



# Standard Test Method for Nondestructive Assay of Special Nuclear Material Holdup Using Gamma-Ray Spectroscopic Methods<sup>1</sup>

This standard is issued under the fixed designation C1455; 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.

<sup>ε1</sup> NOTE—10.4.1.1 editorially corrected in July 2015.

## 1. Scope

1.1 This test method describes gamma-ray methods used to nondestructively measure the quantity of <sup>235</sup>U or <sup>239</sup>Pu present as holdup in nuclear facilities. Holdup may occur in any facility where nuclear material is processed, in process equipment, in exhaust ventilation systems and in building walls and floors.

1.2 This test method includes information useful for management, planning, selection of equipment, consideration of interferences, measurement program definition, and the utilization of resources (1, 2, 3, 4).<sup>2</sup>

1.3 The measurement of nuclear material hold up in process equipment requires a scientific knowledge of radiation sources and detectors, transmission of radiation, calibration, facility operations and uncertainty analysis. It is subject to the constraints of the facility, management, budget, and schedule; plus health and safety requirements. The measurement process includes defining measurement uncertainties and is sensitive to the form and distribution of the material, various backgrounds, and interferences. The work includes investigation of material distributions within a facility, which could include potentially large holdup surface areas. Nuclear material held up in pipes, ductwork, gloveboxes, and heavy equipment, is usually distributed in a diffuse and irregular manner. It is difficult to define the measurement geometry, to identify the form of the material, and to measure it without interference from adjacent sources of radiation.

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

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.10 on Non Destructive Assay.

Current edition approved Jan. 1, 2014. Published March 2014. Originally approved in 2000. Last previous edition approved in 2007 as C1455 – 07. DOI: 10.1520/C1455-14E01.

<sup>2</sup> The boldface numbers in parentheses refer to the list of references at the end of this standard.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

C1490 Guide for the Selection, Training and Qualification of Nondestructive Assay (NDA) Personnel

C1592 Guide for Nondestructive Assay Measurements

C1673 Terminology of C26.10 Nondestructive Assay Methods

### 2.2 ANSI Standards:<sup>4</sup>

ANSI N15.36 Measurement Control Program—Nondestructive Assay Measurement Control and Assurance Systems

ANSI N15.56 Nondestructive Assay Measurements of Nuclear Material Holdup: General Provisions

### 2.3 U.S. Nuclear Regulatory Commission Regulatory Guides:<sup>5</sup>

Regulatory Guide 5.23, In Situ Assay of Plutonium Residual Holdup

## 3. Terminology

3.1 Refer to Terminology C1673 for definitions used in this test method.

## 4. Summary of Test Method

4.1 *Introduction*—Holdup measurements range from the solitary assay of a single item or routine measurement of a piece of equipment, to an extensive campaign of determining the total SNM in-process inventory for a processing plant. Holdup measurements differ from other nondestructive measurement methods in that the assays are performed in situ on equipment or items instead of on multiple items with similar characteristics measured in a specialized, isolated room. Often the chemical form and geometric distribution of the SNM are

<sup>3</sup> 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.

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

<sup>5</sup> Available from the U.S. Nuclear Regulatory Commission, Washington, DC, 20555.