

ANSI N15.36-2010

American National Standard

*for Methods of Nuclear Material Control –
Measurement Control Program –
Nondestructive Assay Measurement
Control and Assurance*



ANSI[®]
N15.36-2010

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Secretariat

Institute for 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 N15.36-2010.)

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) of nuclear materials. Owing to 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 evaluating and monitoring the quality of various types of measurements made by the MPC&A community. This standard is intended to provide guidance for evaluating and monitoring the quality of nondestructive assay systems.

There are five annexes in this standard. They are all informative and are not considered part of this standard.

This standard is expected to be reviewed on a continuing basis, resulting in periodic revision. It is recognized that, in some cases, the standard may not fulfill the user's requirements with regard to application and detail. 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)

<i>Organization Represented</i>	<i>Name of Representative</i>
American Nuclear Society (ANS)	Calvin Hopper
American Society for Quality Control (ASQC)	Chuck Moseley
American Society of Industrial Security (ASIS)	Robert D. Hulshouser
AREVA-NP	Marilyn Law
ASTM	Charles Pietri
BWXT Lynchburg	Matthew Suwala
Global Nuclear Fuels	Rose Martyn
Institute of Nuclear Materials Management (INMM)	Stephen Ortiz
Los Alamos National Laboratory (LANL)	David Bracken
National Institute of Standards and Technology (NIST)	Michael Unterweger

<i>Organization Represented</i>	<i>Name of Representative</i>
New Brunswick Laboratory (NBL)	Stephan Vogt
Sandia National Laboratories (SNL)	Allen Stanley
Savannah River National Laboratory	Saleem Salaymeh
U.S. Department of Energy (DOE)	James Crabtree
U.S. Nuclear Regulatory Commission (NRC)	Thomas Pham
Westinghouse	Rod Likes
Y-12 National Security Complex	Amy Wilson

Members at Large

Obie Amacker, Jr.
Yvonne Ferris
Reuben McGilvary
Joseph D. Rivers
Martha Williams

The writing group that developed this standard had the following members:

Saleem Salaymeh, Chair
(Savannah River National Laboratory)

Michael Baker
(Los Alamos National Laboratory)

Jim Disbrow
(U.S. Department of Energy)

Yvonne Ferris
Retired (Mantech, Inc.)

Andrey Mozhayev
(Pacific Northwest National Laboratory)

Lynne Preston
(U.S. Department of Energy)

Thomas Sampson
(Los Alamos National Laboratory)

Jim Sprinkle
(Los Alamos National Laboratory)

Martha Williams
(U. S. Nuclear Regulatory Commission)

American National Standard
for Methods of Nuclear Material Control –

Measurement Control Program – Nondestructive Assay Measurement Control and Assurance

0 Introduction

This standard is directed to the scientist or engineer with appropriate technical training who is responsible for establishing, maintaining, or supervising a nondestructive assay (NDA) measurement control program.

The goal of a measurement control program is to provide assurance that the measurement process provides results of sufficient quality for facility operations. A measurement control program oversees measurement processes and administers a variety of control measures relating to measurement processes and equipment, personnel qualifications, measurement methods, information flow, record keeping, and program reviews and audits. The measurement control program provides for the evaluation of measurement results. This is accomplished by monitoring measurement system stability and by estimating measurement uncertainties, both measured and unmeasured. The measurement process, in turn, supports facility operations by providing certain qualifying statements about outputs from these operations.

A measurement control program is an integral part of all nuclear measurement programs and is a critical element in any nuclear materials accounting program. Establishing a nuclear materials inventory requires measurement of materials on hand. The cumulative effect of uncertainties inherent in measuring quantities of nuclear material, typically results in non-zero inventory differences. A key question in testing for possible theft or other unrecorded losses is whether the observed inventory difference is significantly different, in a statistical sense, from zero. Hence, a measurement control program, including careful evaluation and control of measurement processes, provides information essential to the interpretation of nuclear materials accounting data.

Measurement control programs are implemented to monitor system response to well-characterized materials. Care must be taken not to interpret limited data as proving the quality of measurement results. For example, repeated measurements of a single control source only provide data regarding the reproducibility of instrument response at a single point. They do not provide data regarding the instrument response over the entire measurement range, the suitability of the method for its intended purpose, or sample-specific sources of uncertainty.

1 Scope and Purpose

1.1 Scope

This standard applies to NDA techniques for the measurement of nuclear materials by the observation of spontaneous or stimulated radioactive emissions [1, 2].¹ This standard also applies to NDA measurements of other attributes of special nuclear materials. The guidelines given for the establishment and operation of an NDA measurement control program may be appropriate for other types of measurement control programs; however, the recommended monitoring and control techniques are designed specifically for NDA measurement of radioactive emissions and may not be applicable to other measurement methods.

This standard represents an acceptable approach to measurement control. It is not intended as a substitute for the advice and guidance of a qualified statistician and a competent NDA specialist. Furthermore, it is not intended to address all aspects of quality assurance associated with NDA instrumentation and its use.

1.2 Purpose

The purpose of this standard is to provide an acceptable and uniform basis for the establishment, operation, and review of an NDA measurement control program. This includes a recommended program for evaluating, monitoring, and controlling NDA measurement uncertainties pertinent to nuclear materials control and accounting.

2 Normative References

The following standards contain provisions that, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards 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 edition of the standards indicated below.

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

3 Definitions

3.1 bias: An uncertainty that appears as a persistent positive or negative deviation of the measurement average from the true or reference value; an estimate of a systematic measurement error.

NOTE: The term "accuracy" is sometimes used when the term "bias" is intended. Accuracy is a measure of the agreement between a measured value and the true value. Since, for some, accuracy implies a measure of precision, the term "accuracy" is not recommended.

3.2 estimate (noun): A value obtained by applying an estimator to a set of sample values.

3.3 estimate (verb): To follow certain statistical principles in drawing an inference about the values of a population's parameters based on information obtained from a sample of that population.

3.4 estimator: A rule or method, usually expressed as a function of sample values, used to estimate a population parameter.

¹ Numbers in brackets correspond to numbered references appearing in Annex E, *Bibliography*.

² Withdrawn as an American National Standard. Revised and updated version currently in development.