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Standard Guide for Quality Management in an Organization That Samples or Tests Coal and Coke¹

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1. Scope

1.1 This guide describes the essential activities that are required to establish and operate a quality management system in a laboratory or organization that provides services in sample collection, sample preparation, or testing of coal, coke, or combustion residues from coal and coke.

NOTE 1—The word “laboratory” is used throughout this guide when referring to an organization that provides services in coal sampling or testing, or both. It is recognized, however, that the word may not be appropriate to an organization that does not perform actual laboratory sample testing.

1.2 The principles of this guide are suggested as being the minimum acceptable requirements for the management of quality in a coal or coke sampling or testing organization, although some elements may not be necessary or appropriate for organizations that provide limited services.

1.3 Laboratories meeting the requirements of this guide may or may not meet the requirements of the ISO 9000 series of standards.

NOTE 2—An accrediting body may also impose other nontechnical requirements such as payment of fees or submittal of quality documentation for review.

1.4 This guide is based upon many of the issues presented in Guide E548. The user may also consult Guide E882 for other items that may be pertinent. ISO Guide 25 has also been extensively consulted.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D346 Practice for Collection and Preparation of Coke Samples for Laboratory Analysis

D2013 Practice for Preparing Coal Samples for Analysis

D3180 Practice for Calculating Coal and Coke Analyses from As-Determined to Different Bases

D3302 Test Method for Total Moisture in Coal

D4182 Practice for Evaluation of Laboratories Using ASTM Procedures in the Sampling and Analysis of Coal and Coke

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E456 Terminology Relating to Quality and Statistics

E548 Guide for General Criteria Used for Evaluating Laboratory Competence³

E882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory

E1187 Terminology Relating to Conformity Assessment³

E1323 Guide for Evaluating Laboratory Measurement Practices and the Statistical Analysis of the Resulting Data

E1579 Guide for Ensuring Data Integrity in Highly Computerized Laboratory Operations³

2.2 Other ASTM Document:

Manual on Presentation of Data and Control Chart Analyses, ASTM Manual 7, 1996⁴

2.3 ISO Document:

Guide 25 General Requirements for the Competence of Calibration and Testing Laboratories⁵

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

⁴ The procedure described herein was adapted from *Basic Statistics—Tools for Continuous Improvement*, M. J. Kiemele and S. R. Schmidt, Air Academy Press, Colorado Springs, CO, 1991.

⁵ *Manual on Presentation of Data and Control Chart Analyses*, ASTM Manual 7, American Society for Testing and Materials, 1996.

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3. Terminology

3.1 *control limits, n*—limits on a control chart which are used as criteria for signaling the need for action, or for judging whether a set of data does or does not indicate a state of statistical control

3.1.1 *Discussion*—Action may be in the form of investigation of the source(s) of an “assignable cause,” making a process adjustment, or terminating the use of a process. (E456)

3.2 *calibration, n*—the set of operations which establishes, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, or values represented by a material measure, and the corresponding known values of a measurand. (E548)

3.2.1 *Discussion*—The act of calibration is also sometimes referred to as standardization. The result of a calibration is sometimes expressed as a calibration factor, or as a series of calibration factors in the form of a calibration curve.

3.3 *certified reference material, CRM, n*—a reference material, one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation that is issued by a certifying body.

3.4 *certifying agency, n*—an agency that, by virtue of its technical capability, reliability, and leadership, is recognized as capable of producing one or more reference materials, and certifying the magnitude of selected properties of the materials after testing or analyzing them using a reference method.

3.5 *control, statistical, n*—a process is in statistical control if the variations between the observed test results from it can be attributed to a constant system of chance causes. (E177)

3.6 *control material, CM, n*—a material of known property values, that is analyzed or tested concurrently with test samples or at specified intervals to evaluate the accuracy of a measurement process.

3.7 *quality assurance, for laboratories, n*—the activity of providing the evidence needed to establish confidence that laboratory data are of the requisite accuracy. (Precision and Bias) (E1187)

3.8 *quality control, n*—the process through which a laboratory measures its performance (of analyses and tests), compares its performance with standards, and acts on any differences. (E1187)

3.9 *quality manual, n*—a document stating the quality policy, and describing the quality management system and quality practices of an organization.

