



Standard Practice for The Separation of Americium from Plutonium by Ion Exchange¹

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1. Scope

1.1 This practice describes the use of an ion exchange technique to separate plutonium from solutions containing low concentrations of americium prior to measurement of the ²⁴¹Am by gamma counting.

1.2 This practice covers the removal of plutonium, but not all the other radioactive isotopes that may interfere in the determination of ²⁴¹Am.

1.3 This practice can be used when ²⁴¹Am is to be determined in samples in which the plutonium is in the form of metal, oxide, or other solid provided that the solid is appropriately sampled and dissolved (See Test Methods C 758, C 759, and C 1168).

1.4 *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 758 Test Methods for Chemical, Mass Spectrometric, Spectrochemical, Nuclear and Radiochemical Analysis of Nuclear-Grade Plutonium Metal²

C 759 Test Methods for Chemical, Mass Spectrochemical, Nuclear, and Radiochemical Analysis of Nuclear-Grade Plutonium Nitrate Solutions²

C 1168 Practice for Preparation and Dissolution of Plutonium Materials for Analysis²

C 1268 Test Method for the Quantitative Determination of Americium 241 in Plutonium by Gamma-Ray Spectrometry²

D 1193 Specification for Reagent Water³

3. Summary of Practice

3.1 Plutonium is adsorbed from a nitric acid (HNO₃) solution (8 M) onto an anion exchange resin. Under these condi-

tions, a negligible amount of americium is adsorbed onto the resin and may be determined by gamma counting of the eluate using Test Method C 1268.

4. Significance and Use

4.1 This practice is applicable when small amounts of ²⁴¹Am are present in plutonium samples (see Test Methods C 758 and C 759). An example is the determination of ²⁴¹Am in a ²³⁸Pu sample. The high specific activity of ²³⁸Pu presents a safety hazard that precludes its presence in a counting facility. Therefore, it is necessary to remove the ²³⁸Pu prior to the determination of ²⁴¹Am.

4.2 When a plutonium solution contains fission or activation products, this practice does not separate all radionuclides that interfere in the determination of ²⁴¹Am, such as the rare earths.

5. Interferences

5.1 The presence of other gamma-ray emitting radionuclides similar in energy to ²⁴¹Am or that interfere with gamma counting make the determination of ²⁴¹Am less accurate. Most +4 valence actinides are adsorbed on the resin. The distribution coefficient for Am on this resin in nitric acid is less than 1, indicating insignificant adsorption. Therefore, this practice will separate many elements that might interfere with gamma counting of ²⁴¹Am.

5.1.1 The elements thorium, neptunium (IV), gold, platinum, iridium, and palladium are not quantitatively separated from plutonium by this procedure.

6. Apparatus

6.1 *Anion exchange resin column* (100-200 mesh), containing quaternary ammonium functional groups (basic resin-chloride ionic form).⁴

6.2 *Bottles*, polyethylene, 30 mL.

6.3 *Sample beaker*, 30 mL, borosilicate glass.

6.4 *Hot plate*.

7. Reagents

7.1 *Purity of Reagents*—Reagent grade chemicals should be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on

¹ 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.

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² *Annual Book of ASTM Standards*, Vol 12.01.

³ *Annual Book of ASTM Standards*, Vol 11.01.

⁴ Prefilled columns packed with AG 1-X8, available from Bio-Rad, Richmond, CA, have been found to be acceptable.