



Standard Test Methods for Chemical, Mass Spectrometric, Spectrochemical, Nuclear, and Radiochemical Analysis of Nuclear-Grade Plutonium Nitrate Solutions¹

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1. Scope

1.1 These test methods cover procedures for the chemical, mass spectrometric, spectrochemical, nuclear, and radiochemical analysis of nuclear-grade plutonium nitrate solutions to determine compliance with specifications.

1.2 The analytical procedures appear in the following order:

	Sections
Plutonium by Controlled-Potential Coulometry	2
Plutonium by Amperometric Titration with Iron(II)	2
Plutonium by Diode Array Spectrophotometry	
Free Acid by Titration in an Oxalate Solution	8 to 15
Free Acid by Iodate Precipitation-Potentiometric Titration Test Method	16 to 22
Uranium by Arsenazo I Spectrophotometric Test Method	23 to 33
Thorium by Thorin Spectrophotometric Test Method	34 to 42
Iron by 1,10-Phenanthroline Spectrophotometric Test Method	43 to 50
Impurities by ICP-AES	
Chloride by Thiocyanate Spectrophotometric Test Method	51 to 58
Fluoride by Distillation-Spectrophotometric Test Method	59 to 66
Sulfate by Barium Sulfate Turbidimetric Test Method	67 to 74
Isotopic Composition by Mass Spectrometry	75 to 76
Plutonium —238 Isotopic Abundance by Alpha Spectrometry	
Americium-241 by Extraction and Gamma Counting	77 to 85
Americium-241 by Gamma Counting	86 to 94
Gamma-Emitting Fission Products, Uranium, and Thorium by Gamma-Ray Spectroscopy	94 to 102
Rare Earths by Copper Spark Spectrochemical Test Method	103 to 105
Tungsten, Niobium (Columbium), and Tantalum by Spectrochemical Test Method	106 to 114
Sample Preparation for Spectrographic Analysis for General Impurities	115 to 118

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

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 applica-*

bility of regulatory limitations prior to use. For specific safeguard and safety hazard statements, see Section 6.

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
- C852 Guide for Design Criteria for Plutonium Gloveboxes
- C1009 Guide for Establishing and Maintaining a Quality Assurance Program for Analytical Laboratories Within the Nuclear Industry
- C1068 Guide for Qualification of Measurement Methods by a Laboratory Within the Nuclear Industry
- C1108 Test Method for Plutonium by Controlled-Potential Coulometry
- C1128 Guide for Preparation of Working Reference Materials for Use in Analysis of Nuclear Fuel Cycle Materials
- C1156 Guide for Establishing Calibration for a Measurement Method Used to Analyze Nuclear Fuel Cycle Materials
- C1165 Test Method for Determining Plutonium by Controlled-Potential Coulometry in H₂SO₄ at a Platinum Working Electrode
- C1206 Test Method for Plutonium by Iron (II)/Chromium (VI) Amperometric Titration (Withdrawn 2015)⁴
- C1210 Guide for Establishing a Measurement System Quality Control Program for Analytical Chemistry Laboratories Within the Nuclear Industry
- C1235 Test Method for Plutonium by Titanium(III)/Cerium(IV) Titration (Withdrawn 2005)⁴
- C1268 Test Method for Quantitative Determination of ²⁴¹Am in Plutonium by Gamma-Ray Spectrometry
- C1297 Guide for Qualification of Laboratory Analysts for the Analysis of Nuclear Fuel Cycle Materials

¹ These test methods are under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and are the direct responsibility of Subcommittee C26.05 on Methods of Test.

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² Discontinued as of November 15, 1992.

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.