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technical FACT SHEET
BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

Rapid Radiochemical Method for Fusion of Radioisotope Thermoelectric Generator (RTG) Materials in Water Prior to Plutonium (Pu) Analyses


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 is a sample dissolution and pretreatment technique used prior to other separation and analysis methods. Refractory radioisotope thermoelectric generator (RTG) particles are collected on a 0.45 µm filter using vacuum. RTG activity remaining in the aqueous filtrate is preconcentrated using calcium phosphate precipitation. The filtered solids fraction and the filtrate fraction are processed separately by fusing with sodium hydroxide/sodium peroxide prior to subsequent chemical separation and alpha spectrometric analysis. Plutonium (Pu) is separated from the fusion matrix using a lanthanum/calcium fluoride matrix removal step in preparation for separation and analysis using the *Rapid Radiochemical Method for Pu-238 and Pu-239/240 in Building Materials for Environmental Remediation Following Radiological Incidents*.

Time to Process: 10.25–13.25 hr

Includes fusion, radiochemical processing, and counting

Compare to traditional method: N/A; no validated methods available for this special matrix

Measurement Quality Objectives

Required method uncertainty: 2.1 pCi/L
Analytical action level (AAL): 16.3 pCi/L
Required relative uncertainty: 13% above AAL
Minimum detectable concentration (MDC): 0.23 pCi/L
Sample quantity: 1 L
Count time: 360 minutes; 240 minutes for MDC

Sample Preservation

None listed in method

Waste Generated

Waste disposal information is provided in the plutonium chemical separation method

Method Access:
https://www.epa.gov/sites/production/files/2015-06/documents/rtg_dissolution_by_fusion_rev_0_402r14003.pdf

Method Application

This fusion method is applicable to the total dissolution of refractory RTG materials via rapid, rigorous, and effective dissolution of refractory radionuclide particles present in water matrices. 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

Balance: top loading or analytical, ± 0.01 g readability or better | **Cartridge reservoirs**: 10 or 20 mL syringe style with locking device, or equivalent | **Centrifuge**: able to accommodate 225 mL tubes | **Centrifuge tubes**: 50 mL and 225 mL tubes | **Crucibles**: 250 mL zirconium with lids | **Filters**: 0.45 µm membrane | **Hot plates**: adjustable temperature | **Laboratory supplies**: 1000 mL beaker; 100 µL, 200 µL, 500 µL, 1 mL pipettes and plastic tips; 1–10 mL electronic/adjustable pipette; tongs; tweezers | **Muffle furnace** capable of reaching at least 700° C | **Reusable vacuum filter units** to hold 47 mm filters with 500 mL receivers or equivalent filter apparatus | **Vacuum system**: box; pump or laboratory system | **Vortex stirrer**

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U.S. Environmental Protection Agency
Office of Research and Development, Homeland Security Research Program

EPA/600/S-17/059
March 2017