



Designation: C1316 – 08 (Reapproved 2017)

Standard Test Method for Nondestructive Assay of Nuclear Material in Scrap and Waste by Passive-Active Neutron Counting Using ²⁵²Cf Shuffler¹

This standard is issued under the fixed designation C1316; 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 test method covers the nondestructive assay of scrap and waste items for U, Pu, or both, using a ²⁵²Cf shuffler. Shuffler measurements have been applied to a variety of matrix materials in containers of up to several 100 L. Corrections are made for the effects of matrix material. Applications of this test method include measurements for safeguards, accountability, TRU, and U waste segregation, disposal, and process control purposes (**1, 2, 3**).²

1.1.1 This test method uses passive neutron coincidence counting (**4**) to measure the ²⁴⁰Pu-effective mass. It has been used to assay items with total Pu contents between 0.03 g and 1000 g. It could be used to measure other spontaneously fissioning isotopes such as Cm and Cf. It specifically describes the approach used with shift register electronics; however, it can be adapted to other electronics.

1.1.2 This test method uses neutron irradiation with a moveable Cf source and counting of the delayed neutrons from the induced fissions to measure the ²³⁵U equivalent fissile mass. It has been used to assay items with ²³⁵U contents between 0.1 g and 1000 g. It could be used to assay other fissile and fissionable isotopes.

1.2 This test method requires knowledge of the relative isotopic composition (See Test Method **C1030**) of the special nuclear material to determine the mass of the different elements from the measurable quantities.

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

1.4 The techniques described in this test method have been applied to materials other than scrap and waste. These other applications are not addressed in this test method.

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. Specific precautionary statements are given in Section 8.

2. Referenced Documents

2.1 ASTM Standards:³

- 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
- C1068** Guide for Qualification of Measurement Methods by a Laboratory Within the Nuclear Industry
- C1128** Guide for Preparation of Working Reference Materials for Use in Analysis of Nuclear Fuel Cycle Materials
- C1133** Test Method for Nondestructive Assay of Special Nuclear Material in Low-Density Scrap and Waste by Segmented Passive Gamma-Ray Scanning
- C1156** Guide for Establishing Calibration for a Measurement Method Used to Analyze Nuclear Fuel Cycle Materials
- C1207** Test Method for Nondestructive Assay of Plutonium in Scrap and Waste by Passive Neutron Coincidence Counting
- C1210** Guide for Establishing a Measurement System Quality Control Program for Analytical Chemistry Laboratories Within the Nuclear Industry
- C1215** Guide for Preparing and Interpreting Precision and Bias Statements in Test Method Standards Used in the Nuclear Industry
- C1490** Guide for the Selection, Training and Qualification of Nondestructive Assay (NDA) Personnel
- C1592** Guide for Nondestructive Assay Measurements

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 a list of references at the end of this test method.

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.