



Designation: D7282 – 24

Standard Practice for Setup, Calibration, and Quality Control of Instruments Used for Radioactivity Measurements¹

This standard is issued under the fixed designation D7282; 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 covers consensus criteria for the setup, calibration, and quality control of nuclear instruments. Setup establishes the operating parameters of the instrument—for example, voltage or discriminator settings. Calibrations determine the instrument's response characteristics—for example, its counting efficiency or energy response. Quality control ensures that the performance of the instrument remains acceptable for its intended use and consistent with the performance at the time of calibration.

1.2 This practice addresses four of the most commonly used types of nuclear counting instruments: alpha-particle spectrometer, gamma-ray spectrometer, gas proportional counter, and liquid scintillation counter.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions that are provided for information only and are not considered standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

D1129 Terminology Relating to Water

¹ This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.04 on Methods of Radiochemical Analysis.

Current edition approved April 1, 2024. Published May 2024. Originally approved in 2006. Last previous edition approved in 2021 as D7282 – 21^{e1}. DOI: 10.1520/D7282-24.

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.

D3648 Practices for the Measurement of Radioactivity

D7283 Test Method for Alpha and Beta Activity in Water By Liquid Scintillation Counting

D7902 Terminology for Radiochemical Analyses

E2586 Practice for Calculating and Using Basic Statistics

2.2 Other Standards:

ANSI N42.22 Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control³

ANSI N42.23 Measurement and Associated Instrumentation Quality Assurance for Radioassay Laboratories³

ANSI/HPS N13.30 Performance Criteria for Radiobioassay³
ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories⁴

JCGM 100:2008 Evaluation of measurement data – Guide to the expression of uncertainty in measurement⁵

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this standard, refer to Terminologies D1129 and D7902 and Practice E2586.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *acceptable verification ratio (AVR), n*—ratio of the absolute difference between the measured value of the verification sample and the known value added to the verification sample to the square root of the sum of the squares of their associated combined standard uncertainties.

3.2.1.1 *Discussion*—See Eq 14 in 9.2.2.21.

3.2.2 *background subtraction count (BSC), n*—a source count used to determine the background to be subtracted from the sample test source count.

3.2.3 *calibration, n*—determination of an instrument's response to a known amount of radioactive material.

3.2.3.1 *Discussion*—Instrument calibrations may include calibrations for counting efficiency, energy, and resolution.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Organization for Standardization (ISO), 1 rue de Varembe, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.

⁵ Available from Bureau International des Poids et Mesures (BIPM), Pavillon de Breteuil F-92312 Sèvres Cedex France, <http://www.bipm.org/en/publications/guides/gum.html>.