

## Rapid Radiochemical Method Radium-226 (<sup>226</sup>Ra) 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:** A known quantity of radium-225 (<sup>225</sup>Ra) is used as the yield determinant in this analysis. Since the source of the suspected contamination may not be known, the sample is initially digested using concentrated nitric acid, followed by volume reduction and conversion to the chloride salt using concentrated hydrochloric acid. The solution is adjusted to a neutral pH and batch equilibrated with manganese oxide resin to separate radium from some radioactive and non-radioactive matrix constituents. Further selectivity is achieved using a column which contains a gel-type cation resin. The radium (including <sup>226</sup>Ra) eluted from the column is prepared for counting by microprecipitation with barium sulfate. Low-level measurements are performed by alpha spectrometry. The activity measured in the <sup>226</sup>Ra region of interest is corrected for chemical yield based on the observed activity of the alpha peak at 7.07 MeV (<sup>217</sup>At, the third progeny of <sup>225</sup>Ra).

<p><b>Time to Process: 37 hr</b></p> <p>Includes radiochemical processing and counting</p> <p><u>Compare to traditional method (EPA 903.0):</u> 18–22 hr Without ingrowth: Needs 2–3 weeks ingrowth time</p>	<p><b>Method Application</b></p> <p>The method is specific for the determination of soluble <sup>226</sup>Ra in drinking water and aqueous samples. Application of this method should be validated by the laboratory using the protocols provided in <a href="#">Method Validation Guide for Qualifying Methods Used by Radiological Laboratories Participating in Incident Response Activities</a>, or the protocols published by a recognized standards organization for method validation.</p>
<p><b>Measurement Quality Objectives</b></p> <p>Required method uncertainty: 0.65 pCi/L Analytical action level (AAL): 5 pCi/L Required relative uncertainty: 13% above AAL Minimum detectable concentration: 1.0 pCi/L Sample quantity: ~ 200 mL Count time: 4 hr</p>	<p><b>Equipment and Supplies</b></p> <p><b>Alpha spectrometer:</b> calibrated for use over ~ 3.5–10 MeV   <b>Centrifuge tubes:</b> polypropylene, 50 mL, disposable, or equivalent   <b>Chromatography columns,</b> polypropylene, disposable: 1.5 cm I.D. x 15 cm with funnel reservoir, or equivalent; 0.8 cm I.D. x 4 cm, or equivalent   <b>Filter stand and funnels</b>   <b>Filter:</b> 0.1 μm, ~ 25 mm diameter   <b>Glass beaker:</b> 600 mL   <b>Heat lamp:</b> 250–300 watt, reflectors mounted ~ 25 cm above base   <b>Membrane filter:</b> 0.45 μm, ~ 47 mm diameter   <b>Petri dish</b> or other suitable container for storing sample test sources   <b>pH paper</b>   <b>Stainless steel planchets</b> or suitable holders/backing for sample test sources, to accommodate 25 mm diameter filter   <b>Stirring hot plate</b>   <b>Vacuum filtration apparatus</b> <i>Optional: Centrifuge bottle: polypropylene, 250 mL, disposable, or equivalent   Magnetic stir bar</i></p>
<p><b>Sample Preservation</b></p> <p>Samples should be collected in 1 L plastic containers Analysis within 3 days of sampling: No preservation required Holding time &gt;3 days: Adjust pH to &lt;2 with concentrated nitric acid</p>	<p><b>Contacts</b></p> <p><u>Program:</u> Kathy Hall 513-379-5260 hall.kathy@epa.gov</p> <p><u>Technical:</u> John Griggs 334-270-3450 griggs.john@epa.gov</p>
<p><b>Waste Generated</b></p> <p>Nitric acid   Hydrochloric acid   Radioactive tracer</p>	
<p><b>Method Access:</b> <a href="https://www.epa.gov/sites/production/files/2015-06/documents/ra-226_in_water_rev_0_1_epa_402-r-10-001c.pdf">https://www.epa.gov/sites/production/files/2015-06/documents/ra-226_in_water_rev_0_1_epa_402-r-10-001c.pdf</a></p>	