



Standard Practice for the Rapid Assessment of Gamma-ray Emitting Radionuclides in Environmental Media by Gamma Spectrometry¹

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1. Scope

1.1 This practice covers the quantification of radionuclides in environmental media (e.g., water, soil, vegetation, food) by means of simple preparation and counting with a high-resolution gamma ray detector. Because the practice is designed for rapid analysis, extensive efforts to ensure homogeneity or ideal sample counting conditions are not taken.

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

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:²

C998 Practice for Sampling Surface Soil for Radionuclides
D1129 Terminology Relating to Water

D3370 Practices for Sampling Water from Closed Conduits

D3648 Practices for the Measurement of Radioactivity

D3649 Practice for High-Resolution Gamma-Ray Spectrometry of Water

D7282 Practice for Set-up, Calibration, and Quality Control of Instruments Used for Radioactivity Measurements

2.2 Other Documents:

PCNUDAT data files National Nuclear Data Center,
Brookhaven National Lab, Upton, NY, USA

3. Terminology

3.1 *Definitions*—for definitions of terms used in this practice, refer to Terminology D1129.

¹ This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.04 on Methods of Radiochemical Analysis.

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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.

4. Summary of Practice

4.1 Following sample collection, sample material is placed in a suitable container for analysis by a gamma spectrometry system. A suitable container is defined as a container which will both hold the sample in a fixed geometry and for which the gamma spectrometry system has been calibrated. For solid samples, the samples may be ground, sieved, or otherwise prepared for the purpose of volume reduction, homogenization, or conformance to the calibration standard, as desired.

5. Significance and Use

5.1 This practice was developed for the rapid determination of gamma-emitting radionuclides in environmental media. The results of the test may be used to determine if the activity of these radionuclides in the sample exceeds the action level for the relevant incident or emergency response. The detection limits will be dependent on sample size, counting configuration, and the detector system in use.

5.2 In most cases, a sample container which is large in diameter and short in height relative to the detector will provide the best gamma-ray detection efficiency. For samples of water or other low-Z materials (e.g., vegetation), the re-entrant or Marinelli-style beaker may yield the best gamma-ray detection efficiency.

5.3 The density of the sample material and physical parameters of the sample container (e.g., diameter, height, material) may have significant consequences for the accuracy of the sample analysis as compared to the calibration. For this reason, the ideal calibration material and container (often referred to as 'geometry') will be exactly the same as the samples to be analyzed. Differences in sample container or sample matrix may introduce significant errors in detector response, especially at low gamma-ray energies. Every effort should be made to account for these differences if the exact calibration geometry is not available.

5.4 This method establishes an empirical gamma-ray spectrometer calibration using standards traceable to a national standardizing body in a specific geometry selected to ensure that the container, density, and composition of the standard matches that of the samples as closely as possible. However, in some cases it may be beneficial to modify such initial calibrations using mathematical modeling or extrapolations to an