3.9.1 *Discussion*—The quality manual may incorporate by reference other documentation relating to the laboratory’s quality arrangements.

3.10 *reference material, RM, n*—a material or substance, one or more properties of which are sufficiently well-established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (E1187)

3.10.1 *Discussion*—Reference materials should bear sufficient resemblance to the material to be analyzed or tested so that no significant differences in procedures or corrections (for example, for interferences or interelement effects) are required.

3.11 *reference method, n*—a method that has been specified as capable, by virtue of recognized accuracy and authority, of providing reference data, which when verified by existing reference materials of the same or similar matrix, can be used to characterize reference materials.

3.12 *standard, n*—a means established by authority, of determining the measure of quantity, quality, extent, or value.

3.13 *standard operating procedure (SOP), n*—any written procedure describing a specific test method or any other aspect of the laboratory operation, including quality practices.

3.14 *standard reference material, n*—Because this term has been used in a variety of ways in this guide, it is not defined or used herein, although it is understood by some persons to be equivalent to certified reference materials.

4. Significance and Use

4.1 This guide describes the elements of a quality management system for an organization that samples, analyzes, or tests coal, coke, or their products.

4.2 The quality management system stresses the use of documented accountability and quality control procedures that serve to assure the laboratory personnel and its clients that adequate accuracy and precision are achieved in the routine performance of its sampling and testing activities, and that reported data were obtained from the samples submitted.

4.3 A laboratory may use this guide to develop its quality management system.

4.4 Laboratory clients, regulatory authorities, and organizations or individuals that evaluate the competency of testing laboratories may find this guide useful. Specific guidelines for evaluating a laboratory can be found in Practice D4182.

4.5 Other accountability and quality control procedures can be developed and may be considered equivalent if they provide all of the benefits previously outlined.

5. Components of a Quality Management System

5.1 A laboratory quality management system consists of the following principal components, which are described in detail in subsequent sections of this guide:

5.1.1 An organizational structure and management commitment designed to ensure that services are performed in a timely and accurate fashion.

5.1.2 A quality manual that documents all aspects of the quality management system;

5.1.3 A staff that has well-defined responsibilities and is trained not only in the technical procedures of sample collection, sample preparation, or sample testing, but also in the philosophy and methods of the quality management system;

5.1.4 Physical facilities and environments that are suitable for the performance of the tasks required;

5.1.5 Equipment and supplies that provide the capability to perform the services;

5.1.6 A quality assurance program that ensures that the laboratory constantly monitors and improves its performance;

5.1.7 Well-defined (that is, documented) procedures for (as appropriate) sample intake or collection, sample management, sample preparation, sample testing, and the calculation and reporting of test results;

5.1.8 A quality control program that constantly ensures that the testing procedures do provide accurate data;

5.1.9 Procedures to ensure that reports accurately reflect the test data, and attribute them to the appropriate sample;

5.1.10 A document control system to ensure that only the latest approved version of procedures are in use;

5.1.11 A record-keeping system that defines what records are required and the length of time that they must be maintained;

5.1.12 A program that provides for audits and reviews of the activities of the organization to ensure that the quality management system is performing as designed.

6. Organization and Management

6.1 Proper organization and management of the laboratory requires the following:

6.1.1 The laboratory is a legally identifiable entity organized and operated in such a way that its permanent, temporary, and mobile facilities meet the requirements of this guide;

6.1.2 The laboratory is organized in such a way that there is confidence in its independence of judgment and integrity at all times;

6.1.2.1 The laboratory ensures that its personnel are free from any commercial, financial, or other pressures that might adversely affect the quality of their work;

6.1.2.2 The laboratory has documented policies and procedures to protect clients' confidential information and proprietary rights;

6.1.3 The laboratory has the staff needed to carry out the laboratory's functions, and specifies and documents the responsibility, authority, and interrelations of all personnel who manage, perform, or verify work affecting the quality of sample collection, preparation, and testing;

6.1.4 The laboratory has a technical manager (however named) who has overall responsibility for the technical operations;

6.1.5 The laboratory has a quality manager (however named) who has responsibility for the quality management system and its implementation.

NOTE 3—The quality manager has direct access to the highest level of management at which decisions are taken on laboratory policy or resources, and has direct access to the technical manager. In some laboratories, the quality manager may also be the technical manager or a deputy technical manager.

