



Designation: **C999 – 05 (Reapproved 2010)<sup>ε1</sup> C999 – 17**

# Standard Practice for Soil Sample Preparation for the Determination of Radionuclides<sup>1</sup>

This standard is issued under the fixed designation C999; 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.

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<sup>ε1</sup> NOTE—Editorial changes were made throughout in June 2010.

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## 1. Scope

1.1 This practice covers the preparation of surface soil samples collected for ~~chemical analysis of radionuclides, radionuclide constituents,~~ particularly uranium and plutonium. This practice describes one acceptable approach to the preparation of soil samples for radiochemical analysis.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information 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.* A specific hazard statement is given in ~~6.37.3~~.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[C859 Terminology Relating to Nuclear Materials](#)

[C998 Practice for Sampling Surface Soil for Radionuclides](#)

[C1402 Guide for High-Resolution Gamma-Ray Spectrometry of Soil Samples](#)

[E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)

## 3. Terminology

3.1 Except as otherwise defined herein, definitions of terms are as given in Terminology [C859](#).<sup>0417c/astm-c999-17</sup>

## 4. Summary of Practice

4.1 Guidance is provided for the preparation of a homogeneous soil sample from ten composited core samples (aggregate weight of 4 to 5 kg) collected as to be representative of the area.

## 5. Significance and Use

5.1 Soil samples prepared for radionuclide analyses by this practice can be used to ~~monitor fallout distribution from nuclear facilities, characterize radionuclide constituents.~~ This practice is intended to produce a homogeneous sample from which a relatively small aliquot (10 g) ~~smaller aliquots~~ may be drawn for ~~radiochemical analyses, radionuclide characterization.~~

5.2 ~~Most nuclear facilities fulfill major requirements of their monitoring programs by~~ Many soil characterization plans for radionuclide constituents utilize gamma-ray spectrometry measurements of soil. ~~soil to quantify a number of possible gamma emitting analytes.~~ A widely used practice for these measurements is to fill a calibrated sample container, such as a Marinelli beaker (~600-mL volume), with a homogenized soil ~~sample.~~ sample for counting such as what may be done using Guide [C1402](#). By

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<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. Current edition approved ~~June 1, 2010~~ June 1, 2017. Published ~~June 2010~~ July 2017. Originally approved in 1983. Last previous edition approved in ~~2005~~ 2010 as [C999 – 05](#); [C999 – 05 \(2010\)<sup>ε1</sup>](#). DOI: [10.1520/C0999-05R10E01](#); [10.1520/C0999-17](#).

<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.

preparing the entire soil core collection, sufficient homogeneous sample is available for ~~radiochemical and such~~ gamma-ray spectrometry and other radiochemical measurements.

## 6. Apparatus

- 6.1 *Scale*, capacity of 10 kg.
- 6.2 *Drying Oven*, able to maintain  $\pm 2^{\circ}\text{C}$ .
- 6.3 *Pans*, disposable aluminum.
- 6.4 *Jar Mill*, capacity for 7.57-L (2-gal) cans.
- 6.5 *Steel Cans and Lids*, 7.57-L (2-gal).
- 6.6 *Ceramic Rods*, 21 by 21-mm ( $1\frac{3}{16}$  by  $1\frac{3}{16}$ -in.) or steel grinding balls, 25.4-mm (1-in.) diameter.
- 6.7 *Sieve*, U.S. Series No. 35 (500- $\mu\text{m}$  or 32 mesh).
- 6.8 *Plastic Bottles*, 7.57-L (2-gal).

## 7. Procedure

- 7.1 Label a cleaned 7.57-L (2-gal) steel can and lid with a unique laboratory code number.
- 7.2 Weigh the labeled steel can and lid. Record the weight.
- 7.3 Transfer the ten soil cores (including vegetation) from the field collection ~~containers~~ containers, such as may have been collected using Practice C998, into the labeled, preweighed steel can. Do not pack the can full. Place the steel lid loosely on the can. (**Warning**—Wear gloves throughout the preparation procedure to minimize the possibility of fungus infection.)
- 7.4 Weigh the sample cores, steel can, and lid to  $\pm 50$  g. Record the weight.
- 7.5 Remove the lid and place the sample in a  $110^{\circ}\text{C}$  drying oven for 24 h or longer, depending on the depth of soil in the can, until the sample has reached constant weight.
- 7.6 Remove the sample from the oven, cap the can with its lid, and cool to room temperature.
- 7.7 Weigh the dried sample cores, steel can, and lid to  $\pm 50$  g. Record the weight.
- 7.8 Remove the can lid and add 10 to 12 ceramic rods (21 by 21-mm) or steel balls (25.4-mm diameter) to the can.
- 7.9 Replace the lid and tightly seal the sample can.
- 7.10 Place the sample can on a jar mill for at least 4 h, or overnight if possible, at 30 r/min.
- 7.11 Remove the sample can from the mill and place in a hood.
- 7.12 Allow the sample to settle for a few minutes.
- 7.13 Label a 7.57-L (2-gal) plastic jar and cap with the laboratory code number of the sample.
- 7.14 Remove the lid from the sample can and transfer a portion of the sample to a U.S. Series No. 35 (500- $\mu\text{m}$  or 32 mesh) sieve.
- 7.15 Sieve the sample and transfer the sieved fraction to the prelabeled plastic jar.
- 7.16 Repeat the sieving and transfer steps until the entire sample has been processed.
- 7.17 Remove the ceramic rods or steel balls from the unsieved material.
- 7.18 Place the unsieved material in the can and replace the lid.
- 7.19 Weigh, record the weight, and discard the unsieved material and can. (**Caution**—The unsieved material should consist of rocks, stones, ~~and sandy matter~~ sandy matter, and any remaining vegetation. If soil clumps remain, additional milling is required.) (**Caution**—The ceramic or steel grinding media and the sieve must be cleaned thoroughly prior to reuse to eliminate the possibility of cross-contamination of samples.)
- 7.20 Remove a suitable aliquot of the sample from the jar for radiochemical ~~analysis~~ analysis using for example Guide C1402.
- 7.21 Cap the sample jar tightly. Wash and dry the outside of the container prior to storage.

## 8. Calculation

8.1 *Wet Weight of the Composited Soil Cores*—The wet weight ( $W$ ) of the composited soil cores is the weight measured prior to oven-drying the cores as follows:

$$W = T - C \quad (1)$$

where: