

ANSI N15.51-2017

American National Standard

*for Methods of Nuclear Material Control –
Measurement Control Program –
Nuclear Materials
Analytical Chemistry Laboratory*



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ANSI N15.51-2007

American National Standard
for Methods of Nuclear Material Control –
Measurement Control Program –
Nuclear Materials
Analytical Chemistry Laboratory

Secretariat

Institute of Nuclear Materials Management

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American National Standards Institute, Inc.

American National Standard

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Foreword (This foreword is not part of American National Standard ANSI N15.51-2017.)

This standard was revised by Accredited Standards Committee N15 on Methods of Nuclear Material Control in compliance with the procedures established by the American National Standards Institute. The secretariat of N15 is held by the Institute of Nuclear Materials Management (INMM). Committee N15 has the following scope:

Standards for the protection, control, and accounting of special nuclear materials in all phases of the nuclear fuel cycle, including analytical procedures where necessary and special to this purpose, except that physical protection of special nuclear materials within a nuclear power plant is not included.

The Institute of Nuclear Materials Management has long recognized the importance of measurement quality for maintaining adequate material protection, control, and accountability (MPC&A) for nuclear materials. Writing Group INMM-5 on Measurement Control was established because of this commitment to quality. The Writing Group issued a generic standard covering the general principles of good and acceptable measurement control, N15.41 "Derivation of Measurement Control Programs – General Principles." Additional standards were prepared to provide guidance for determining and monitoring the quality of various types of measurements made by the MPC&A community. This standard provides the principal elements of a measurement control program for an analytical chemistry laboratory that supports nuclear fuel cycle activities.

There are 25 annexes in this standard. Annexes A, F, G, H, K, P, R, S, T, U, W, and Y are normative and form part of the requirements of this standard. Annexes B, C, D, E, J, L, M, N, Q, V, X, Z, and AA are informative and are included for information only. (There are no annexes designated with the letters 'I' or 'O'.)

Suggestions for improvement of the standard will be welcome. They should be sent to the Institute of Nuclear Materials Management, 1120 Rt 73, Suite 200; Mount Laurel, NJ 08054. (Additional information about the INMM may be found at <https://www.inmm.org>.)

This standard was prepared by Committee N15 following ANSI requirements for due process and for obtaining consensus. N15 Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the N15 Committee had the following members:

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(U.S. Department of Energy)
Lynne Preston, Vice-Chair
(U.S. Department of Energy)
B. (Chino) Srinivasan, Secretary
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American National Standard for Methods of Nuclear Material Control –

Measurement Control Program – Nuclear Materials Analytical Chemistry Laboratory

0. Introduction

The ability to manage nuclear materials through the principles of material accounting depends on the knowledge of the chemical composition, the concentrations of components, and the associated uncertainty of each measurement of those materials as they are produced, used, shipped, stored, and inventoried. When making the required measurements, the measurement data must be reliable. A comprehensive measurement control program assures that the measurements used in the nuclear industry are suitable for their intended purpose, demonstrates the reliability of the measurement data, quantifies the performance of the measurement system, and provides for detection and correction of adverse changes.

A laboratory measurement control program should address both the technical and the administrative aspects of measurement processes. The administrative aspects correspond to quality assurance elements, and their implementation establishes quality assurance practices in the measurement control program. Such practices should be traceable to the measurement control requirements of 10 CFR Part 74 [1], DOE O 470.4B [2], and DOE O 474.2 [3].¹

A laboratory measurement control program is an essential part of the nuclear facility quality assurance program. Additional information may be found in ISO/IEC 17025 [4], and in other standards such as ANSI N42.23 [5], ASTM C1210 [6] and ASTM D7282 [7].

The goal of any measurement control program is to document and quantify the performance of each analytical measurement system and to provide for detection and correction of adverse changes. The specific needs of each system are determined by identifying the level of performance required and the consequences of using faulty data from that system as part of the material control and accountability program. Additionally, for those facilities that measure nuclear materials for physical inventory, the measurement control program provides data for establishing the uncertainty (or limit of error) associated with a given inventory difference value. The provisions of this standard provide the basis for evaluating existing practices and modifying those practices, if necessary.

1. Scope and purpose

1.1 Scope. This standard is based on ANSI N15.41-1984 (R1994), *Derivation of Measurement Control Programs - General Principles* [8], which provides the general principles of a measurement control program. This N15.51 standard, although limited to the principal elements of a measurement control program for an analytical chemistry laboratory supporting nuclear

¹ See the Bibliography for the titles of publications and information regarding their availability.

materials programs, has elements that are also applicable to other analytical laboratories. (Measurement control programs for nondestructive analysis are discussed in N15.36. [9])

Measurement control elements specific for bulk measurements (mass and volume) from processes and specific process sampling techniques are not addressed in detail in this standard, nor are special analytical techniques such as mass spectrometry and calorimetry. These subjects are treated in other standards within this series.

1.2 Purpose. The purpose of this standard is to provide the principal elements for the development and implementation of a comprehensive measurement control program for analytical chemistry laboratories supporting the management of nuclear materials.

The elements addressed cover both technical and administrative aspects of a laboratory measurement control program. References to supporting publications are provided. Annexes included as part of the standard contain examples that illustrate the general principles presented in the body of the standard.

2. Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards and publications are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards and publications listed below.

NRC Publication, *Auditing Measurement Control Programs*. NUREG/CR-0772 (PNL-3019) (October 1979), U.S. Nuclear Regulatory Commission, Washington, DC. Available at <http://www.osti.gov/bridge/index.jsp>.

3. Definitions

3.1 accountability: The determination of quantities of nuclear materials and current record maintenance associated with receipts; shipments; measured discards; transfers into, out of, or between material balance areas, item control areas, or both; and total material on current inventory.

3.2 accuracy: A measure of the agreement between the measured value and the true (or assigned) value. See *bias*.

3.3 assigned value: A value assigned to a standard used for calibrating and/or controlling a nuclear material measurement device or system.

3.4 ASTM International: Formerly the acronym for the American Society for Testing and Materials; now used by the Society as its complete name.

3.5 audit: An examination of current activities to assure that they are in compliance with program policies and procedures.

3.6 bias: A systematic error that can be estimated by comparison of the sample mean of a series of measurements with a true or reference value, in which case a correction can be applied to reduce the effect of the bias on the measurements.