6.1.5.1 The laboratory has a well-defined procedure to nominate deputies in case of absence of the technical or quality manager;

6.1.6 The laboratory provides supervision by persons familiar with the sample collection or test methods and procedures, the objectives of the tests and the assessment of the results;

6.1.7 The laboratory has written policies for continuous improvement;

6.1.8 The laboratory has well-defined procedures for soliciting customer feedback in a systematic way and for dealing with customer complaints;

6.1.9 The laboratory, if appropriate, has documents readily available attesting that the laboratory is certified or registered by a recognized agency.

7. Quality Manual

7.1 The quality manual documents the elements of the quality policy, the quality management system, and quality practices.

7.2 Contents of the quality manual are communicated to, understood by, and implemented by all of the staff.

7.3 The quality manual is readily available for use by the staff.

7.4 There is a well-defined procedure for keeping the manual current by modifying the manual whenever any quality system provision is changed. The individual(s) who has/have the authority to make changes is/are identified.

7.5 The quality manual or formal quality documents referenced by the manual contain:

7.5.1 A quality policy statement, including the purpose of the quality management system and the commitments to it by laboratory or institutional management;

7.5.2 A description of the organization and management structure of the laboratory, its place in any parent organization, and all relevant organizational charts;

7.5.3 Documentation of the responsibility, authority, and interrelation of all personnel who manage, perform, or verify work affecting the quality of calibrations and tests;

7.5.4 Identification of the laboratory's authorized signatories (where this concept is appropriate);

7.5.5 An outline of the documentation used in the quality management system;

7.5.6 A description of procedures for control and maintenance of documentation (Section 18);

7.5.7 Procedures to ensure that the laboratory has the appropriate facilities and resources before commencing any new test or contract;

7.5.8 Descriptions of or reference to a document that describes the major equipment and equipment maintenance schedules and procedures;

7.5.9 A list of procedures and tests that the laboratory performs routinely (Section 15);

7.5.10 Documented, standard operating procedures (SOPs), or references to same, for each procedure and test that is routinely conducted by the laboratory. Appropriate ASTM standards are referenced and, if the laboratory deals with international customers, international standards are referenced;

NOTE 4—The terms "standard operating procedure" and "SOP" are used in this guide to designate any written procedure whether it applies to a specific test method or to a procedure that is used in any other aspect of the laboratory operation, including quality elements. The laboratory may refer to such documents by a name other than standard operating procedure. Reference simply to published standards is generally inadequate because they may need to be supplemented by additional information pertaining to quality control activities that are not commonly covered in standard test methods. If an operating procedure deviates from an established standard, data should be available to demonstrate that the modified procedure provides results that are equivalent to those obtained by using the standard procedure.

7.5.11 Calibration procedures and the proper use of reference materials in calibration;

7.5.12 Verification practices, including interlaboratory comparisons or proficiency testing programs, use of reference materials to verify calibrations, and internal quality control procedures;

7.5.13 The laboratory's procedures for achieving traceability of measurements to specific samples (Section 12);

7.5.14 Procedures for recognizing testing discrepancies or nonconforming work or departures from documented policies and procedures, for taking corrective action in such instances, and for communicating the information to key personnel and (where appropriate) to clients;

7.5.15 Procedures to prevent unauthorized tampering with equipment or modification of control or test procedures, a current list of personnel who are authorized to make any required changes, and criteria to be used to determine when changes are required;

7.5.16 A list of persons who are authorized to permit exceptional departures from documented policies and procedures or from standard specifications, and descriptions of the extent of their responsibilities and authority;

7.5.17 Procedures for soliciting customer feedback and for dealing with customer complaints;

7.5.18 Procedures for protecting confidentiality and proprietary rights.

8. Staff

8.1 The laboratory has personnel with appropriate education, training, technical knowledge, and experience to conduct the operations of the laboratory.

8.2 Where appropriate, technical personnel are able to demonstrate a satisfactory knowledge of sample collection and sample preparation procedures, and are capable of collecting and preparing samples in accordance with appropriate methods or practices.

8.3 Where appropriate, technical personnel are able to demonstrate a satisfactory knowledge of test methods and of sample procurement and processing procedures for which they are responsible. Any procedure for which the laboratory claims competence can be performed by at least one capable individual.

