

ANSI N15.51-2007

American National Standard

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



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N15.51-2007
Revision of
ANSI N15.51-1990 (R2006)

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 Standard

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Foreword (This foreword is not part of American National Standard ANSI N15.51-2007.)

This standard was revised under the procedures of the American National Standards Institute by Accredited Standards Committee N15 on Methods of Nuclear Material Control. 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 protection, control, and accountability (MPC&A) for nuclear materials. Because of this commitment to quality, Writing Group INMM-5 on Measurement Control was established. 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 supporting 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. (In accordance with the ISO Directives Part 3, 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, 60 Revere Drive, Suite 500, Northbrook, IL 60062. (Additional information about the INMM may be found at <http://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:

- Carrie Mathews, Chair
(Pacific Northwest National Laboratory)
- Melanie May, Vice-Chair
(U.S. Department of Energy)
- Lynne Preston, Secretary
(U.S. Department of Energy)

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American Society of Industrial Security (ASIS).....	Robert D. Hulshouser
American Society for Quality Control (ASQC)	Chuck Moseley
American Society for Testing and Materials (ASTM).....	Charles Pietri
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Writing Group INMM 5.1 on Measurement Control for the Analytical Laboratory, which developed this standard, had the following members:

- Charles Pietri, Chair
(HITECH Consultants)
- Kenneth Lewis, Secretary
(U.S. Department of Energy, retired)
- Jere T. Bracey
(United States Enrichment Corporation, Paducah Gaseous Diffusion Plant)
- John Clark
(Savannah River Site)
- Yvonne Ferris
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(U.S. Department of Energy - New Brunswick Laboratory)
- Mika Sumi
(Japan Atomic Energy Agency)

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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 demonstrates the reliability of the measurement data, quantifies the performance of the measurement system, assures that the measurements used in the nuclear industry are suitable for their intended use, 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 and DOE O 470.4, DOE M 470.4-1 and DOE M 470.4-6 (See Annex AA).¹

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 must conduct physical inventories, 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 N15.41 (see clause 2, Normative References), 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 fuel cycle activities, has elements that are also applicable to other analytical laboratories.

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 of this series.

¹ See annex AA, Bibliography, for the titles and availability information for these publications.

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 are attached that 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.

N15.41-1984 (R1994), *Derivation of measurement control programs - General principles*²

ASTM C970-87 (2006), *Standard practice for sampling special nuclear materials in multi-container lots*³

NUREG/CR-0772 (PNL-3019) (October 1979), *Auditing measurement control programs*⁴

3. Definitions

3.1 accountability: The determination of quantities of nuclear materials (NM) 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 NM 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 remove the effect of the bias on the measurements.

² Available from the ANSI Electronic Standards Store (ESS) at www.webstore.ansi.org.

³ Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

⁴ Available from the Superintendent of Documents, U.S. Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401 or the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.