Designation: C 1310 – 01

Standard Test Method for Determining Radionuclides in Soils by Inductively Coupled Plasma-Mass Spectrometry Using Flow Injection Preconcentration[1]

This standard is issued under the fixed designation C 1310; 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 a procedure for measuring ^{99}Tc and a procedure for measuring ^{230}Th and ^{234}U in soils. It is applicable to background soils and soils that have been contaminated by nuclear processes. It is intended as an alternative to radiochemical methods because it is faster, requires less labor, and produces less waste than many radiochemical methods.

1.2 Samples are dried, ground, dissolved by fusion, and analyzed by inductively coupled plasma-mass spectrometry (ICP-MS). A sequential flow injection (FI) technique is used to provide lower detection limits than those obtained with direct aspiration into an ICP-MS, and, in the case of ^{99}Tc, provides separation from interferences.

1.3 The ^{230}Th and ^{234}U procedure also would work for ^{232}Th, ^{235}U, and ^{238}U, but the FI preconcentration usually is not required to measure these isotopes at the concentrations typically found in soils.

1.4 This test method is guided by quality control procedures derived from U.S. EPA procedures for inorganic analysis reported in SW-846[2] and the Contract Laboratory Program Statement of Work[3]. The required level of quality control may vary between laboratories and projects. Laboratory statistical quality control procedures are required to ensure that this test method is reliable.

1.5 Becquerel (Bq) is the acceptable metric unit for radionuclide activity. However, picocurie (pCi) frequently is the unit used to express regulatory limits for radioactivity. The values stated in either of these units shall be regarded as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

1.6 Refer to Practice C 998 for information on soil sample collection.

1.7 *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:*

C 998 Practice for Sampling Surface Soil for Radionuclides[4]

C 1215 Guide for Preparing and Interpreting Precision and Bias Statements in Test Method Standards Used in the Nuclear Industry[4]

D 1193 Specification for Reagent Water[5]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[6]

E 135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials[7]

2.2 *U.S. EPA Standards:*

SW-846, Test Methods for Evaluating Solid Waste[2]

U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis[3]

3. Terminology

3.1 *Definition:*

3.1.1 *calibration*—refer to Terminology E 135.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *abundance sensitivity*—the characteristic of a mass spectrometer specifying the likelihood of a large peak producing counts at an adjacent mass. It usually is expressed as the number of counts required in the large peak to produce one count at an adjacent mass.

3.2.2 *analyte*—an isotope whose concentration is being determined by the test method.

3.2.3 *calibration blank*—a solution used to establish the zero-concentration calibration point.

3.2.4 *calibration reference solution*—a solution containing known concentrations of the analytes used for instrument calibration.

[1] This test method 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 10, 2001. Published October 2001. Originally published as E 1310–95 (Reapproved 2001).

[2] Third edition, revision 1, 1992. Available from the U.S. Government Printing Office, Washington, DC 20402.

[3] Document Number ILM01.0. Available from the CLP Sample Management Office, P.O. Box 818, Alexandria, VA 22313.

[4] *Annual Book of ASTM Standards*, Vol 12.01.

[5] *Annual Book of ASTM Standards*, Vol 11.01.

[6] *Annual Book of ASTM Standards*, Vol 14.02.

[7] *Annual Book of ASTM Standards*, Vol 03.05.

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