



Standard Test Method for Nondestructive Assay of Plutonium, Tritium and ^{241}Am by Calorimetric Assay¹

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1. Scope

1.1 This test method describes the nondestructive assay (NDA) of plutonium, tritium, and ^{241}Am using heat flow calorimetry. For plutonium the typical range of applicability, depending on the isotopic composition, corresponds to ~0.1 g to ~5 g quantities while for tritium the typical range extends from ~0.001 g to ~400 g. This test method can be applied to materials in a wide range of container sizes up to 380 L. It has been used routinely to assay items whose thermal power ranges from 0.001 W to 135 W.

1.2 This test method requires knowledge of the relative abundances of the plutonium isotopes and the $^{241}\text{Am}/\text{Pu}$ mass ratio to determine the total plutonium mass.

1.3 This test method provides a direct measure of tritium content.

1.4 This test method provides a measure of ^{241}Am either as a single isotope or mixed with plutonium.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

C697 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Plutonium Dioxide Powders and Pellets

¹ 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.

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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.

C1009 Guide for Establishing and Maintaining a Quality Assurance Program for Analytical Laboratories Within the Nuclear Industry

C1030 Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectrometry

C1592 Guide for Nondestructive Assay Measurements

C1673 Terminology of C26.10 Nondestructive Assay Methods

2.2 ANSI Standard:³

ANSI N15.36 Measurement Control Program – Nondestructive Assay Measurement Control and Assurance

3. Terminology

3.1 Definitions:

3.1.1 Terms shall be defined in accordance with C26.10 Terminology **C1673** except for the following:

3.1.2 *active mode*—a mode of calorimeter operation where an external power, applied by means of a series of band heaters for instance, is used to maintain the calorimeter at constant temperature.

3.1.3 *baseline, n*—the calorimeter output signal with no heat-generating item in the calorimeter item chamber.

3.1.4 *base power, n*—a constant thermal power applied in a calorimeter through an electrical resistance heater with no heat-generating item in the item chamber.

3.1.5 *equilibrium, n*—the point at which the temperature of the calorimeter measurement cell and the item being measured stabilizes.

3.1.6 *heat distribution error, n*—the bias arising from the location of the heat source within the calorimeter chamber.

3.1.7 *passive mode, n*—a mode of calorimeter operation where temperature change (caused by the heat to be quantified) is measured by means of temperature sensors with no external power applied except in the case of Wheatstone bridge temperature sensors where electrical current is needed to excite the bridge circuit.

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