



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

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1. Scope

1.1 This test method covers the nondestructive assay of scrap and waste for uranium and plutonium content using a ^{252}Cf shuffler. Shuffler measurements provide rapid results and can be applied to a variety of matrix materials in containers as large as 208-litre drums. Corrections are made for the effects of matrix material. This test method has been used to assay items containing uranium, plutonium, or both. 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 to measure ^{238}Pu , ^{240}Pu , and ^{242}Pu . It has been used to assay items with plutonium contents between 0.03 g and 1000 g. It could be used to measure other spontaneously fissioning isotopes.

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

1.2 This test method requires knowledge of the relative isotopic composition to determine the mass of the different elements.

1.3 This test method may give biased results for measurements of containers that include large quantities of hydrogen.

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:

- C 859 Terminology Relating to Nuclear Materials³
- C 986 Guide for Developing Training Programs in the Nuclear Fuel Cycle³
- C 1009 Guide for Establishing a Quality Assurance Program for Analytical Chemistry Laboratories Within the Nuclear Industry³
- C 1030 Test Method for Determination of Plutonium Isotopic Composition by Gamma-Ray Spectrometry³
- C 1068 Guide for Qualification of Measurement Methods by a Laboratory Within the Nuclear Industry³
- C 1128 Guide for Preparation of Working Reference Materials for Use in the Analysis of Nuclear Fuel Cycle Materials³
- C 1133 Test Method for Nondestructive Assay of Special Nuclear Material in Low Density Scrap and Waste by Segmented Passive Gamma-Ray Scanning³
- C 1156 Guide for Establishing Calibration for a Measurement Method Used to Analyze Nuclear Fuel Cycle Materials³
- C 1207 Test Method for Nondestructive Assay of Plutonium in Scrap and Waste by Passive Neutron Coincidence Counting³
- C 1210 Guide for Establishing a Measurement System Quality Control Program for Analytical Chemistry Laboratories Within the Nuclear Industry³
- C 1215 Guide for Preparing and Interpreting Precision and Bias Statements in Test Method Standards used in the Nuclear Industry³

2.2 ANSI Documents:

- ANSI 15.20 Guide to Calibrating Nondestructive Assay Systems⁴
- ANSI N15.36 Nondestructive Assay Measurement Control and Assurance⁴
- ANSI/IEEE 739 Software Quality Assurance Plans⁴
- ANSI/IEEE 828 Software Configuration Management Plans⁴

¹ This test method is under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.10 on Nondestructive 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 Annual Book of ASTM Standards, Vol 12.01.

⁴ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.