8.4 A formal program is used to identify training needs and to train the technical staff to carry out the procedures for which the laboratory claims competence.

8.4.1 There is an ongoing procedure for evaluating the competence of laboratory personnel.

8.4.2 Records are kept of the relevant qualifications, training, skill, and experience of the technical personnel.

8.5 There is a formal program to train the staff in and to maintain its awareness of the quality management system including quality assurance and quality control methods.

9. Facilities and Environment

9.1 Laboratory facilities, including benches, desks, calculators, computers, supplies, energy sources, lighting, heating, ventilation, and cooling, are appropriate for proper performance of laboratory activities.

9.2 The environment in work areas supports the achievement of required accuracy of sampling or testing.

9.2.1 The laboratory monitors and controls environmental conditions. Appropriate attention is paid, for example, to dust, electromagnetic interference, electrical power voltage level and stability, room temperature and humidity, and sound and vibration levels.

9.2.2 There is in place a documented procedure to stop technical activities when environmental conditions might jeopardize results of tests, and a record is maintained of such occurrences.

9.2.3 Particular care is taken when activities are undertaken at sites other than the permanent laboratory premises.

9.3 Adequate measures are taken to ensure good housekeeping in the laboratory.

9.4 Work areas are separated effectively to prevent inadvertent interference or contamination.

9.5 Access to and use of all areas affecting the quality of results is controlled.

NOTE 5—It is the laboratory's responsibility to comply with relevant health and safety requirements. This aspect, however, is outside the scope of this guide.

10. Equipment and Supplies

10.1 All items of equipment and all supplies required for the proper performance of sample collection, sample preparation, and tests are available in the laboratory. If the laboratory needs to use equipment outside its permanent control, it ensures that the equipment meets the requirements of the appropriate procedure.

10.2 A copy of the manufacturer's instructions (where available) or other instructions are kept in reasonable proximity to the equipment.

10.3 For each major item of equipment, a log is maintained that includes: the name of the item of equipment and an unique identification number; the manufacturer's name; model identification; date received and date placed in service; condition when received (for example, new, used, reconditioned); current location; dates and results of calibrations or verifications and date of the next calibration or verification; details of maintenance carried out to date and planned for the future; and history of any damage, malfunction, modification, or repair.

10.4 All measuring and testing equipment is calibrated or verified for accuracy before being put into service.

10.4.1 Balances are sufficiently sensitive and accurate for the activities in which they are used.

10.4.2 The laboratory has an established program for periodically verifying the calibration status of its measuring and test equipment (Section 14). A record of calibration status is maintained in near proximity to all equipment in use and also, preferably, in the equipment log.

10.5 All equipment is properly maintained according to written procedures and according to a written schedule.

10.6 An updated list of critical parts is maintained and provisions are made to ensure that the list is used to immediately reorder needed spare parts in a timely fashion in order to keep the operation functional.

10.7 Any item of equipment that has produced results suspected to be in error, or that has been discovered to be defective, is immediately taken out of service and marked,

and, wherever possible, stored at a specified place until it has been tested, calibrated, or, if necessary, repaired.

10.7.1 The laboratory has well-defined procedures to examine the effect of any defect on previous tests, and is prepared to retest samples that may have been improperly tested because of such defect.

10.8 Unauthorized tampering with or modification of equipment is prohibited. Modifications are made only after a specific problem has been identified and only after approval by an authorized person, for instance, the technical manager. All corrective actions are documented and the equipment is verified for fitness before being placed in service.

10.9 Sufficient supplies (including reference materials) are kept in stock to ensure that all operations can function. A list of the quantities of critical consumable materials and supplies is maintained and routinely updated, and is used to reorder them in a timely manner.

10.9.1 Records are maintained for every reference material used in the laboratory, and include source, date of acquisition, and other information pertinent to their proper use.

10.10 Wherever appropriate, purchased equipment and consumable materials are not used until they have been inspected, calibrated, or otherwise verified as complying with any standard specifications relevant to the tests concerned.

11. Quality Assurance Program

11.1 The laboratory maintains a quality assurance program that continuously controls and evaluates its performance to ensure that test results meet the needs of its users and clients. The critical elements of the quality assurance system are listed as follows, and are discussed in detail in subsequent sections of this guide.

