



Standard Practice for The Separation of Lanthanide Elements from Uranium Matrices Using High Pressure Ion Chromatography (HPIC) for Isotopic Analyses by Inductively Coupled Plasma Mass Spectrometry (ICP-MS)¹

This standard is issued under the fixed designation C1845; 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.

1. Scope

1.1 This practice provides instructions for the rapid separation of lanthanide elements using high pressure ion chromatography (HPIC) from dissolved uranium materials such as: nuclear fuels, uranium ores, hydrolyzed UF_6 , and depleted, natural, or enriched oxides/powders, or metals. When optimized, this technique will produce purified elemental fractions of the lanthanide elements isolated from the bulk uranium matrix allowing for isotopic assay using inductively coupled plasma mass spectrometry (ICP-MS).

1.2 This practice is most applicable for analyte concentrations of nanograms per gram uranium or higher. For ICP-MS detection and measurement of analyte concentrations lower than this, it would be necessary to perform additional pre-cleanup or concentration techniques, or both, which are not addressed in this practice.

1.3 When combined with isotope dilution, this practice can also be used for improved precision assays of the lanthanide elements using the principle of isotope dilution mass spectrometry (IDMS).

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

1.5 *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 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.

Current edition approved June 1, 2016. Published June 2016. DOI: 10.1520/C1845-16.

2. Referenced Documents

2.1 ASTM Standards:²

- C859 Terminology Relating to Nuclear Materials
- C1052 Practice for Bulk Sampling of Liquid Uranium Hexafluoride
- C1075 Practices for Sampling Uranium-Ore Concentrate
- C1168 Practice for Preparation and Dissolution of Plutonium Materials for Analysis
- C1347 Practice for Preparation and Dissolution of Uranium Materials for Analysis
- C1689 Practice for Subsampling of Uranium Hexafluoride
- C1769 Practice for Analysis of Spent Nuclear Fuel to Determine Selected Isotopes and Estimate Fuel Burnup
- D1193 Specification for Reagent Water
- E105 Practice for Probability Sampling of Materials

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology C859.

4. Summary of Practice

4.1 Solid samples are dissolved according to Practices C1168, C1347, or other appropriate methods. Uranium hexafluoride can be sampled in accordance with Practices C1052 and C1689. The resulting dissolver solution is processed to produce solutions of isolated lanthanide elements for mass spectrometric isotopic analysis. The elements are selectively separated from the dissolver solution and collected using HPIC instrumentation equipped with automated fraction collection. Appropriate aliquots of the unseparated dissolutions

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.