deterioration, loss or damage to the sample, sampling media or calibration material during storage, handling and preparation. Handling instructions provided with the item shall be followed. When items have to be stored or conditioned under specified environmental conditions, these conditions shall be maintained, monitored and recorded. Where a sample is to be held secure, the AETB shall have arrangements for storage and security that protect the condition and integrity of the secured items or portions concerned.

6.9 *Assuring Quality of Test Results:*

6.9.1 The AETB shall have quality control procedures for monitoring the validity of the services provided where quality control procedures are not specified in the test methods.

6.9.2 Quality control data shall be analyzed and, where they are found to be outside pre-defined criteria as defined in the test methods, planned action shall be taken to correct the problem and to prevent incorrect results from being reported.

6.10 *Reporting:*

6.10.1 The results of each test or series of tests or carried out by the AETB shall be reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the test methods.

6.10.2 The report shall include all information requested by the client and relevant regulatory authority and necessary for the interpretation of the test results and all information required by the method used.

6.10.3 Each test report shall include at least the following information, unless the AETB has valid reasons for not doing so:

(a) A title;

(b) The name and address of the AETB, and the testing location;

(c) Unique identification of the test report and on each page an identification in order to ensure that the page is recognized as a part of the test report, and a clear identification of the end of the test report;

(d) The name and address of the client;

(e) Unambiguous identification of the substance, material or product sampled;

(f) The location of sampling, including any diagrams, sketches or photographs;

(g) Detailed process description and process operations for each test run;

(h) Identification of the method(s) used;

(i) A description and unambiguous identification of the item(s) tested;

(j) The date(s) of performance of the test;

(k) Reference to the test plan and procedures used by the AETB;

(l) The test results with, where appropriate, the units of measurement;

(m) Deviations from, additions to, or exclusions from the test protocol, test methods, the AETB's Quality Manual, or this Practice;

(n) information on specific test conditions, such as environmental conditions;

(o) A discussion of test results including the uncertainty associated with the test and discussion of possible errors or limiting conditions;

(p) Calibration certificates for all equipment significant to the testing performed;

(q) Documentation and sufficient raw data to verify and reproduce all report calculations;

(r) The name(s), function(s) and signature(s) or equivalent identification of person(s) authorizing the test report;

(s) Documentation of QI credentials;

(t) A signed statement by a responsible official that the AETB operates in conformance with the requirements of this Practice during the test project.

NOTE 23—It is recommended that the AETB include a statement specifying that reproducing portions of the test report may omit critical substantiating documentation or be taken out of context and that due care must be exercised in this regard.

NOTE 24—Air emission testing is a process that integrates sampling and analysis. The operating parameters of the source are often important for a complete and accurate interpretation of test results. AETBs, whenever possible, should incorporate information on relevant source process parameters (for example, raw material feed rates, steam flow, and so forth) measured during the testing period.

6.10.4 In the case of tests performed for internal clients, or in the case of a agreement with external clients, the results may e reported in a simplified way.

6.10.5 When opinions and interpretations are included, the AETB shall document the basis upon which the opinions and interpretations have been made. Opinions and interpretations shall be clearly marked as such in a test report.

6.10.6 Amendments to a test report after issue shall be made only in the form of a further document, or data transfer, which includes the statement: "Supplement to Test Report, serial number ... [or as otherwise identified]", or an equivalent form of wording. Such amendments shall meet all the requirements of this Practice.

6.10.7 When it is necessary to issue a complete new test report, this shall be uniquely identified and shall contain a reference to the original that it replaces.

7. Keywords

7.1 AETB; air emissions testing; data quality; emission measurement; sampling; source testing; stack testing; stationary source testing