11.2 *Sample Identification and Data Control*—Documented procedures exist for sample intake or procurement, identification, preparation, and maintenance. Samples and test data are handled in a well-defined and controlled manner (see Sections 12 and 13 for details).

11.3 *Calibration of Equipment*—Documented procedures ensure the appropriate use of reference materials or standardized test equipment to calibrate equipment and instruments so that they provide accurate results (Section 14).

11.4 *Conducting Procedures and Test Methods*—Every technical procedure for sample procurement, sample preparation, equipment calibration, or sample testing is performed only in accordance with the latest, approved version of a written standard operating procedure (SOP) (Section 15).

11.5 *Quality Control Testing*—The on-going quality of results that are provided to clients is ensured by vigorously pursuing a quality control test program. Results of quality control testing are always documented and are reviewed regularly (Section 16 and Appendix X2 and Appendix X3).

11.6 *Data Review, Control, and Reporting*—There is a documented procedure for data transfer and review to ensure that the result of each test or activity is attributed to the proper sample and is reported accurately, clearly, unambiguously, and objectively (Section 17).

11.7 *Documentation*—Documentation and record keeping are performed in a timely manner and are adequate to ensure auditors, staff, and customers that key elements of the quality

management program are practiced and are accomplishing their objectives (Section 18).

11.8 *Audits and Reviews*—The laboratory conducts audits of operations (including its quality management program) on a routine basis to ensure that they are operating effectively (Section 19).

12. Collection, Intake, and Management of Test Samples

12.1 If the laboratory collects gross samples, it can demonstrate that personnel engaged in sample collection are adequately trained and able to accomplish the tasks in accordance with ASTM prescribed methods (for example, procedures in Practice D2234 / D3180).

12.2 There is a procedure to ensure that the laboratory and customer agree on the method of sampling for a particular job, and that a description of or reference to the test method used becomes a part of the sample log and final report.

12.3 Any mechanical sampling system for which the laboratory has responsibility is:

12.3.1 Tested for bias when it is put into service or when substantial modifications have been made;

12.3.2 Tested for bias on a relatively short-term, routine schedule, generally employing a simplified procedure;

12.3.3 Maintained in accordance with written procedures on a specified, routine basis;

12.3.4 Checked before and during the collection of the gross sample, including determination that sample mass is consistent with product throughput.

12.3.5 The laboratory maintains records of the condition of, maintenance and modifications performed on, and bias test results from mechanical sampling systems for which it has responsibility.

12.4 The laboratory has documented procedures for the receipt, retention, and safe disposal of test samples.

12.5 To ensure that there can be no confusion regarding the identity of samples at any time, the laboratory has a documented system for uniquely identifying samples to be tested. The laboratory assigns to each sample a unique laboratory identifier (ID), for instance, a unique number of letter/number combination. Each sample or subsample is labeled with its ID in a way that it will not be separated from the sample or rendered unreadable during its residence in the laboratory. All laboratory work records, intermediate sample containers, data sheets, and reports clearly show the laboratory ID. The ID number is included on any invoice for work on the sample.

12.6 For each sample, a sample log is maintained that contains information required for historical reference, such as account or job number, mass or volume of sample, condition of sample, type of sample, top size of sample, person or organization submitting sample, location from which the sample was collected (if known), date and time of collection (if known), date and time samples were received in the laboratory, and type of container. The sample log is also used to maintain a record of chain-of-custody of a sample.

12.7 Instructions provided by the customer about the sample are communicated to appropriate personnel and are followed by them.

12.8 Where there is any doubt as to the sample's suitability for testing, where the sample does not conform to the description provided, or where the test required is not fully specified, a specified, responsible individual consults the client for further instruction before proceeding. Laboratory personnel have specific responsibilities to establish whether the sample has been adequately prepared, or whether the client requires preparation to be undertaken in or arranged by the laboratory.

12.9 Because oxidation and moisture changes occur readily to many coal samples, documented practices are designed to minimize deterioration or damage to the test sample during storage, handling, preparation, and testing (**Note 6**). Where a test sample or portion of a sample is to be held after testing (for example, for reasons of record or to enable check tests to be performed later), the laboratory has storage and security arrangements that protect sample condition and integrity.

