



# Standard Practice for Removal of Uranium or Plutonium, or both, for Impurity Assay in Uranium or Plutonium Materials<sup>1</sup>

This standard is issued under the fixed designation C1647; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers instructions for using an extraction chromatography column method for the removal of plutonium or uranium, or both, from liquid or digested oxides or metals prior to impurity measurements. Quantification of impurities can be made by techniques such as inductively coupled plasma mass spectrometry (ICP-MS), inductively coupled plasma atomic emission spectrometry (ICP-AES) or atomic absorption spectrometry (AAS.)

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

1.3 *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:<sup>2</sup>

- C753 Specification for Nuclear-Grade, Sinterable Uranium Dioxide Powder
- C757 Specification for Nuclear-Grade Plutonium Dioxide Powder, Sinterable
- C776 Specification for Sintered Uranium Dioxide Pellets
- C787 Specification for Uranium Hexafluoride for Enrichment
- C788 Specification for Nuclear-Grade Uranyl Nitrate Solution or Crystals
- C859 Terminology Relating to Nuclear Materials
- C996 Specification for Uranium Hexafluoride Enriched to Less Than 5 % <sup>235</sup>U

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.05 on Methods of Test.

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<sup>2</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.

- C1168 Practice for Preparation and Dissolution of Plutonium Materials for Analysis
- C1287 Test Method for Determination of Impurities in Nuclear Grade Uranium Compounds by Inductively Coupled Plasma Mass Spectrometry
- C1347 Practice for Preparation and Dissolution of Uranium Materials for Analysis
- C1432 Test Method for Determination of Impurities in Plutonium: Acid Dissolution, Ion Exchange Matrix Separation, and Inductively Coupled Plasma-Atomic Emission Spectroscopic (ICP/AES) Analysis
- C1517 Test Method for Determination of Metallic Impurities in Uranium Metal or Compounds by DC-Arc Emission Spectroscopy
- D1193 Specification for Reagent Water

## 3. Terminology

3.1 For definitions of terms used in this test method but not defined herein, refer to Terminology C859.

## 4. Summary of Practice

4.1 An aliquot of liquid sample or dissolved solid sample is adjusted as needed to 8M nitric acid for plutonium/uranium removal using extraction chromatography. Uranium and plutonium are retained on the resin and trace impurities are collected in the column effluent. The impurities can be measured by a variety of techniques.

## 5. Significance and Use

5.1 This practice can be used to separate uranium or plutonium, or both, prior to the impurity analysis by various techniques. The removal of uranium and plutonium prior to quantification can improve the detection limits by minimizing the signal suppression caused by uranium or plutonium when using ICP techniques. Detection limits of ~1–10 part-per-billion (PPB) may be obtainable by matrix removal. Also, removal of the uranium and plutonium may allow the impurities analysis to be performed on a non-glove box enclosed instrument.

5.2 Other test methods exist to determine impurities in uranium or plutonium. Test Method C1517 is able to determine many impurities in uranium at detection levels of ~1–10