



Standard Test Method for The Radiochemical Determination of Americium-241 in Soil by Alpha Spectrometry¹

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1. Scope

1.1 This method covers the determination of americium-241 in soil by means of chemical separations and alpha spectrometry. It is designed to analyze up to ten grams of soil or other sample matrices that contain up to 30 mg of combined rare earths. This method allows the determination of americium-241 concentrations from ambient levels to applicable standards. The values stated in SI units are to be regarded as standard.

1.2 *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. For specific precaution statements, see Section 9.*

2. Referenced Documents

2.1 ASTM Standards:

C 998 Standard Practice for Sampling Surface Soil for Radionuclides²

C 999 Standard Practice for Soil Sample Preparation for the Determination of Radionuclides²

C 1163 Standard Method for Mounting Actinides for Alpha Spectrometry Using Neodymium Fluoride²

D 1193 Specification for Reagent Water³

D 3084 Standard Practice for Alpha Spectrometry of Water⁴

D 3648 Standard Practices for the Measurement of Radioactivity⁴

3. Summary of Test Method

3.1 Americium-241 is determined in prepared soil samples of up to 10 g. The soil is completely dissolved by use of

pyrosulfate fusion. After an initial separation on barium sulfate and extraction with an organophosphorous compound, the americium is separated from the other trivalent actinides and the rare earths by oxidation of the americium and precipitation of the interferences. The americium is prepared for alpha spectrometry by coprecipitation with neodymium fluoride and the americium-241 determined by alpha spectrometry using americium-243 as a yield monitor.

3.2 Typical radiochemical recoveries of this method as determined by the yield monitor, are between 75 and 90 percent. Decontamination factors from other radionuclides that may interfere with the determination of americium in this energy range are 10^4 – 10^5 .

3.3 The reagent blank contains all reagents plus the americium-243 tracer. Five samples and a reagent blank can be completed and ready for alpha spectrometry in approximately 6 h. The full-width at half-maximum (FWHM) detector resolution ranges between 43 and 65 keV.

4. Significance and Use

4.1 This test method provides the speed and high decontamination factors attainable with liquid-liquid extraction of the actinides and eliminates filtration techniques that are more time consuming.

4.2 This test method provides a precise determination of americium in concentrations normally found in environmental samples.

5. Interferences

5.1 Plutonium, if inadequately separated, may interfere with the alpha spectrometric determination of americium-241. Thorium-228, identifiable by its daughter products, is a serious interference to the final determination of americium by alpha spectrometry if decontamination factors are not sufficiently high. An inadequate separation of polonium-210 may result in an inaccurate determination of the americium-243 yield monitor but this is unlikely when using the neodymium fluoride precipitation method. If high concentrations of these radionuclides are known to be present, a preliminary separation may be required.

¹ This practice is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee D26.05 on Methods of Test.

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² Annual Book of ASTM Standards, Vol 12.01.

³ Annual Book of ASTM Standards, Vol 11.01.

⁴ Annual Book of ASTM Standards, Vol 11.02.