NOTE 6—Well-sealed solid containers, Mylar® or foil-lined bags preserve sample condition best. However, the condition of even a well-stored sample of coal (especially low-rank coal) almost always changes with time. Therefore, the laboratory should normally test samples within a few days of receipt. Data from analyses of samples that have been stored for more than a few days should be used cautiously.

13. Sample Preparation

13.1 Appropriate personnel can demonstrate capability to prepare samples in accordance with Practice **D2013** (for coal) or Practice **D346** (for coke), or both.

13.2 Equipment for size reduction and sample division is appropriate for the task and is used appropriately.

13.2.1 Riffles or other dividers are tightly enclosed to prevent dust loss, have correct opening or chute sizes, and are used in an appropriate manner (Practice **D2013**).

13.2.2 Essentially all sample material is recovered from preparation equipment such as riffles, crushers, and pulverizers to prevent creation of a biased sample.

13.2.3 To prevent sample contamination, size-reduction and sample division equipment are thoroughly cleaned after each use.

NOTE 7—Vacuuming is preferred for cleaning. The use of an air blast to clean equipment is not advisable if it disperses dust into the atmosphere. Although thorough cleaning is always appropriate, it is especially important before small quantities of sample are to be processed.

13.3 Sample integrity is preserved while samples are being processed or while they are awaiting processing. In particular, samples are protected from temperature extremes and are kept in sealed containers to minimize moisture changes, oxidation, and contamination.

NOTE 8—Although not mandatory, it is desirable to conduct some tests to assess the magnitude of any incidental moisture changes that might occur during routine storage, reduction, and division of gross samples. The protocol for such tests is left to the individual laboratory. If tests are conducted, results should be documented and made accessible to customers or clients upon request. If significant changes are detected, the procedure should be modified to further minimize such inadvertent changes.

13.4 Air-drying is carried out according to procedures specified in Practice **D2013** or Test Method **D3302**.

13.5 The magnitude of the variance attributable to routine sample preparation procedures has been measured and docu-

mented (see Annexes in Practice **D2013**), and is made available to customers or clients when requested. This may not be practical where customers provide only small quantities of sample. However, where coal from a single source or a limited number of sources is tested, the assessment of variance is recommended.

13.6 Sample mass at each stage of division conforms to Practice **D2013**.

13.7 Particle sizes of crushed or pulverized samples are checked routinely to ensure that samples meet the appropriate size criteria. Screens in size reduction equipment are frequently examined visually, preferably before each use.

13.8 Pulverized samples are mixed on a mixing wheel (a child's toy jack or "jack rock" may be placed in the container to improve mixing). To minimize size segregation (commonly sifting of finest particles to the bottom of a container), samples are not unduly shaken or tapped after mixing, and the aliquot used in a test is recovered from the container in a manner that minimizes selecting a biased size fraction. Samples removed from storage or that have been standing for extended periods are remixed before testing.

13.8.1 Test samples are maintained in well-sealed bottles or other containers until analyzed or tested and are exposed for as short a period as possible to the atmosphere.

NOTE 9—It is desirable to perform some tests to demonstrate that the container lids do seal well, thereby preventing moisture changes and oxidation. A convenient test is to determine, by weighing, if water evaporates when sealed in typical containers.

14. Calibration of Equipment

14.1 A program of calibration, verification, or validation of equipment is carried out when equipment is first placed in service or when it has been placed in service after repair or modification.

14.2 Wherever possible, calibration is performed using certified reference materials (CRMs) or certified measuring devices (for example, temperature-measuring devices).

NOTE 10—It is good practice to verify that the certified value for a reference material is reliable, for example, by comparing results from different batches of the reference material, that is, "old" bottle versus "new" bottle.

14.3 There is a documented program for frequently verifying the calibration status of test equipment between routine, scheduled recalibrations.

NOTE 11—For most test methods, it is appropriate to verify calibration with a device, reference material, or control material daily or at the beginning of each shift. For some tests, more frequent verification is required; for some, less frequent verification is appropriate. The quality manager uses his/her best judgment to define the frequency required for each test.

14.4 Calibrations and calibration verifications are conducted at different times of day, on different days of the week, and by different personnel (preferably those who test or analyze samples).

14.5 An appropriate number of determinations are used to establish or verify calibrations.