



Standard Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectrometry¹

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1. Scope

1.1 This test method is applicable to the determination of isotopic abundances in isotopically homogeneous plutonium-bearing materials. This test method may be applicable to other plutonium-bearing materials, some of which may require modifications to the described test method.

1.2 The procedure is applicable to items containing plutonium masses ranging from a few tens of milligrams up to the maximum plutonium mass allowed by criticality limits.

1.3 Measurable gamma ray emissions from plutonium cover the energy range from approximately 30 keV to above 800 keV. K-X-ray emissions from plutonium and its daughters are found in the region around 100 keV. This test method has been applied to all portions of this broad spectrum of emissions.

1.4 The isotopic abundance of the ²⁴²Pu isotope is not directly determined because it has no useful gamma-ray signature. Isotopic correlation techniques may be used to estimate its relative abundance Refs (1) and (2).²

1.5 This test method has been demonstrated in routine use for isotopic abundances ranging from 99 to <50 % ²³⁹Pu. This test method has also been employed for isotopic abundances outside this range.

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

1.7 *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.*

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 The boldface numbers in parentheses refer to the list of references at the end of this standard.

2. Referenced Documents

2.1 ASTM Standards:³

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

C698 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Mixed Oxides ((U, Pu)O₂)

C982 Guide for Selecting Components for Energy-Dispersive X-Ray Fluorescence (XRF) Systems (Withdrawn 2008)⁴

C1207 Test Method for Nondestructive Assay of Plutonium in Scrap and Waste by Passive Neutron Coincidence Counting

C1316 Test Method for Nondestructive Assay of Nuclear Material in Scrap and Waste by Passive-Active Neutron Counting Using ²⁵²Cf Shuffler

C1458 Test Method for Nondestructive Assay of Plutonium, Tritium and ²⁴¹Am by Calorimetric Assay

C1493 Test Method for Non-Destructive Assay of Nuclear Material in Waste by Passive and Active Neutron Counting Using a Differential Die-Away System

C1500 Test Method for Nondestructive Assay of Plutonium by Passive Neutron Multiplicity Counting

E181 Test Methods for Detector Calibration and Analysis of Radionuclides

E267 Test Method for Uranium and Plutonium Concentrations and Isotopic Abundances

2.2 ANSI Standards:⁵

ANSI/IEEE Std 325-1996 IEEE Standard Test Procedures for Germanium Gamma-Ray Detectors

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

³ 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.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.