

Rapid Radiochemical Method Curium-244 (²⁴⁴Cm) in Water Samples



EPA's rapid radiochemical methods expedite analytical turnaround time for selected radionuclides while providing quantitative results that meet measurement quality objectives. Methods are applicable to samples where contamination is from either known or unknown origins. This fact sheet is intended for radioanalytical laboratory personnel, decision makers within the incident command structure, additional reoccupancy decision makers (e.g., state and local public health), and other field environmental response personnel.

Method Summary: This method uses extraction chromatography resin cartridges to isolate and purify curium (Cm). Interfering radionuclides and other matrix components are removed, and the Cm fraction is counted by alpha spectrometry. The method uses vacuum-assisted flow to improve the speed of the separations. An americium-243 (²⁴³Am) tracer is equilibrated with the water sample and used as a yield monitor. Following chemical separation of Cm and Am, the sample test source is prepared by microprecipitation with cerium fluoride. The alpha emissions from the source are measured using an alpha spectrometer and used to calculate the activity of ²⁴⁴Cm in the sample.

Time to Process: 8 hr

Includes radiochemical processing and counting

Compare to traditional method: N/A; no validated methods available

Measurement Quality Objectives

Required method uncertainty: 2.0 pCi/L
 Analytical action level (AAL): 15 pCi/L
 Required relative uncertainty: 13% above AAL
 Minimum detectable concentration: 1.515 pCi/L given the 0.2 L aliquant size and a 300-minute count on a typical alpha spectrometer
 Sample quantity: ~ 0.2 L
 Count time: At least 4 hr

Sample Preservation

Analysis within 3 days of sampling: No preservation required
 Holding time >3 days: Adjust pH to <2 with concentrated nitric acid then store for at least 16 hours prior to analysis

Waste Generated per Sample

~ 210 mL basic waste
 ~ 90 mL acidic waste
 1 mL hydrofluoric acid
 ~ 5 mL ethanol
 2 resin cartridges
 Low levels ²⁴³Am, ²⁴⁴Cm, other radionuclides as present in samples

Method Application

The method is specific for the determination of soluble ²⁴⁴Cm in drinking water and aqueous samples. Application of this method should be validated by the laboratory using the protocols provided in [Method Validation Guide for Qualifying Methods Used by Radiological Laboratories Participating in Incident Response Activities](#), or the protocols published by a recognized standards organization for method validation.

Equipment and Supplies

Alpha spectrometer: range includes 4.5 and 7.0 MeV | **Analytical balance:** minimum 10⁻² g readability | **Cartridge reservoirs:** 10 or 20 mL syringe style with locking device, or columns plus 12 mL reservoirs, or equivalent | **Centrifuge and tubes:** 225 mL, 50 mL capacity, or equivalent | **Heat lamp** | **Hot plate** | **Laboratory supplies:** 150, 250, 500, 1,000 mL plastic/glass/Teflon ware; electronic pipettor and 1–10 mL plastic tips as needed; pipettors and 100 µL, 200 µL, 500 µL, and 1 mL plastic tips or equivalent, as needed; stainless steel planchets; sample test source mounts; tweezers | **Polypropylene filter:** 0.1 µm pore size, 25 mm diameter, or equivalent | **Vacuum system:** box/rack; vacuum box tips, white inner tubes, yellow outer, vacuum source | **Vortex mixer**

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